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# NDSU in Perspective

## A Bit of History

On March 8, 1890, the state's first governor, John Miller, signed the bill designating the land to establish a college of agriculture and mechanic arts, the North Dakota Agricultural College, as a part of the Morrill Act of 1862. In 1960, the name was changed to North Dakota State University.

## The Graduate School

Graduate students were first accepted in 1895, and a formal announcement of graduate studies has been carried in the bulletins since 1902.

The Graduate School was formalized July 1, 1954, by approval of the North Dakota Board of Higher Education. Graduate studies were administered by a Graduate Council from November 1949 to June 1954, and before that by a Graduate Committee.

The first Master of Science degree was awarded in 1899. Since then, graduate students have been in regular attendance and have participated in the scholarly activity of the campus. The number of degrees awarded increased noticeably after 1920 and again after 1950 in reflection of general trends in higher education in the United States.

In 1959, the North Dakota Board of Higher Education first authorized certain departments to offer the Doctor of Philosophy degree. The first Ph.D. degrees were awarded in 1963.

## NDSU Today

North Dakota State University is the state's first Morrill Act land-grant institution. Located on the state's eastern border in Fargo, North Dakota's largest city, the university strives to be a leader in information systems, technology transfer, economic development, and lifelong learning; and encompasses a broad spectrum of curricular offerings, scholarly activity, and service. It is one of two major research universities in an eleven-institution state university system.

NDSU has enjoyed steady enrollment growth for the past decade. Current enrollment is about 12,000 students on the campus in Fargo. NDSU also serves several thousand people throughout the state in continuing education and extension programs.

Instruction is carried out in nine academic units: the Colleges of Agriculture, Food Systems, and Natural Resources; Arts, Humanities, and Social Sciences; Business Administration; Engineering and Architecture; Human Development and Education; Pharmacy; Science and Mathematics; University Studies; and The Graduate School. NDSU has 41 doctoral and professional programs, 55 master's degree programs, and 81 bachelor's degree programs. The North Dakota Agricultural Experiment Station and NDSU Extension Service are integral parts of the University.

NDSU participates in the Tri-College University consortium with neighboring Minnesota State University Moorhead and Concordia College. NDSU has approximately 1,500 staff members and 950 faculty and academic staff.

## The Fargo-Moorhead Community

Recently named one of the most desirable places in the country to live by Money magazine, Fargo is quietly earning a reputation as a perfect place to make a home. Nestled in the rich farmlands of the Red River Valley, the Fargo-Moorhead community has many qualities that contribute to this reputation, including the highly respected educational system; advanced medical technology; a progressive business community; numerous cultural and arts opportunities; clean air and water; and good-hearted, friendly people. With more than 163,000 people in the community and about 500,000 people in the service area, Fargo-Moorhead is among the largest metropolitan centers between Minneapolis and Seattle.

One of the reasons people choose NDSU as a place to get a good education is that the F-M community provides students access to part-time jobs, internships, parks and other recreational facilities, entertainment, and cultural amenities.

## Graduate Facilities

Opportunities for graduate study are available in seven colleges including the School of Education. Many departments have long records of strong graduate offerings. An active program of physical plant improvement has provided greatly expanded facilities for graduate work. A study of the level and location of degrees earned by the graduate faculty attests to the caliber of instruction maintained.

Cooperating agencies such as the Institute for Regional Studies, the Agricultural Experiment Station, and the United States Department of Agriculture provide unusually fine opportunities for research experience, for the selection of disquisition topics, and for guidance in the preparation of the disquisition. These agencies also provide opportunities for part-time employment for a number of graduate students.

## Tri-College University

Tri-College University is a consortium of the three Fargo-Moorhead institutions of higher education: North Dakota State University, Concordia College, and Minnesota State University Moorhead. Through the Tri-College course exchange, students can take courses on the other two campuses without going through separate admissions procedures. Tuition is paid only to the home school. Guidelines are available in the general NDSU Bulletin and from the registrar.

Bus service is provided among the campuses daily during the academic year. Reciprocal parking arrangements are available for students who wish to drive to the other schools.

Students may use the library resources of all three schools. This highly effective sharing of library resources is facilitated by a combined serials listing and twice-daily delivery service.

Several academic programs are conducted jointly by the three schools. Master of Science, Master of Education, and Educational Specialist degrees in Educational Leadership are offered through the Tri-College University. The scope of opportunities for students is expanded by the sharing and coordination of programs and services among the many academic departments within the three schools.

## Continuing Education

Continuing Education is an outreach unit of the university that makes the resources of the institution available in a variety of ways, including distance-based education. Courses, locations, and delivery systems are planned in response to requests and identified needs. Continuing Education activities fall into three main categories: on- and off-campus credit courses, non-credit activities, and learning opportunities mediated via technology.

Admission to NDSU is required to enroll in Continuing Education courses, Which are numbered 601 or above. Individuals interested in enrolling in degree eligible credit activities must complete application procedures through the Graduate School.

## Credit Courses

Continuing Education offers regular credit courses on campus as a means to supplement tuition-based offerings. These include developmental courses that are prerequisites for other courses as well as those that apply to programs of study.

Off-campus credit courses are regular or special courses offered by NDSU units at off-campus locations. Courses are usually established at the request of those who have special interests or educational needs. Students must consult with their advisers in advance to determine if specific courses will apply to their programs of study. There are limits on the number of credits earned through Continuing Education that may be applied to a degree program.

## Non-Credit Activities

Continuing Education offers a wide range of workshops, conferences, and in-service activities. These educational experiences vary in length from an hour, to a day, to periodic meetings distributed over several months. Continuing Education arranges transportation, housing, and physical facilities; contracts speakers and banquet facilities; and provides financial management and other special services.

The purpose of these functions is to provide needed and appropriate educational services. In some cases, Continuing Education Units (CEUs) may be earned for these activities.

## Distance and Technology-Enhanced Learning

Continuing Education uses an array of distance delivery systems both for credit and non-credit courses and activities. Delivery systems include satellite, the North Dakota Interactive Video Network (IVN), Internet, video- and print-based individual study, video-conferencing, and combinations of these mediums. In addition to bridging geographic limitations, some technologies allow students to complete work on their own at any time, any place. Other technologies facilitate synchronous work at a distance.

## Continuing Education Fees

Students enrolled in Continuing Education courses may expect to pay course fees similar to normal resident tuition. Fees may be less than normal resident tuition if grants or other external funds are available. In cases where delivery costs are higher or for specialized programs, fees may be higher. Continuing Education reserves the right to adjust course fees as needed without prior notice. Courses offered through Continuing Education generally count toward credit totals for financial aid but not toward the NDSU tuition cap. For further information, contact the Division of Distance and Continuing Education, phone 701-231-7015, 209 Engineering Technology Building, Fargo, ND 58105-5819, fax 701-231-7016, or www.ndsu.edu/conted.

## Distance Education

NDSU offers several distance education alternatives.

## NDIVN

The North Dakota Interactive Video Network (IVN) uses V-Tel systems to provide flexible, two-way interactive communications. Cameras and microphones at one site allow participants at other sites to watch and listen to an instructor or presenter on a television monitor. Cameras and microphones at each receiving site allow participants to be seen and heard on television monitors at the other participating sites. IVN consists of 26 sites. Each university/college has one to three sites. The other sites are the State Capitol, Jamestown State Hospital, the Tribal Colleges (5 sites), and the K-12 Great Western Network (18 sites). Connections can also be made to other video networks around the world. For additional information contact the IVN Site Coordinator at 800-830-7160 or 701-231-1090, or visit the Web site at www.ndsu.edu/its/depts/ivn.

## World Wide Web

NDSU has courses that are supplemented through the World Wide Web. For additional information, go to http://wow.cc.ndsu.nodak.edu/users/courseindex/index.shtml or contact Information Technology Services at 701-231-8685.
North Dakota State University is one of over 200 Internet2 institutions and a partner institution of the very high performance Backbone Network System (vBNS). These two memberships provide high-speed network access to desktops and high-speed connections to other universities and federal agencies for research and distance education.

CourseInfo Gateway (CourseInfoTM) is a WWW-based tool suite to build and manage course materials and virtual courses and classrooms. NDSU instructors can use the graphical, point-and-click interface to seamlessly incorporate learning materials from word processing, audio and video, spreadsheets, and presentation files. The URL is www.ndsu.edu:8080.

## Videoconferencing

NDSU is exploring technologies that will offer classes using videoconferencing programs for classes using the Internet or phone lines. Contact Information Technology Services at 701-231-8688 for information.

Distance education is used to deliver quality postsecondary programs and services to citizens who would not otherwise have access to these services; improve the quality of offerings on each campus by sharing knowledge, courses, services, and resources with each other; and expand services to the state through cooperative arrangements with elementary, secondary and vocational education, state agencies, and the private sector.

## Administration of Graduate Studies

### Accreditation

North Dakota State University is accredited at the doctoral level by the Commission on Colleges and Universities of the North Central Association of Colleges and Secondary Schools.

## State Board of Higher Education

Created by constitutional amendment in 1939, the State Board of Higher Education is the governing body of North Dakota State University and all other state-supported institutions of higher education in North Dakota.

The nine-member State Board of Higher Education is the policy-setting body for the North Dakota University System and consists of seven citizen members who serve four-year terms and who are appointed by the governor, one student who is also appointed by the governor for a one-year term, and one faculty member who is selected by the Council of College Faculties.

John Q. Paulsen, President 2004-2008
Beverly Clayburgh, Vice President 1996-2007
Sue Andrews 2002-2010
Bruce I. Christianson 2001-2007
Pamela J. Kostelecky 2002-2009
Charles W. Murphy 2006-2010
Nicholas Rogers, Student 2006-2007
Richie Smith 2004-2008
John Pederson, Faculty Advisor 2005-2007

## Administration

**Joseph A. Chapman, Ph.D.**, President

**R. Craig Schnell, Ph.D.**, Provost and Vice President for Academic Affairs

**Keith Bjerke, B.S.**, Vice President for University Relations

**Prakash C. Mathew, M.A.**, Vice President for Student Affairs

**D.C.Costen, Ph.D**, Vice President for Agriculture and University Extension

**John C.Adams, M.B.A.**, Vice President for Business and Finance

**Philip Boudjouk, Ph.D.**, Vice President for Research, Creative Activities, and Technology Transfer

**Greg McCarthy, Ph.D.**, Associate Vice President for Interdisciplinary Research

**R. S. Krishnan, Ph.D.**, Associate Vice President for Academic Affairs

**Sudhir Mehta, Ph.D.**, Associate Vice President for Academic Affairs

**Catherine S. Haugen, Ph.D.**, Associate Vice President for Student Affairs

**Broc Lietz, B.S.**, Associate Vice President of Business and Finance

**Valrey Kettner, J.D.**, Assistant Vice President Sponsored Programs Administration

**Rick D. Johnson, J.D., LL.M.**, General Counsel

**David A. Wittrock, Ph.D.**, Dean of the College of Graduate and Interdisciplinary Studies and Dean of the College of University Studies

**Janna Mausolf Stoskopf, M.S.**, Dean of Student Life

**Kenneth F. Grafton, Ph.D.**, Dean of the College of Agriculture, Food Systems, and Natural Resources

**Thomas Riley, Ph.D.**, Dean of the College of Arts, Humanities, and Social Sciences

**Ronald D. Johnson, Ph.D.**, Dean of the College of Business Administration

**Gary Smith , Ph.D.**, Interim Dean of the College of Engineering and Architecture

**Virginia L. Clark Johnson, Ph.D.**, Dean of the College of Human Development and Education

**Charles C. Peterson, Pharm. D.**, Dean of the College of Pharmacy, Nursing and Allied Sciences

**Kevin Mc Call, Ph.D.**, Dean of the College of Science and Mathematics

**James Council, Ph.D.**, Dean of NDSU Libraries

**Kristi Wold McCormick, Ph.D.**, Registrar

**Barbara Lonbaken, M.S., R.N.**, Associate Dean Student Wellness, Student Health Service and Wellness Education and Director of Student Health Services

**Kerri Spiering, M.A.**, Director of International Programs

**Sandra Holbrook, Ph.D.**, Director of Office for Equity and Diversity

**William D. Slanger, Ph.D.**, Director of Institutional Research and Analysis

**Jeff Gerst,** Interim Director of Information Technology Services

**Ann Burnett, Ph.D.**, Director of Women's Studies

**Robert Harrold, Ph.D.**, Director of Assessment and Accreditation

**Gene Griffin, M.S.**, Director of the Upper Great Plains Transportation Institute

**Lisa Nordick, M.S.**, Director of Distance and Continuing Education

**Bruce Bollinger, M.B.A.**, Director of the Agricultural Budget Office

**Duane Hauck, M.S.**, Interim Director of the Extension Service

**James R. Venette, Ph.D.**, Associate Dean and Director of Academic Programs

**Stacey Winter**, Director of Purchasing

**Raymond E. Boyer Jr.**, Director of the University Police and Safety

**Bruce S. Frantz, M.A.**, Director of Facilities Management

**Jack Donahue, B.S./B.A.**, Director of Dining Services

**Margaret K. Gaynor, S.P.C.L.**, Director of Counseling and Disabilities Services

**Steven K. Glunberg, M.D.**, Medical Director, Student Health Services

**Michael D. Harwood, M.S.**, Director of Residence Life

**Jeanne Enebo**, Director of Student Financial Services

**Allyn W. Kostecki, M.A.**, Director of Trio Programs

**Carol J. Miller, B.S.**, Director of the University Bookstore

**Laura Oster-Aaland, M.S.**, Director of Orientation and Student Success

**Jaclynn Davis Wallette, B.A.**, Director of Multicultural Student Services

**Jill Wilkey, B.S.**, Director of Career Center

**Laura M. McDaniel, M.S.**, Director of Marketing Communication

**David C. Wahlberg, Ph.D.**, Director of University News

**Jobey Lichtblau, M.Mgt.**, Director of Admissions

**Karen Hendrickson, M.S.**, Manager of Restricted Fund Accounting

**Karin Hegstad.**, Manager of Business Office

**Paula Thovson, B.S.**, Budget Director

**Gary L. Wawers, M.B.A.**, Controller

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# Research Support Units

## Agricultural Experiment Station

The North Dakota Agricultural Experiment Station, co-located with North Dakota State University, provides leadership and innovation in research that supports agriculture and rural communities. Together with scientists at eight Research Extension Centers (RECs) distributed throughout the state, researchers with the Experiment Station at NDSU develop new technologies and methods to address current critical problems. They pave the way for future development systems in animal and crop production by understanding molecular, cellular, and organismic interactions and by providing economic and social bases for comprehending agricultural systems. The scope of research continues to evolve, and recent initiatives in food safety, resource management, and animal health add to an impressive list of relevant subject areas. Experiment Station faculty are NDSU graduate faculty and provide enhanced opportunities for student's professional training and access to world-class laboratories, equipment, and other facilities.

Because faculty work closely with professionals in the region's agriculture and food processing sectors, they can direct students to work on real issues and problems. The results (findings) of the research, plus interaction with industry/academic professionals, provide unique access to professional careers. Many graduate, as well as undergraduate, students are employed by the Agricultural Experiment Station.

Most faculty in the Agricultural Experiment Station also have an appointment in the College of Agriculture, Food Systems, and Natural Resources, so students have access to graduate training programs using Experiment Station facilities, funds, and support personnel. Opportunities for study at the RECs should be directed to the appropriate academic department.

## Center for High Performance Computing

NDSU's Center for High Performance Computing (CHPC) was established in 2003 to provide access to secure, advanced scientific computation resources for the university's researchers and their private and public sector partners. This center also gives NDSU the ability to participate in its own program of advanced computation and networking research, allowing the school to assume an international role in the development of improved programming and networking methods.

## Center for Nanoscale Science and Engineering (CNSE)

NDSU's Center for Nanoscale Science and Engineering, established in 2002, conducts large-scale, multidisciplinary research for government and industry. The Center, located in a state-of-the-art research facility in the NDSU Research and Technology Park, employs ca. 50 permanent staff, 22 faculty associates, and 65 graduate and undergraduate assistants. This facility includes cleanroom, laboratory and engineering spaces that house its design, synthesis, fabrication, and characterization capabilities. Current core competencies include wireless miniaturized electronics design and prototype fabrication, and advanced materials research and development.

The Departments of Coatings & Polymeric Materials and Chemistry Molecular Biology (College of Science and Mathematics), and Electrical, Mechanical, Industrial & Manufacturing, and Civil Engineering (College of Engineering and Architecture) were instrumental in launching CNSE in 2001, and continue to

play an integral role in its development. Faculty and faculty-CNSE teams from these departments have already been successful in funding new projects that utilize CNSE's unique capabilities.

CNSE is a Department of Defense Center of Excellence for design and manufacture of microsensors and miniaturized wireless communication devices and has capabilities that are unique among U.S. universities.

## Center for Writers

The Center for Writers serves the North Dakota State University community by providing free writing assistance to students, faculty, and staff in all departments at all levels in the following ways by providing a supportive environment where writers and readers work efficiently one- on-one or in small groups, by helping students improve their strategies for writing proficiently and independently, by training writing tutors to become effective readers of and responders to texts from various disciplines, by helping faculty develop and refine writing assignments and assess student writing effectively and efficiently and by helping faculty and staff with questions about their own writing.

## Extension Service

The NDSU Extension Service extends education to North Dakota residents of all ages and walks of life through its county offices, research extension centers, and the main campus of North Dakota State University. Extension's purpose is to create learning partnerships that help adults and youth enhance their lives and communities. Special emphasis is placed on strengthening agriculture and developing the potential of youth, adults, and communities. Efforts are funded by county, state, and federal government. The Extension Service has close ties with NDSU research and academic units as well as other land-grant universities across the nation. Additional information about the NDSU Extension Service is available on the World Wide Web: www.ag.ndsu.edu/extension.

## Great Plains Institute of Food Safety

The Great Plains Institute of Food Safety (GPIFS) was developed to combat food borne illnesses. To ensure the security of our food supply and otherwise serve the food safety needs of our students and other stakeholders, the Institute employs a tripartite approach to food safety with education and outreach, service, and research components. The educational arm of GPIFS provides or will provide in-service and outreach education at the graduate, undergraduate, professional, and consumer levels, both on- and off-campus. Members of our service component seek to provide the latest information about food safety to our constituents, and our researchers use "state-of-the art" approaches to provide for early detection of food safety problems, their prevention or amelioration. Faculty participants of GPIFS come from a wide variety of disciplines allowing us to apply multidisciplinary approaches to problems all along the food chain. All participants are avid teachers and researchers, each dedicated to serving the public's food safety needs.

## Information Technology Services

## General Services

Information Technology Services (ITS) is a strategic partner that helps advance the educational, research and administrative potential of the university. A wide range of IT resources and support services are available to NDSU students, faculty and staff. ITS administrative offices are located in the Industrial Agriculture and Communications Center (IACC) building. For more information visit the ITS Web page (http://its.ndsu.nodak.edu/).

## Network Infrastructure

The ITS network infrastructure provides access to the Internet, the state network (STAGEnet), and

Internet2 (the high-speed, high-capacity research network) for all students, faculty, and staff.

ITS is dedicated to working cooperatively with departments to enhance research activity and to provide opportunities for both students and faculty to learn and apply the most advanced technologies. Classrooms, offices, and residence hall rooms have direct campus network connections. North Dakota State University is an Internet2 member. Member institutions are committed to having a campus infrastructure capable of delivering high-speed network access to the desktops of its instructional and research users. Other high-speed network partnerships continue to emerge as ITS proceeds to develop a computer and network environment which will help promote NDSU's goal of becoming a Carnegie Doctoral/Research University---Extensive.

## Computer Connections

NDSU has a direct, high-speed connection to the Internet and an extensive high-speed campus network utilizing fiber optics, switched fast (100 MB), and Gigabit Ethernet. North Dakota State University is one of approximately 170 Internet2 institutions and a partner institution in the very high-performance Backbone Network System (vBNS). Through these networks, users can exchange information with systems worldwide.

## Computer Clusters and Classroom Support

Several hundred on-campus computers are available for student use as well as for classroom instruction. The diverse computing environment includes Windows, Macintosh, and UNIX computers all having Internet access through a direct campus network connection. Other services include color printing, plotting, equipment checkout (i.e., VCR, projection equipment, laptops, and digital cameras), cluster consulting, multimedia assistance, video-editing, and cluster and equipment reservations.

## Help Desk

The ITS Help Desk offers assistance to students, faculty, and staff needing help with e-mail accounts, dial-up or Ethernet connections, or general computing questions. Faculty and staff can also purchase a variety of software programs through the Software Licensing Program which offers a substantial cost savings.

## Institute of Natural Resources and Economic Development

The Institute of Natural Resources and Economic Development offers professional services in four major areas: 1) economic and fiscal impact assessments, 2) economic feasibility analyses, 3) analyses of natural resources management issues, and 4) investigation of population and labor force dynamics. In addition to research reports, services are delivered in the form of seminars, executive training programs, and software.
The Institute is based in the Department of Agribusiness and Applied Economics and includes faculty from several departments. In addition to Institute personnel, unique expertise from both public and private sectors in the region, nation, and world are accessed as needed to meet research and training requests. It is a grant-driven institute, both responding to requests with funding attached and seeking external funding jointly with clientele. The Institute of Natural Resources and Economic Development was originally established by the North Dakota State Board of Higher Education in 1983 as the Northern Plains Natural Resources Institute. The name was modified in 1995 to more closely reflect the activities of the Institute and the capabilities of the faculty associated with it.

## NDSU Libraries

The Libraries are comprised of the Main Library and four departmental libraries: the Architecture Library, the H.J. Klosterman Chemistry Library, the Pharmacy Library, and the Institute for Regional Studies/ NDSU Archives. The Librarie's collections include more than 498,000 bound volumes; 3,934 current serials; more than 86,000 maps; and a wide variety of audiovisual and microform materials. As a Joint

Regional U.S. Government Publications Depository, NDSU and the University of North Dakota share receipt of all U.S. Government deposited publications. More than 470,000 U.S. government documents are in the NDSU Libraries. Except for materials placed on closed reserves by faculty, all library materials are located in open, well-lighted, and readily accessible stack areas.

The NDSU Libraries share library resources through the Tri-College arrangement with Minnesota State University Moorhead and Concordia College. NDSU library cards are valid at all NDSU, MSUM, and Concordia libraries. The NDSU Librarie's Interlibrary Loan Service and Document Delivery Service provide access to books, articles, and other materials not available at the NDSU Libraries. Regularly scheduled shuttles between various libraries in North Dakota and Minnesota enhance these delivery services and provide a greatly expanded bibliographical resource to NDSU faculty, students, and staff.

Fast and efficient access to the Librarie's holdings is obtained via the online catalog. In addition, the online catalog interfaces with other online catalogs in North Dakota, Minnesota, the remainder of the United States, and Canada. Directories and journal article databases are also available as files on the catalog. The NDSU Libraries also provide access to hundreds of bibliographical databases and other electronic information resources located at NDSU and throughout the world.

Reference and research assistance is available in the Main Library at least 80 hours per week (telephone extension 231-8886). Library subject specialists are also available by appointment to provide in-depth assistance in locating and using various print and electronic information resources. The staff of NDSU Libraries offer a full range of educational services related to library and informational literacy, including tours and orientations, demonstrations, research consultations, course-related instruction, subject-specific instruction, and entire courses for University credit.

The Main Library is generally open a minimum of 90 hours per week throughout the academic year; departmental libraries are open approximately 70 hours per week. The Librarie's hours are posted in the libraries and announced in campus publications. Information and resources can also be accessed at www.lib.ndsu.nodak.edu/.

## North Dakota Institute for Regional Studies

The Institute for Regional Studies, founded at North Dakota State University in 1950, stimulates and coordinates the activities of NDSU in regional scholarship.

The mission of the Institute for Regional Studies is to foster understanding of regional life through research on, teaching about, and service to those regions with particular import to North Dakota State University. These regions include the Red River Valley, the state of North Dakota, the Plains of North America (comprising both the Great Plains of the United States and the Prairies of Canada), and comparable regions of other continents. In keeping with the land-grant university tradition, the Institute seeks not only knowledge, but also application.

The activities of the Institute fall into four categories: collections, publications, outreach, and the Center for Social Research. The research collections of the Institute are located at 1305 19th Ave. N. under the curatorship of library staff. The publication programs are housed in the College of Arts, Humanities, and Social Sciences. Outreach activities involve various units of the University and include radio and television production, public programs, and oral history. Finally, the Center for Social Research, established in 1976, exists to facilitate such social-science research as conducting focus-group research and computerized telephone surveys.

## North Dakota State Data Center

NDSU serves as the lead agency for the state data center in cooperation with the U.S. Bureau of the Census to receive and distribute economic and demographic information. Services include responding to requests, conducting research, compiling information, and disseminating research findings to meet the demographic and economic needs of North Dakota.

## North Dakota Water Resources Research Institute

The North Dakota Water Resources Research Institute is one of 54 institutes authorized by Congress in 1964 at land-grant universities. The institutes together constitute the National Institutes for Water Resources. The Institute awards Graduate Student Fellowships on a competitive basis to enrolled graduate students whose thesis proposals in water-related topics have been accepted by their advisory and examination committees. www.ce.ndsu.nodak.edu/wrri.

Additional information can be obtained from the ND WRRI at this address:
Water Resources Research Institute, Engineering 108, North Dakota State University, Fargo, ND 58105-5285.

## Northern Crops Institute

Northern Crops Institute (NCI) is a collaborative effort between North Dakota , Minnesota , Montana , and South Dakota to support the promotion and market development of crops grown in this four-state region. The NCI is an international meeting and learning center which brings together customers, commodity traders, technical experts, and processors for discussion, education, and technical services. Situated on the campus of North Dakota State University, in Fargo, North Dakota, USA, this unique facility is only minutes from the farm fields which yield much of the world's food.

NCI short courses enable participants from around the world and across the U.S. to learn about northern grown crops and their unique quality, marketing, and processing characteristics. The Northern Crops Institute also provides technical services for the domestic and overseas markets.

## Red River Valley Agricultural Research Center
## USDA Agricultural Research Service

The Red River Valley Agricultural Research Center is part of the national research program of the Agricultural Research Service, U.S. Department of Agriculture. The center is composed of 1) Biosciences Research Laboratory (BRL), 2) the Northern Crops Science Laboratory (NCSL), and 3) the Hard Red Spring and Durum Wheat Quality Laboratory (WQL) located on the North Dakota State University campus.

The Center's staff of approximately 40 scientists conducts research that covers the effects of foreign chemicals in animals, explores new methods to control perennial weed and insect pests, tests wheat and oats to enhance quality, and improves the storage characteristics of potatoes. The Center also develops improved germplasm for wheat, barley, sugarbeets, and sunflowers. Scientists work in genetics; cytology; radiation biology; chemistry; biochemistry; and the physiology of plants, insects, and animals. Opportunities are available for graduate students to use the Center for thesis and dissertation research under the guidance of selected Center staff members who have university Graduate School appointments.
The Center occupies approximately 15 acres of the NDSU campus and has extensive, well-equipped laboratories, greenhouses, animal facilities, and insectaries, as well as a scanning electron microscope (in cooperation with NDSU), NMR and mass spectrometers, and other instrumentation for genomic and chemical analysis.

## The Upper Great Plains Transportation Institute

The Upper Great Plains Transportation Institute was established by the North Dakota Legislative Assembly in 1967. The act assigned administrative responsibility for the Institute to North Dakota State University.

The Institute's two basic responsibilities are to conduct research related to the immediate and long-range transportation needs of the region, and to conduct information dissemination programs through conferences, workshops, and seminars for the general public and selected audiences. The research program of the Institute is guided, in part, by an advisory council composed of representatives of various organizations, industries, and agencies affecting, or affected by, transportation.

The NDSU Departments of Agribusiness and Applied Economics and Civil Engineering, in cooperation with the UGPTI, offer transportation options within their respective M.S. degree programs. The transportation options draw from a core set of interdisciplinary multi-modal courses. These courses include rural and non-metropolitan transportation, logistics, statewide transportation planning, public transportation, and transportation administration. Students from the North Dakota Department of Transportation at Bismarck are currently receiving their classes via distance education technology (TEL8).

NDSU also offers a Ph.D. in Transportation and Logistics.



E-Mail: The Graduate School

Prospective students may schedule a visit by calling 1-800-488-NDSU.

The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

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# Graduate Course Numbering

**General graduate course offerings in all departments.**

## 790 Graduate Seminar (1-3 credits)

Presentations and discussions of contemporary issues, trends, and recent research and developments by graduate students, faculty, and visiting scholars.

## 791 Temporary/Trial Topics (1-5 credits)

Group study involving critical examination and discussion of subject matter selected for proposal as a temporary or trial course. Course title will be indicated on the student's transcript. Requires the same approval process as if it were a permanent course.

## 792 Case Studies (1-3 credits)

Critical review, analysis, and evaluation of selected topics by individual presentations and group discussions. Case study topics are indicated by title on the student's transcript. Graded S or U.

## 793 Individual Study/Tutorial (1-3 credits)

Directed study allowing an individual student under faculty supervision to undertake selected, independent work in topics of special interest or a limited experience in research. Requires departmental approval.

## 794 Practicum/Internship (1-6 credits)

Course designed to provide practical participation under professional supervision in selected situations to gain experience in the application of concepts, principles, and theories related to the student's area of specialization. Requires approved program and consent of instructor. Graded S or U.

## 795 Field Experience (1-15 credits)

Field-oriented, supervised learning activities conducted outside the traditional classroom/laboratory. Pre-planned assessment of the experience and post-evaluation with the instructor are required. Requires departmental approval.

## 696/796 Special Topics (1-5 credits)

Group study involving critical examination and discussion of subject matter selected mutually by faculty and students and not covered in other courses. Special topics are indicated by title on the student's transcript. Requires departmental approval.

## 797 Master's Paper (1-3 credits)

Literature review, research, and preparation for paper required for the Comprehensive Study Option. Graded S or U.

## 798 Master's Thesis (1-10 credits)

Original investigation under the supervision of a major adviser and a supervisory committee. Graded S or U.

## 798s Specialist Field Study, TCU (1-6 credits)

## 799 Doctoral Dissertation (1-15 credits)

Original investigation under the supervision of a major adviser and an advisory committee. Graded S or U.

*Courses in this Bulletin are offered with the understanding that the University may withdraw any course if conditions beyond the institution's control make it impossible to offer it or if enrollment in that course is insufficient to justify it.*



E-Mail: The Graduate School

Prospective students may schedule a visit by calling 1-800-488-NDSU.

The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

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# Test and TOEFL Scores

**Pdf format - Click Here**

## GRE required (or recommended) with applications to the following programs:

Note: For more information about GRE Click Here

### International Students

| | |
|---|---|
| Agribusiness and Applied Economics | International Agribusiness |
| Biochemistry and Molecular Biology (general + subject) | Manufacturing Engineering |
| Biology | Mass Communication |
| Botany | Mathematics |
| Cellular and Molecular Biology | Mechanical Engineering |
| Chemistry (general + subject) | Microbiology |
| Coatings & Polymeric Materials (general required; subject recommended) | Molecular Pathogenesis |
| Communication | Pharmaceutical Sciences |
| Computer Science (recommended) | Physics (recommended) |
| Criminal Justice ( Ph.D.Program) | Plant Sciences |
| Digital Enterprise (recommended) | Political Science |
| Electrical and Computer Engineering | Psychology (general + subject) |
| Emergency Management ( Masters Program) | Software Engineering (recommended) |
| Engineering Ph.D. (recommended) | Soil Science (450 minimum for both Q and A) |
| Environmental Engineering (recommended) | Speech Communication |
| Food Safety | Statistics (recommended) |
| History | Transportation and Logistics (req without M.S.) |
| Industrial Engineering and Management | Zoology |

### Domestic Students

| | |
|---|---|
| Biochemistry and Molecular Biology (general) | Mass Communication |
| Biology (general) | Mathematics |
| Botany (general) | Microbiology |
| Cellular and Molecular Biology | Molecular Pathogenesis |
| Chemistry (general) | Pharmaceutical Sciences |
| Coatings & Polymeric Materials (general required; subject recommended) | Physics (recommended) |

Communication
Computer Science (recommended)
Criminal Justice ( Ph.D.Program)
Digital Enterprise (recommended)
Electrical and Computer Engineering
Emergency Management ( Master Program)
Food Safety
History
Industrial Engineering and Management
Manufacturing Engineering
Plant Sciences
Political Science
Psychology (general + subject)
Software Engineering (recommended)
Soil Science (450 minimum for both Q and A)
Speech Communication
Statistics (recommended)
Transportation and Logistics (req without M.S.)
Zoology

## MAT (Miller Analogies Test) or GRE may be required with applications to the following programs:

Agricultural Education
Counseling & Guidance (Counselor Education)
Education
Educational Administration (Leadership)
Family and Consumer Sciences Education
Teacher Education (includes Curriculum Design; Health, Nutrition, and Exercise Sciences; Music Education; and Science Education)

**GMAT required with applications to Master of Business Administration Program : Minimum acceptable score is 500.**

## Minimum TOEFL or International English Language Testing System (IELTS) Scores. NDSU requires a minimum TOEFL score of 525 (Paper-based), 197 (Computer-based), or 71 (Internet-based); or a minimum IELTS score of 5.5.

Note: For more information about TOEFL Click Here

Note: For more information about GMAT Click Here

## The following programs have a higher minimum TOEFL or IELTS requirement.

| Department | TOEFL | | | IELTS |
|---|---|---|---|---|
| | Paper-based | Computer-based | Internet - based | |
| Agricultural and Biosystems Engineering | 550 | 213 | 79 | 6 |
| Agricultural Economics | 550 | 213 | 79 | 6 |
| Anthropology | 600 | 250 | 100 | 7 |
| Biochemistry and Molecular Biology | 600 | 250 | 100 | 7 |
| Biology | 550 | 213 | 79 | 6 |
| Botany | 550 | 213 | 79 | 6 |
| Business Administration | 550 | 213 | 79 | 6 |
| Cereal Science | 550 | 213 | 79 | 6 |
| Chemistry | 600 | 250 | 100 | 7 |
| Communication | 600 | 250 | 100 | 7 |

| | | | | |
|---|---|---|---|---|
| Computer Science | 550 | 213 | 79 | 6 |
| Engineering Ph.D | 550 | 213 | 79 | 6 |
| English | 600 | 250 | 100 | 7 |
| Entomology | 550 | 213 | 79 | 6 |
| Environmental and Conservation Sciences | 550 | 213 | 79 | 6 |
| History | 600 | 250 | 100 | 7 |
| Industrial and Manufacturing Engineering | 550 | 213 | 79 | 6 |
| Pharmaceutical Sciences | 550 | 213 | 79 | 6 |
| Physics | 550 | 213 | 79 | 6 |
| Plant Pathology | 550 | 213 | 79 | 6 |
| Political Science | 600 | 250 | 100 | 7 |
| Polymers and Coatings | 550 | 213 | 79 | 6 |
| Software Engineering | 550 | 213 | 79 | 6 |
| Statistics | 550 | 213 | 79 | 6 |
| Zoology | 550 | 213 | 79 | 6 |



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# Reservation Of Rights

Every effort has been made to provide accurate and current information; however, the right is reserved to change any of the rules and regulations of the University at any time, including those relating to admission, instruction, and graduation. The right to withdraw curricula and specific courses, change or discontinue programs, alter course content, change the calendar, and impose or increase fees similarly is reserved.

In some cases, requirements for programs and prerequisites for courses offered are effective even if they are not listed in this bulletin. All such changes are effective at such times as the proper authorities determine, and may apply not only to prospective students but also to those who already are enrolled in the University.



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# Disclaimer

The State Board of Higher Education requires that the following announcement be published in all catalogs and bulletins of information issued by the state educational institutions of North Dakota: "Catalogs and bulletins of educational institutions are usually prepared by faculty committees or administrative officers for the purpose of furnishing prospective students and other interested persons with information about the institutions that issue the same. Announcements contained in such printed materials are subject to change without notice, and may not be regarded in the nature of binding obligations on the institutions and the State. In times of changing conditions, it is especially necessary to have this definitely understood."



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# Equal Opportunity

NDSU is an Equal Opportunity Institution

North Dakota State University is fully committed to equal opportunity in employment decisions and educational programs and activities, in compliance with all applicable federal and state laws and including appropriate affirmative action efforts, for all individuals without regard to race, color, national origin, religion, sex, disability, age, Vietnam Era Veterans status, sexual orientation, status with regard to marriage or public assistance, or participation in lawful activity off the employer's premises during nonworking hours which is not in direct conflict with the essential business-related interests of the employer.

More specifically, the University abides by the requirements of Title VI of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, and Section 504 of the Rehabilitation Act of 1973 as well as the implementing regulations of the Department of Education (34 CFR Parts 100, 106, and 104, respectively).

Inquiries concerning compliance may be directed to NDSU Director of the Office for Equity and Diversity (202 Old Main, 231-7703), or to the Office for Civil Rights, Chicago Office, U.S. Department of Education, 111 N. Canal Street, Suite 1053, Chicago, IL 60606-7204.



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# Accreditation

North Dakota State University is accredited as an institution by the North Central Association of Colleges and Secondary Schools. Inquiries may be directed to the North Central Association of Colleges and Schools Commission on Institutions of Higher Education, 30 North LaSalle St., Suite 2400, Chicago, IL 60602-2504. (tel. 1-800-621-7440). In addition, many programs are accredited or approved by their respective professional organizations and agencies.



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# Privacy Of Student Records

The disclosure of student educational records is governed by policies developed by North Dakota State University in compliance with state law and the Family Educational Rights and Privacy Act of 1974 as amended (FERPA). There are essentially two types of student records, public directory information and nonpublic information. Directory information may be released publicly except in cases where students have specifically requested that the information not be released. Nonpublic information, which includes the academic transcript, is considered confidential and will not be released, other than to authorized personnel or as allowed by law, without the written authorization of the individual. University policies relative to student records are specified in the FERPA annual notice, the "NDSU Policy Manual" Section 600, and at www.ndsu.nodak.edu/general_counsel/, and contained in the publication titled "Rights & Responsibilities of Community: A Code of Student Behavior," which may be obtained from the Office of Student Affairs, 100 Old Main. Students may restrict the release of directory information no later than the tenth class day of the semester at Registration and Records, 110 Ceres.



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# Admissions

## Admission Requirements

Admission to the Graduate School is open to qualified graduates of universities and colleges of recognized standing without regard to race, color, national origin, religion, sex, disability, age, Vietnam-era veterans status, sexual orientation, or status with regard to marriage or public assistance.

Admission to the Graduate School is a selective process intended to identify applicants who are outstanding among recipients of baccalaureate degrees.

The following minimum qualifications are required of all students seeking an advanced degree:

1. The applicant must have a baccalaureate degree from an educational institution of recognized standing.
2. The applicant must have adequate preparation in the chosen field of study and must show potential to undertake advanced study and research as evidenced by academic performance and experience.
3. At the baccalaureate level, the applicant must have earned a cumulative grade point average (GPA) of at least 3.0, or equivalent, to attain full standing in a graduate degree program. Applicants whose last degree completed is a graduate degree may be admitted in full standing if the final GPA of that degree is at least 3.0 or equivalent.
4. Each program may set higher qualifications and may require the submission of additional evidence of academic performance.

A student shall be permitted to register for graduate study only after formal admission. Programs make recommendations on all applications, but the final admission decision is the responsibility of the Dean of the Graduate School.

## For graduate application

All application materials are due one month before registration for U.S. students; some programs have earlier deadlines. (See program sections within the Graduate Bulletin for details.) For international students, the completed application packet (application form, application fee, reasons for graduate study statement, official transcripts, and the three letters of reference) and required test scores must be received by the Graduate School prior to May 1 for Fall Semester and prior to August 1 for Spring Semester unless the department has other posted deadlines. There is additional paperwork for international students.Click here for graduate application.

Official transcripts (transcripts having an appropriate seal or stamp) of all previous undergraduate and graduate records must be received by the Graduate School before the application is considered complete. When a transcript is submitted in advance of completion of either undergraduate or graduate studies, an updated transcript showing all course credits, grades, and degree completions must be provided prior to initial registration at NDSU.

Three letters of recommendation are required before action is taken on any application. Personal reference report forms are available from the Graduate School website.

A list of programs requiring or recommending Graduate Record Examination (GRE) scores can be found by following this link TestScores. The Master of Business Administration program requires a score of 520 or above on the Graduate Management Admission Test (GMAT). Minimum TOEFL or International English Language Testing System (IELTS) scores by program are also listed on TestScores. Test dates of all official tests must be within two years of the date of the application to the Graduate School.

## Admission of International Students

North Dakota State University welcomes international students as part of the student body, and the Graduate School encourages applications from qualified students throughout the world. More than 25% of the approximately 1,700 graduate students are international students.

In addition to meeting the previously stated admission requirements, to qualify for admission in an advanced degree program, all international students must demonstrate proficiency in English and must provide evidence of adequate financial support for themselves and any dependents for the duration of their graduate program.

## Language Proficiency

English proficiency must be demonstrated prior to admission by obtaining a minimum score of 525 (paper-based test) or 197 (computer-based test) or 71 (internet-based test) on the Test of English as a Foreign Language (TOEFL) or a score of 5.5 on the (IELTS). The test date must be within two years of the date of the application to the Graduate School. Information about these tests are available from our website (TestScores).

Some programs require higher scores for admission to their degree programs (Click Here). This requirement of a TOEFL or IELTS score may be waived for students from countries where English is the official language and for students who have recently earned a degree from a U.S. university or college.

Once documentation of the required level of English proficiency has been received by the Graduate School and all other admission requirements are met, the student may be admitted to a graduate degree program.

Under certain circumstances, applications from students not able to demonstrate the minimum level of proficiency in the English language may be accepted conditionally, but English proficiency at the stated level must be demonstrated prior to attainment of full standing in a graduate degree program. North Dakota State University offers an Intensive English Language Program during the Summer, Fall, and Spring Semesters designed to raise the English proficiency of Graduate School applicants who have scored at least 500 on the TOEFL or a 5 on the IELTS and are otherwise academically acceptable. Applicants accepted into Graduate School with TOEFL scores between 500 (173 computer-based test or 61 internet-based test) and 525 (195 computer-based test or 71 internet-based test) are given conditional admission and required to complete this program at their own expense or submit a new TOEFL score after further study.

The address is

Intensive English Language Program,
North Dakota State University,
Office of International Programs,
P.O. Box 5582,
Fargo, North Dakota 58105-5582, USA.
Tel: 701-231-7895, Fax: 701-231-1014
e-mail: ndsu.international@ndsu.nodak.edu
Online: www.ndsu.edu/International.

## Special Examinations for International Graduate Students Involved with Teaching

Teaching assistants must attain a score of 600 (paper-based test) or 250 (computer-based test) or 100 (internet-based test) or better on the TOEFL or a score of 7 or better on the IELTS; must pass an oral proficiency interview administered by a Graduate School representative; and must show written proficiency with either a Test of Written English (TWE) score of 5.0 or better, a pass grade on a writing sample administered at NDSU, or completion of two semesters of English writing at NDSU with grades of B or better. It is recommended that the TWE be taken at the same time as the TOEFL or IELTS whenever possible. The test dates of the TOEFL, IELTS and TWE must be within two years of the date of application to the Graduate School.

In addition to the TOEFL or IELTS, many programs require or recommend Graduate Record Examination (GRE) scores of international applicants (Click Here).

## Financial Requirements

Certification of adequate financial support is required from all international applicants other than permanent residents of the United States, parolees, refugees, United States trust territory applicants, or immigrants. Admission will not be granted until proof of funds for the duration of graduate study has been submitted. A special North Dakota State University Financial Certification Form must be completed for this purpose (Click Here). Failure to complete this certification and submit supporting documents will delay admission decisions and the issuance of the appropriate immigration forms. Applicants must be prepared to pay tuition, fees, and costs for living expenses for their entire stay at the university. North Dakota State University does not provide financial assistance for graduate international students who have not been granted an assistantship. A detailed summary of expenses is included in the international application packet. Each applicant should become familiar with his/her financial needs based on that summary.

## Transfer of Funds

There are often difficulties in transferring funds from foreign countries to the United States. Before departing for the United States, students should become thoroughly familiar with their home government's regulations for exchanging and forwarding money.

## Transfer International Students

All international students currently studying in the United States must submit the Supplemental Information Form as part of the application. This form is to be completed by the applicant and the applicant's present or most recent international student adviser.

## Medical Insurance

International students are required by the North Dakota State Board of Higher Education to purchase the Board approved health insurance policy before they are allowed to register. No other policy may be substituted. The fee for health insurance for one year must be paid upon arrival and at the beginning of each subsequent year. Because of the increasing costs of healthcare in the United States, health insurance for a student's spouse and accompanying dependents is highly recommended and is included in the estimate of expenses for accompanying dependents. In addition, the state of North Dakota requires documentation of immunity to measles, mumps, and rubella prior to registration for courses.

## International Application Deadline

All application materials for international students must be received by the Graduate School prior to May 1 for Fall Semester and prior to August 1 for Spring Semester. Applications received after that date will automatically be considered for the next semester. This regulation applies to students matriculating from abroad because of the time required to obtain current financial information, determine student status, and issue the appropriate immigration form.

International students transferring to NDSU from another United States university or college must submit complete applications not later than June 1 for Fall Semester and October 1 for Spring Semester.

## Intensive English Language Program

The Intensive English Language Program is open to international visitors and graduate and undergraduate applicants who plan to enroll at North Dakota State University. The course is designed for individuals whose scores on the Test of English as a Foreign Language (TOEFL) or IELTS do not meet minimum standards and who are required to participate in the course as a condition of admission to the university or as a condition of being awarded a teaching assistantship. However, it is recommended for any international student wishing to improve his or her English language skills or desiring extra preparation for college-level course work. The full-time, highly intensive course is offered every Summer for 5 weeks and every Fall and Spring Semester for 15 weeks. No college credit is given, and students attend at their own expense.

For more information, contact

Intensive English Language Program
North Dakota State University
Office of International Programs
P.O. Box 5582
Fargo, North Dakota 58105-5582 U.S.A.
Tel: 701-231-7895
Fax: 701-231-1014
e-mail: ndsu.international@ndsu.nodak.edu
Online at: www.ndsu.edu/International.

## Sponsored International Students

Agencies and foreign governments that require special administrative and management services from the Office of International Programs at NDSU are assessed an administrative fee. Contact the Office of International Programs for fee amounts.

## Action on Applications

All applicants who have provided the required application materials, including completed application forms, application fee, reasons for graduate study statement, transcripts, transcript evaluation fee (if necessary), any required educational credentialing, three completed letters of recommendation, and any appropriate test scores, will be notified of action taken on their request for admittance to the Graduate School. Admission of all graduate students requires approval by the Dean of the Graduate School.

## Admission Status

Graduate students will be admitted under one of the following classifications:

**Full Graduate Standing**
These students have met all requirements for admission and have been accepted by a program leading to a graduate degree. A student must have full graduate standing to receive a graduate degree.

**Conditional Standing**
Students in conditional standing do not meet all requirements for admission or have deficiencies in prerequisite course work but show potential for successful graduate study. Evidence must be provided showing that the applicant's potential is not adequately reflected by his or her record. In making this recommendation, the program must specify standards of performance that must be satisfied for a change in status to full graduate standing. Any students admitted in conditional status because of grade

deficiency is automatically placed on aceademic warning. If a student on academic warning fails to achieve GPA of atleast 3.0 in the subsequent semester of attendance, then the student will be placed on academic probation. The student may not earn more than 12 semester hours of graduate credit in the conditional status.

Students admitted under conditional status may, in consultation with their major adviser, request a change to full graduate standing after demonstration of specified capability in graduate studies. This request containing the academic justification for the change is to be made of the Dean of the Graduate School by the major adviser and approved by the program administrator. Eligibility for graduate assistantships will be determined by the program. Students with conditional status cannot become candidates for a degree; they have to achieve full graduate standing.

**Non-Degree Enrollment**
Individuals who hold a baccalaureate degree from an institution of recognized standing may enroll as non-degree students. This category is for individuals who desire to pursue study beyond the baccalaureate degree for personal growth and improvement of skills but not in order to work toward an advanced degree objective. To become a non-degree student, individuals must complete an application form and submit the appropriate fees. Students must have the prerequisite courses or background/experience necessary for the course or courses in which they desire to enroll. This may require consultation and approval from course instructors. In courses with limited enrollment, preference will be given to degree-seeking students.

Students enrolled with non-degree status are not eligible for graduate assistantships, tuition waivers, or federal title IV student financial assistance. Students in this category are affiliated with the Graduate School and not an academic program. No more than 10 credits taken under the non-degree status with a grade of B or higher can be transferred to any official program of study should there be, at any future date, a decision to seek degree classification. Professional development graduate courses (numbered 600) are not eligible for graduate degree programs and may be taken without formal admission to NDSU.

## Change in Classification

Students enrolled with non-degree status may subsequently desire to be considered for admission to the Graduate School to pursue an advanced degree. Such a change in status may be accomplished for a subsequent term by submitting a complete application to the Graduate School as a degree-seeking student. The student must be acceptable to a specific program. Appropriate course credits (no more than 10) earned in the non-degree status may be used to fulfill graduate degree requirements if approved by the student's program committee and the Dean of the Graduate School. No course taken in the non-degree status for which the grade is less than B will be permitted on a plan of study for a graduate degree.

## Registration Procedure

In the letter notifying an applicant of admission, the Graduate School will identify an individual, usually the program administrator, whom the applicant should contact. The student should confer with this, or another, program representative prior to initial registration.

## General

The purpose of this bulletin is to provide information about the graduate programs of North Dakota State University. It should not be considered an offer or a contract. While every effort has been made to make this information as complete and accurate as possible, it should be noted that changes may occur at any time in the requirements, course offerings, fees, etc. listed in this bulletin. However, students are allowed to meet the degree requirements in effect at the time of first enrollment as a degree-seeking student, provided the student is able to complete the degree requirements reflected in the appropriate bulletin within the stated time frame and the student has maintained continuous enrollment status.
It is the responsibility of the student to be familiar with and complete the requirements for the degree being sought.

NDSU  The Graduate School





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# Graduate School Policies





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# General Policies

## Scholastic Standards

In fulfilling graduate course requirements on any plan of study, only grades of A, B, or C are acceptable. For master's paper (797), master's thesis (798), and doctoral dissertation (799), only the grade of satisfactory (S) is acceptable. For seminar (790), case studies (792), individual study/tutorial (793), practicum/internship (794), or field experience (795), only grades of A, B, C, or S are acceptable for graduate credit.

All courses taken by a graduate student for which grades are given will be used in calculating the grade point average, except where a course has been repeated. Both grades will appear on the transcript, but only the second grade will be used in calculating the grade point average. (A specific course can be retaken only once, and only three total courses can be retaken).

Satisfactory or Unsatisfactory is assigned for research credits, and they are not used in calculating the GPA. To be in academic good standing and to receive a graduate degree, a student must have a cumulative grade point average of at least 3.0.

Programs and/or supervisory committees may require a higher performance than C in certain courses. While some courses may be used for graduate credit with a grade of C, acquisition of more than two grades of C or below may be grounds for dismissal upon recommendation by the program administrator.

Any student in GOOD STANDING whose cumulative grade point average drops to less than 3.0 at any time of attendance is automatically placed on academic WARNING. Any student admitted in CONDITIONAL status because of grade deficiency is automatically placed on academic WARNING. If a student on academic WARNING fails to achieve a cumulative grade point average of at least 3.0 in the subsequent semester of attendance, then the student will be placed on academic PROBATION.

A student on academic PROBATION may not continue the pursuit of the graduate degree program without a waiver from the Dean of The Graduate School acting on a recommendation from the appropriate program administrator. This recommendation must include a review of the student's status and a proposed plan of remediation which will allow the student an opportunity to return to a cumulative grade point average of at least 3.0 within one additional semester. If the cumulative grade point average is not at least 3.0 after this one additional semester, the student will be dismissed from his or her graduate program.

A student on academic PROBATION is not eligible for a graduate assistantship or tuition waiver.

These minimal scholastic requirements apply to each student enrolled in The Graduate School. Additional requirements may exist for certain graduate programs.

## Credit Load

Nine credits are considered a full-time graduate load. Graduate assistants in half-time status (0.5 FTE) are considered full-time if registered for four or more graduate credits. Federal law requires all international students with a 20-hr/week assistantship to carry at least six graduate credits for full-time status. Graduate assistants wishing to register for more than 12 credits in a regular semester shall secure the approval of their academic dean and the Dean of The Graduate School.

## Graduate Courses

Courses approved at the 600 and 700 level may be taken for graduate credit and used to satisfy course requirements on the student's graduate plan of study. Didactic courses are those courses approved for graduate credit numbered 601-689, 691, 700-789 and 791. Courses numbered 690, 692-699, 790, and 792-799 are considered special or experimental courses and are not to be included as didactic courses on a plan of study. Courses that a student has used to fulfill the requirements of a baccalaureate degree may not be used on that student's graduate plan of study.

## Registration for Research Credit

A student conducting research for the disquisition is to be enrolled in 797, 798, or 799 for the number of credits specified on the plan of study. If a student's program has a cap on the number of 797, 798 or 799 credits that may be earned in the pursuit of degree, the student is to register for 797R, 798R, or 799R (or regular credit at the discretion of the host Program) during each semester in which the student uses faculty consultation and/or University facilities and/or University administration. Such registration is required even in absentia when faculty and/or administration time is consumed in manuscript review, communication, and other forms of assistance.

## Continuing Education Graduate Courses

Graduate courses administered through the Office of Distance and Continuing Education (DCE) are eligible for graduate degree plans of study if they carry a permanent course number, or the 691/791 or 696/796 designation. Courses numbered 691/791 are trial courses and course numbered 696/796 are special topic courses; courses 691/791 are viewed as didactic courses. The 696/796 courses can be counted as didactic courses if they are later approved as permanent courses.

Courses designed for professional advancement are given the number 600. Although such courses are considered graduate level and the grades for the courses are calculated into the cumulative GPA, they cannot be counted for NDSU graduate degree plans of study.

Course instructors must be full of associate members of the NDSU graduate faculty or approved in advance by the administrator of the unit whose course prefix is used, the appropriate academic dean, and the Graduate Dean.

## Continuous Enrollment/Leave of Absence

Graduate credit for any course work that is more than seven (7) calendar years old at the time of the final examination cannot be used to satisfy a master's degree program. The analogous time limitation for a doctoral degree is 10 years. Following the final examination, the candidate has one (1) year during which to provide The Graduate School a disquisition for which the Graduate Dean will sign final approval of all requirements for the degree. Should the disquisition not be deposited as specified or any other degree requirements not be completed within this time limit, the student must repeat the final examination.

Several signatures are required for admittance into The Graduate School, and several signatures are required to either graduate or withdraw from the system. It is only fair to the system that graduate students inform The Graduate School as to their whereabouts. Students who interrupt their graduate program prior to the completion of all degree requirements must maintain continuous enrollment for the Fall and/or Spring Semesters of the absence or obtain a leave of absence, which is to be submitted in writing for approval by the Graduate Dean.

The penalty for not maintaining continuous enrollment until submitting final copies can become steep. The Graduate Dean will not approve the degree until the student has registered for the appropriate number of credits of research for any Fall and/or Spring Semesters not covered by either registration or leave of absence. The number of these credits, determined by the Graduate Dean after consulting with the student and the chair of the student's supervisory committee, will amount to at least one (1) credit per semester not covered by either registration or leave of absence, but not more than four (4) credits total. A student who has not registered for longer than a continuous two-year period must also reapply for

admission and is subject to the degree requirements at the time of readmission. Students who move out of the state may maintain their North Dakota residence status for up to 12 months, after which it is assumed that out-of-state tuition applies.

NOTE: Leaves of absence do not amend in any way the seven and ten-year time limitations.



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# Graduate Assistantships

- **Graduate Assistantship Policy**
- **English Language Proficiency for Teaching Assistants**



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Fax: (701) 231-6524

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# Graduate Assistantships

## Graduate Assistantship Policy

## Introduction

Graduate assistants are typically full-time graduate students who participate in teaching, research, or administrative activities in exchange for financial support at North Dakota State University . Graduate assistantships and fellowships are awarded to graduate students who, based on their credentials, are deemed likely to be highly successful as students. Graduate assistantships contribute to student professional development with the primary purpose of assisting students in the successful completion of their academic program. Activities that are relevant to each student's program of study and contribute to the university's teaching, research/creative activity, or service efforts should be incorporated. Each assistantship requires periodic oral and written assessment and feedback regarding a student's performance. Students receiving a graduate assistantship or fellowship are expected to maintain good academic standing and satisfactory progress toward their degrees. Please refer to the section on Graduate School Policies for more information.

## Eligibility for Assistantships

Each graduate program must develop a procedure for the awarding of graduate assistantships. Recommendations for assistantships are made to the graduate dean and are subject to the dean's approval. Graduate programs may have specific requirements for eligibility and need to develop a procedure to periodically assess the performance of graduate assistants. Graduate assistantships may also be awarded outside of the student's home program. These assistantships require the continued approval of the graduate program administrator and the graduate dean.

Before any assistantship can be awarded, students must be admitted to the Graduate School as a degree-seeking student. Students placed on Academic Warning may retain their assistantship. Students placed on Probation may no longer receive an assistantship.

Teaching assistants whose native language is not English need to demonstrate English proficiency (refer to section titled “English Language Proficiency for Teaching Assistants”).

## Assistantship Expectations

Students must be registered for credit each semester they receive an assistantship. Students must dedicate the required number of hours to assigned work each week. In addition, international students must maintain the appropriate residency status.

Assistantship appointments may vary in length and are contingent upon the availability of funding. Some assistantships are granted for one academic term or year with reappointment dependent upon performance review. Other assistantships are for multiple years with annual performance reviews. A general guideline for maximum time allowed is two to three years for a master's student and four to five years for doctoral students. Additional time may be approved, on a case-by-case basis, if the work being accomplished by the student warrants such action.

## Stipend Levels

Graduate assistantship stipends vary by discipline. A full-time assistantship consists of 20 hours/week. For information on the current minimum stipend level for a full assistantship, refer to graduate student handbooks for the specific department and/or departmental web site information. Departments may award stipends of less than the full-time amount, but they must reduce the workload accordingly.

The responsibilities associated with a graduate assistantship may be variable in nature. The hour commitment defined by an assistantship may be averaged across a given time period. For example, a teaching assistantship of 20 hours/week should total to 320 hours across the 16 weeks of the academic term. In these cases, students should be given adequate advance notice of these variable expectations so that they can adjust their schedules to meet the requirements of the assistantship. Supervisors must also remain sensitive to the academic demands faced by graduate students. Students receiving graduate assistantships also receive tuition waivers. To be eligible for a tuition waiver, the assistantship must be at least half-time (10 hours per week) and must pay at least the federal minimum wage. Requests for tuition waivers are submitted by the graduate program administrator in the student's home program. The tuition waiver may have limitations depending on the assistantship appointment.

## Additional Employment at NDSU

Graduate assistants on full assistantships are not allowed to work on a second assistantship, as part-time instructors, as student workers, or in any other capacity for NDSU while working as a graduate assistant unless an exception is approved by the graduate dean *prior to the work being performed* .

Exceptions may be granted for a few hours of extra work for a specific job (for example, administering an occasional exam, teaching an occasional music lesson, or working at a special event held on a weekend), but not for regular additional hours. Additional work performed during the Winter or Spring breaks is allowed. Additional hours may also be appropriate during the Summer term, depending upon the student's credit load for the Summer term. Exceptions must be recommended in writing by the student's supervisor; approved by the student's advisor; and the student's department or program administrator and forwarded to the Graduate School . The Graduate School notifies Payroll that an exception has been granted. These steps must be completed in the order described and before the student begins work.

## Rights and Privileges of Graduate Assistants

Graduate assistants have certain rights and privileges specific to the assistantship experience:

- The right to be notified in writing of all decisions that affect their status as a graduate assistant. This includes advance notification of evaluation procedures and a summary of their performance evaluation.
- The right to be notified of any complaints received by a supervisor or department chair concerning their performance of duties.
- The right to respond in writing to such complaints.
- The right, depending on the availability of departmental and university resources, to be supported in pursuing additional activities that pertain to their professional development.
- The right to balance their assistantship responsibilities with their responsibilities to their academic program so that they can complete their degree in a timely manner.
- The privilege of being treated as a professional in their chosen field of study.

## Termination

Graduate assistants may have their assistantship terminated by the graduate dean, upon recommendation by their supervisor, with probable cause. Early termination for cause may occur when

- A student does not abide by the appointment conditions.
- A student fails to perform tasks as assigned.
- A student does not make adequate degree progress.
- A student is placed on Academic Probation.
- A student does not make satisfactory research progress.
- A student fails to maintain minimum registration.
- A student persistently refuses to follow reasonable advice and counsel of faculty in carrying out assistantship obligations.
- A student fails to comply with responsibilities as an employee set forth in the *Graduate Bulletin* , department rules and regulations governing assistantships, or the terms of sponsored research agreements that fund the assistantship.
- A student's personal conduct is seriously prejudicial to the university, including violation of the NDSU Code of Student Behavior, state or federal law, and general university regulations.

## Appeals Process

The North Dakota State University philosophy is to encourage and seek resolution of problems at the level most closely related to the origin of the specific disputes. This means

- The first step should be an informal conference to first discuss and attempt to resolve the problem (s) with the person(s) directly involved.
- When a mutually satisfactory resolution cannot be reached or if discussion of the problem(s) seems inappropriate because of the nature of the student's complaint, the student should seek advice from the chair of the department.
- Depending on the nature of the problem(s), the department chair or student's graduate committee chair may deal with the situation directly, advise the student to discuss the problem(s) with the appropriate academic dean and/or the graduate dean, or advise the student of the appropriate grievance procedure to pursue.
- If the graduate assistant wishes to challenge the termination decision, a written appeal to the dean of the Graduate School must be made within two weeks of notification of the mediation results (refer to section titled “Graduate Student Appeals”).

Students should not carry more than a full-time load. Individual departments will determine a minimum and a maximum number of credit hours.



E-Mail: The Graduate School

Prospective students may schedule a visit by calling 1-800-488-NDSU.

The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

**Graduate School Search:**

Go

# Graduate Assistantships

## Graduate Bulletin

## English Language Proficiency for Teaching Assistants

North Dakota State University has established a process for verifying communication skills for all personnel whose appointments include classroom instruction. These policies as they apply to graduate students are as follows:

1. Requirements for spoken communication proficiency
Potential teaching assistants whose first language is not English must demonstrate spoken communication proficiency by one of the following methods.

a. Potential teaching assistants whose first language is not English must obtain a minimum score of 26 on the TOEFL iBT Speaking subscale or a minimum score of 7 on the IELTS Speaking subscale.

b. Potential teaching assistants whose first language is not English must obtain a minimum score of 50 on the Test of Spoken English (TSE). This examination assesses oral language proficiency in English as spoken in North America . It evaluates a person's overall comprehensibility, pronunciation, grammar, and fluency. A score of 50 indicates that the individual is generally comprehensible to Americans who are not used to listening to speakers whose first language is not English. This exam is administered by the North Dakota State University Department of Modern Languages in August, December, and April.

c. Graduate assistants who are serving as a tutor must obtain a minimum score of 25 on the TOEFL iBT Speaking subscale, a minimum score of 7 on the IELTS Speaking subscale, or a minimum score of 48 on the TSE.

d. Graduate assistants who are serving as a grading assistant must obtain a minimum TOEFL score of 79 (internet-based test), 550 (paper-based test), or 213 (computer-based test) or a minimum score of 6 on the IELTS.

2. Requirements for written communication proficiency
All potential teaching assistants must provide evidence of their proficiency in written communication skills by submitting evidence of one or more of the following:

a. Completion of one or more courses in English Composition at an accredited institution of higher learning in the United States with a grade of B or better.

b. Completion of an advanced English writing course, e.g., technical writing, at an accredited institution of higher learning in the United States with a grade of B or better.

c. Completion of the TOEFL iBT Writing subscale with a score of 23 or higher or a score of 7 on the IELTS Writing subscale.

d. Completion of the Language Proficiency Test (LPT) administered by the NDSU Center for Writers with a score of 5 or higher.

e. Completion of the Test of Written English (TWE) with a score of 5.0 or higher for teaching assistants whose first language is not English and who do not meet any of requirements a, b, or c above.

f. Completion of North Dakota State University's Intensive English Language Program for teaching assistants whose first language is not English and who do not meet any of requirements a, b, or c. The program is designed to improve the participant's four language skills: listening, speaking, reading, and writing. See index under Intensive English Language Program for pages in this bulletin that give the details of this program.

g. Completion of English 112-122 (Writing for Non-native Speakers) with a grade of B or better for teaching assistants whose first language is not English and who do not meet any of requirements a, b, or c.

3. Comprehensive English Proficiency
All potential teaching assistants whose first language is not English must provide a Test of English as a Foreign Language (TOEFL) score of not less than 100 (internet-based test), 600 (paper-based test), or 243 (computer-based test) to The Graduate School or a minimum score of 7 on the IELTS.



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# Master's Program Policies

## General Requirements for a Master's Degree

**Master's Degree: Supervisory Committee**

The supervisory committee will have at least four members. The members consist of

1. The major adviser, who is selected by the student with the approval of the program administrator. The major adviser-student relationship must be a mutually acceptable one. The major adviser will act as the chair of the student's supervisory committee and will be in charge of the Plan of Study. The remaining members of the committee must be agreed upon by the student and the major adviser.
2. A second member, who must be a full or associate member of the graduate faculty.
3. A third member, who could be either a faculty member or a qualified off-campus expert in the field. If this committee member is not a full or associate member of the graduate faculty, the approval of the Dean of The Graduate School is required. Approval by the dean requires a recommendation from the program administrator accompanied by rationale and a curriculum vitae.
4. The Graduate School appointee. This appointment is made by the graduate dean, but suggestions as to whom the appointee might be are welcome and helpful. The Graduate School appointee must be a full member of the NDSU graduate faculty from outside the student's program. The role of The Graduate School appointee is to ensure that the student's Plan of Study follows Graduate School guidelines and that other Graduate School policies are observed. The Graduate School appointee also ensures that the expectations for the student's performance are reasonable and that interactions with the supervisory committee are conducted on a professional basis.

NOTE: Other qualified individuals may participate as committee members following approval by the Graduate Dean upon a recommendation accompanied by rationale and curriculum vitae by the appropriate program administrator and academic dean.

The supervisory committee should be formed not later than the term immediately after the major adviser is identified for the student, and members should be identified before the plan of study is formulated so all committee members have a chance to contribute to the plan of study.

The supervisory committee agreed upon by the major adviser and student, and approved by the program administrator and the academic dean shall be recommended to the Dean of The Graduate School for final approval.

Each committee member shall have an equal vote in committee decisions. The committee is to assist the student in the preparation of a plan of study and to advise him or her during the period of graduate work. The supervisory committee is encouraged to convene at least once per semester and meet at least once per year to review the progress of the student.

## Master's Degree: Plan of Study

The plan of study shall be appropriate to meet the interests and needs of the student in his or her chosen field as determined by the supervisory committee and approved by the program administrator, the academic dean, and the Dean of The Graduate School. The plan of study should be submitted to The Graduate School for approval not later than the term immediately after the supervisory committee is formed and must be filed in The Graduate School prior to scheduling the final examination. Revisions may be made later as advisable and necessary, but must be approved by the student, all supervisory committee members, the administrator of the student's program, and the Graduate Dean. The Graduate Dean will officially notify the student, supervisory committee, program administrator, and academic dean of all changes.

The plan of study shall include the specific courses the student is expected to complete and any other special requirements of the particular master's degree that the student is seeking. The total credits will be determined by

each program but must not be less than 30 graduate credits.
For the Thesis Option, of the required minimum 30 graduate credits, at least 16 credits must be approved for graduate credit numbered from 601-689, 691, 700-789, and 791 while the research credits (798) must be not fewer than 6 nor more than 10 credits. Once these minimum requirements have been met, any other graduate courses can be used to satisfy the remaining plan of study requirements.

For the Comprehensive Study Option, of the required minimum 30 graduate credits, at least 21 credits must be completed using courses approved for graduate credit numbered from 601-689, 691, 700-789, and 791 while the research credits (797) must be not fewer than 2 nor more than 4 credits.

The various programs determine which approved graduate courses may be used. For specific requirements, the student should consult the specific programs.

## Master's Degree: Transfer of Credit

All graduate credits used to meet the requirements of a master's degree must be approved by the supervisory committee, the program administrator, the academic dean, and the Dean of The Graduate School. A candidate for the master's degree must petition in order to transfer up to a maximum of 9 semester hours of graduate credit from another institution to satisfy course requirements on the plan of study.

Courses listed in the Graduate Bulletin of the Tri-College University Educational Leadership Program are not considered transfer credits and can be included on programs of study without petition. All other Minnesota State University Moorhead graduate credits are subject to the minimums of transfer credits and to the policies given in the text.

Transfer credits 1) must ordinarily have been earned from a U.S. or Canadian institution accredited to offer graduate courses and degrees (Credits from international institutions can be transferred only if approved by a committee from the student's program); 2) must carry only grades of A or B; 3) must have been earned within a 7-year period at the time of the final examination; 4) must be graduate level; 5) must not be a continuing education, correspondence, extension, or workshop course; 6) must not be internship, individual study, special problem, or research (disquisition) courses, or courses graded Pass/Fail or Satisfactory/Unsatisfactory; 7) must not have been used to fulfill the requirements of a baccalaureate degree; 8) must be verified by an official transcript; and 9) will not be used in calculation of the grade point average. It is the responsibility of the student to provide official transcripts of graduate courses taken elsewhere to The Graduate School.

NOTE: The Special Problem credits of item (6) above are equivalent to North Dakota State University's 696/796 Special Topic credits.

## Master's Degree: Time Limitation

Graduate credit for any course work which is more than seven (7) calendar years old at the time of the final examination cannot be used to satisfy degree requirements. The final examination must be retaken if the final five (5) copies of the approved disquisition are not delivered to The Graduate School within one (1) year of the date of the final examination or if any other degree requirements have not been completed within one (1) year of the date of the final examination.

If a period of time two years or greater lapses before the final copies are submitted, the student must reapply to The Graduate School and must register for a minimum of two (2) credits. Degree date is based on the date when **final** copies are submitted to The Graduate School.

## Master's Degree: Final Examination

The candidate shall pass a final examination (either oral or written as specified for the degree) before being awarded the master's degree. The supervisory committee shall serve as the examining committee of which the major adviser shall serve as chair. Substitutions must be approved by the Dean of The Graduate School.

The final examination shall cover the course work taken by the candidate and also the disquisition, seminar papers, or oral examination paper and knowledge fundamental thereto. The candidate shall prepare for each member of the committee a written statement describing the plan of study, i.e., a list of courses, instructors, credits, grades, and dates taken. Permission to schedule the examination must be requested of The Graduate School by the student's major adviser using the appropriate form. The request to schedule must be sent to The Graduate School at least two (2) weeks prior to the examination. Also, the student should personally meet with The Graduate School to verify that all courses on the plan of study have been completed and the required grade point average has been attained. The Graduate Dean will formally notify the committee and the student when and where the examination has been

scheduled.

Care should be taken by the student to schedule the examination with all committee members. The notification by The Graduate School will confirm this scheduled examination.

The disquisition in a near final form must be given to the committee members no fewer than seven (7) days prior to the examination. If this seven (7)-day stipulation cannot be met, the student must either secure the concurrence of all committee members or reschedule the examination. At the conclusion of the examination, the examining committee shall record, in writing, approval or disapproval. This form must be filed with The Graduate School within seven (7) days of the exam.

A negative vote by more than one member of the student's committee will signify failure of the final examination. The student may repeat the examination only upon permission from a majority of the supervisory committee. The committee will specify a period of time, not less than one (1) month, that must elapse before the examination can be repeated. Exceptions to this time limit will be considered by the Graduate Dean upon presentation of written justification from the chair of the committee in consultation with the committee.

Should the examination be failed twice, the student will not be given a third examination except by recommendation of the examining committee, program administrator, and special approval of the Dean of The Graduate School following consultation with the Graduate Council.

Continuous enrollment is required until all degree requirements are completed.

To participate in commencement, the student must have passed the final examination seven days prior to the commencement ceremony.

## Multiple Graduate Degrees

On occasion, a student may be allowed to work at satisfying the requirements of two graduate degrees concurrently. In completing all program and Graduate School requirements for two degrees, a maximum of nine (9) graduate credits of course work can be applied to both programs of study as approved by all members of both supervisory committees, the two program administrators, the academic dean(s), and the Dean of The Graduate School. The disquisitions must differ substantially and must result from substantial work completed independently in each discipline. There are two final examinations. The appropriate time limitation applies to all course work.

## Master's Degree with Two Major Areas

Under special circumstances, a student may pursue one master's degree with two major areas. Such a program must have the concurrent recommendation of the administrators of the two programs. The plan of study shall clearly delineate the course work required for each major area. A minimum of 40 credit hours is required, including at least 14 graduate course credits in each of the two major areas. No more than 10 of the required 40 credits shall be research credits under the Thesis Option while no more than 3 of the required 40 credits shall be paper credits under the Comprehensive Study Option. The student is required to conduct interdisciplinary scholarly work culminating in a disquisition acceptable in both major areas.

## Master of Science Requirements

The Master of Science degree is offered in two options: Thesis Option (available in all programs) or Comprehensive Study Option (not available in all programs). The Thesis Option emphasizes research and abilities to analyze data and prepare a scholarly thesis, whereas the Comprehensive Study Option emphasizes a broader understanding of a major area. In those programs offering both options, the choice should be made jointly by the student and adviser, based upon the nature of the responsibilities for which the student is preparing.

## Thesis Option

Under the guidance of the major adviser, each candidate shall prepare a thesis approved by the administrator of the major program and acceptable to the oral examination committee and to the Dean of The Graduate School. Of the 30 graduate credits required, a minimum of 16 credits must be in courses approved for graduate credit numbered 601-689, 691, 700-789, and 791 (referred to as didactic courses); thesis credits must not be fewer than 6 nor more than 10 credits. The thesis bearing the approval of the major adviser shall be in the hands of the examining committee at least seven (7) days before the final oral examination. The candidate shall consult the major adviser regarding the form in which the thesis is to be presented. General instructions on the thesis format are included in the North Dakota

State University Graduate School's Guidelines for the Preparation of Dissertations, Theses, and Papers. The thesis is the basis for opening the oral examination.

## Comprehensive Study Option

This option is offered in certain fields where the candidate may benefit more from a broader range of knowledge than from the preparation of a thesis. Of the 30 graduate credits required, a minimum of 21 credits must be in courses approved for graduate credit numbered 601-689, 691, 700-789, and 791 (referred to as didactic courses). The research credits(797) must not be fewer than 2 nor more than 4.

The creative component(paper, portfolio, etc.) bearing the approval of the major adviser shall be in the hands of the examining committee at least 7 days before the final oral examination. The creative component must demonstrate ability to do scholarly study appropriate to the major field and present evidence of appropriate written expression. The creative component is the basis for opening the oral examination. General instructions on the format for papers are included in the North Dakota State University Graduate School's Guidelines for the Preparation of Dissertations, Theses, and Papers.

## Master's Degree IRB, IBC, and/or IACUC Approval

Disquisitions which involve research using human or animals as subjects or biohazard materials will not be approved by The Graduate School if such research has not been previously approved by the Institutional Review Board (IRB), Institutional Animal Care and Use Committee (IACUC), or Institutional Biosafety Committee (IBC) as appropriate. Every effort should be made by advisers to see that students are aware of these University requirements.

NOTE: If a proposed graduate research project involves human, animal, or biohazard subjects, it must be submitted for review and approval by the Institutional Review Board (IRB), the Institutional Animal Care and Use Committee (IACUC), and/or the Institutional Biosafety Committee (IBC). This process should be initiated by the student after his or her supervisory committee has approved the final research design because IRB, IBC, and/or IACUC approval must be obtained **before** the research project commences and cannot be granted retroactively. Please include a copy of the appropriate approval letters when the dissertation is submitted for editing.

## Filing the Thesis or Paper

After the final examination, the student incorporates into the thesis or paper corrections suggested at the oral examination. The student, major adviser, and program administrator then sign the Checklist for Dissertations, Theses, and Papers; and one copy of the thesis or paper, printed on regular paper, is presented to The Graduate School for approval by a disquisition editor and the Dean of The Graduate School. This copy must be accompanied by a receipt from the Business Office for the completion package. After approval, 5 final copies of the thesis or paper, on the required paper are to be presented, unbound, to The Graduate School. Two bound copies of the thesis or paper go to the university library. The remaining 3 bound copies are for the student, the student's adviser, and the student's program.

The student will have 1 year from the date of the final examination to deliver the 5 final copies to The Graduate School and complete all other degree requirements. Should the disquisition not be deposited as specified or any other degree requirements not be completed, the student must retake the final examination. If a period of time two years or greater lapses before the final copies are submitted, the student must reapply to The Graduate School and must register for a minimum of 2 credits. Degree date is based on the date when **final** copies are submitted to The Graduate School.

## Master of Arts Requirements (M.A.)

The Master of Arts degree is offered in two options: The Thesis Option or the Comprehensive Study Option. Candidates for the Master of Arts degree will meet the above general requirements and those specific requirements in the humanities or social and behavioral sciences. These normally include 2 years of a foreign language. This requirement can be satisfied with undergraduate courses and/or a proficiency examination. The Department of Modern Languages will certify proficiency in the specified foreign language by signing the program of study in the appropriate place.

## Master of Business Administration (M.B.A.)

The Master of Business Administration degree is a non-disquisition, professional degree program structured to serve qualified students with any undergraduate degree. The program has two general parts: a foundation course requirement involving up to 30 semester credits and an MBA (common body of knowledge) graduate course requirement of 30 semester credit hours. Depending upon the student's prior course work, all or part of the foundation requirement may be waived. For more details, see the section on Business Administration in this bulletin.

## Master of Education (M.Ed.)

The Master of Education degree is a non-disquisition, practitioner-oriented degree for teachers and school counselors. Candidates for this degree will meet these general requirements as well as specific requirements established by the School of Education.

## Education Specialist (Ed.S.) in Educational Administration

In addition to offering several Master of Education (M.Ed.) programs preparing candidates for administration credentials in North Dakota, the Educational Leadership program is an integral part of the Tri-College University (a consortium of North Dakota State University, Minnesota State University Moorhead, and Concordia College) which prepares students for Master of Science (M.S.) and Education Specialist (Ed.S.) degrees in Educational Administration. Programs meet certification requirements in the various areas appropriate to elementary and secondary administration. Information can be secured from the Tri-College University Office or the NDSU Graduate School.

## General Summary of Procedures

1. Gain admission to The Graduate School.
2. Select, with the major adviser, two other members to serve on the supervisory committee. One of the members must be a full or associate member of the graduate faculty. The other member could be either a faculty member or a qualified off-campus expert in the field, depending upon the program. The fourth committee member is The Graduate School appointee, who must be a full member of the NDSU Graduate Faculty.
3. If appropriate, remove admission deficiencies in order to qualify for full-standing status.
4. Develop a plan of study with the major adviser in consultation with all other supervisory committee members.
5. Submit the plan of study to the Dean of The Graduate School for approval no later than the term immediately after the supervisory committee is formed.
6. Complete courses listed on plan of study, including the disquisition. Maintain continuous enrollment, or obtain leave of absence from the Dean of The Graduate School.
7. Personally meet with a student service associate in The Graduate School to verify that all courses on the plan of study have been completed and the required GPA has been attained.
8. Seek permission to schedule the oral examination from the major adviser. The request to schedule the examination is sent to The Graduate School two (2) weeks prior to the examination.
9. Submit the disquisition in near final form to the supervisory committee members no fewer than 7 days prior to the examination.
10. Be sure that the examining committee immediately reports, in writing, the results of the examination to the Dean of The Graduate School.
11. Submit 1 draft of the thesis or paper to The Graduate School for approval. Please include a copy of the IRB, IBC, and/or IACUC approval letters(s) on top of this draft. The $200 completion package charge needs to be submitted with the first draft. Revision(s) of the thesis or paper may be required.
12. Submit 5 final and approved copies of the disquisition to The Graduate School no later than 1 year after the oral defense. Failure to do so results in a second oral defense. Degree date is based on the date when **final** copies are submitted to The Graduate School.
13. Submit request to participate in commencement. (Optional)
14. Participate in commencement. (Optional)

## Addendum

## Culminating Experience for master's degree programs
## Approved 4-06

North Dakota State University offers master's degrees in three broad categories. Plan A master's includes completion of a thesis including an oral defense. Plan B master's includes an individual creative component other than a thesis and includes an oral defense. Plan C master's includes coursework accompanied by a well-defined culminating experience.

A program need not offer all three types of masters. The types of masters which a program chooses to offer should be justified based on relevant criteria such as pedagogy or principles appropriate to the field. Programs wishing to grant a Master of Science degree or a Master of Arts degree typically need to satisfy the requirements of either the Plan A or the Plan B options. The Plan C option is primarily intended for professional degree programs. In addition, the three plans differ in the composition of the student's supervisory committee and required submissions to the graduate school upon degree completion.

The Plan A option requires the completion of a thesis. The thesis would typically include a problem statement, a review of existing literature relevant to that problem, and the creation and presentation of new knowledge in providing a solution to the problem. Each student would assemble a supervisory committee as described in the graduate bulletin section titled General Requirements for a Master's Degree. Each candidate is required to pass a final oral examination in which the supervisory committee serves as the examining committee. Following a successful defense, the candidate will submit copies of their thesis to the graduate school as described in the graduate bulletin.

The Plan B option generally requires a student to develop a thorough understanding of existing knowledge and the ability to apply that existing knowledge to a problem of interest. Under this option, the student would generate an individual creative component which reflects a solution to the problem. Note that under this option, the new knowledge being created is limited, and this is the primary difference between the Plan A and Plan B options. The new knowledge created under the Plan B option need not meet the standard set forth under the Plan A option. The precise nature of the individual creative component is defined by the program with approval by the graduate school. Examples of possible creative components include a comprehensive paper, a portfolio, or an integrated field experience. As under the Plan A option, each candidate would assemble a supervisory committee and pass a final oral examination. Following a successful defense, the candidate will compose an executive summary or assemble other appropriate documentation as defined by the program to be submitted to the graduate school. This submission to the graduate school is to be approved by the student's supervisory committee.

The Plan C option is designed for degree programs in which a well-defined culminating experience is more important than is an individual creative component. This option will most frequently be available in professional degree programs. If a Plan C option is available the program must provide to the Graduate School a rationale for the use of the culminating experience and a plan for implementation. Under this option, each program will define a culminating experience such as a capstone course, a written examination, or some other approach to measure the candidate's understanding of the relevant material in the area. The student's supervisory committee would generally consist of faculty solely from within that discipline. The supervisory committee may specify that a certain level of performance (i. e., a minimum GPA) be obtained in specified courses or in the program itself. Upon completion of the appropriate coursework and culminating experience, the candidate will be considered to have completed their masters and their name will be forwarded by the program to the graduate school. Plan C programs do not require the candidate to submit any other documentation to the graduate school.



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# Doctoral Program Policies

## Doctor of Musical Arts (D.M.A.)

The D.M.A. is the terminal professional practical degree in music, designed for performers and conductors wishing to acquire the highest performance abilities.

## Doctor of Philosophy Requirements

The Doctor of Philosophy degree is awarded in recognition of high scholarly attainment as evidenced by a period of successful advanced study, the satisfactory completion of prescribed examinations, and the development of an acceptable dissertation covering some significant aspect of a major field of learning.

## Doctor of Philosophy Degree: Supervisory Committee

The supervisory committee will have at least four members. The members consist of

1. The major adviser, who is selected by the student with the approval of the program administrator. The major adviser-student relationship must be a mutually acceptable one. The major adviser will act as the chair of the student's supervisory committee and will be in charge of the Plan of Study. The remaining members of the committee must be agreed upon by the student and the major adviser.
2. A second member, who must be a full or associate member of the graduate faculty.
3. A third member, who could be either a faculty member or a qualified off-campus expert in the field. If this committee member is not a full or associate member of the graduate faculty, the approval of the Dean of The Graduate School is required. Approval by the dean requires a recommendation from the program administrator accompanied by rationale and a curriculum vitae.
4. The Graduate School appointee. This appointment is made by the graduate dean, but suggestions as to whom the appointee might be are welcome and helpful. The Graduate School appointee must be a full member of the NDSU graduate faculty from outside the student's program. The role of The Graduate School appointee is to ensure that the student's Plan of Study follows Graduate School guidelines and that other Graduate School policies are observed. The Graduate School appointee also ensures that the expectations for the student's performance are reasonable and that interactions with the supervisory committee are conducted on a professional basis.

NOTE: Other qualified individuals may participate as committee members following approval by the graduate dean upon a recommendation accompanied by rationale and curriculum vitae by the appropriate program administrator and academic dean.

The supervisory committee should be formed not later than the term immediately after the major adviser has been identified for the student, and members should be identified before the plan of study is formulated so all committee members have a chance to contribute to the plan of study.
The supervisory committee agreed upon by the major adviser and student, and approved by the program administrator and the academic dean shall be recommended to the Dean of The Graduate School for final approval.

Each committee member shall have an equal vote in committee decisions. The committee is to assist the student in the preparation of a plan of study and to advise him or her during the period of graduate work. The supervisory committee is encouraged to convene at least once per semester and meet at least once per year to review the progress of the student's plan of study.

## Doctor of Philosophy Degree: Plan of Study

The plan of study will be prepared by the student and the major adviser. It shall be approved by the supervisory

committee, program administrator, academic dean, and dean of the Graduate School.

The plan of study should be submitted to The Graduate School for approval not later than the term immediately after the supervisory committee is formed and must be filed in The Graduate School prior to scheduling the comprehensive/preliminary examination. Revisions in the program of study must be approved by the student, supervisory committee, program administrator, and Dean of The Graduate School. The graduate dean will officially notify the student, supervisory committee, program administrator, and the academic dean of all changes.

Each program has the responsibility of defining the requirements for a major in its disciplinary area. The total credits will be determined by each program but must not be less than 90 semester graduate credits, of which not less than 27 credits must be in courses approved for graduate credit numbered 601-689, 691, 700-789, and 791 (referred to as didactic courses). Of these 27 credits, not fewer than 15 credits must be in 700-level course work (700-789 & 791). A student matriculating with a master's degree, including a degree earned at an international institution, must earn not fewer than 60 graduate credits at NDSU. Of these credits, not fewer than 15 credits must be NDSU courses at the 700 level (700-789 & 791). For specific requirements, the student should consult the specific programs.

## Doctor of Philosophy Degree: Transfer of Credit

All graduate credits used to meet the requirements of a doctoral degree must be approved by the supervisory committee, the program administrator, the academic dean, and the Dean of The Graduate School.

The doctorate requires 27 credits of course work, and of these, no more than 12 may be transferred by the petition process. Course work which is transferred does not reduce the total requirement of 60 credits for students with a master's degree in the same discipline.

Courses listed in the Graduate Bulletin of the Tri-College University Leadership Administration Program are not considered transfer credits and can be included on programs of study without petition. All other Minnesota State University Moorhead graduate credits are subject to the minimums of transfer credits and to the policies given in the text.

All transfer credits

1. must ordinarily have been earned from a U.S. or Canadian institution accredited to offer graduate courses and degrees (Credits from international institutions are transferable only after examination by a committee from the student's program.);
2. must carry only grades of A or B;
3. must have been earned within a 10-year period at the time of the final examination;
4. must be clearly graduate level (a course listed as both graduate and/or undergraduate level will not be transferred);
5. must not be a continuing education, correspondence, extension, or workshop course;
6. must not be internship, individual study, special problem, or research (disquisition) courses, or courses graded Pass/Fail or Satisfactory/Unsatisfactory;
7. must not have been used to fulfill the requirements of a baccalaureate degree;
8. must be verified by an official transcript; and 9) will not be used in calculation of the grade point average. It is the responsibility of the student to provide official transcripts of graduate courses taken elsewhere to The Graduate School.

NOTE: The special problem credits in item 6 are equivalent to North Dakota State University 696/796 Special Topic credits.

## Doctor of Philosophy Degree

## Time Limitation

Graduate credit for any course work that is more than 10 calendar years old at the time of the final examination cannot be used to satisfy degree requirements. The final examination must be retaken if the final 6 copies of the approved dissertation are not delivered to The Graduate School within 1 year of the date of the final examination or if any other degree requirements have not been completed within 1 year of the date of the final examination. If a period of time two years or greater lapses before the final copies are submitted, the student must reapply to The Graduate School and must register for a minimum of 2 credits. Degree date is based on the date when **final** copies are submitted to The Graduate School.

## Doctor of Philosophy Degree: Residence Requirements

Graduate study for the Doctor of Philosophy degree normally requires a minimum of 3 years of full-time study beyond the baccalaureate degree. A student who has a master's degree or equivalent must devote at least one of the two remaining academic years of study in residence at North Dakota State University.

## Doctor of Philosophy Degree: Language Requirements

Each graduate program will determine whether it will require a language and, if so, the language or languages applicable to the candidate's field of study and the level of reading proficiency required. Low-level proficiency will measure the candidate's comprehension of material in the major field in the foreign language with unlimited use of linguistic reference sources (e.g., dictionaries, glossaries, etc.); high-level proficiency will measure a similar reading comprehension with limited use of such reference sources. All examinations will be administered under the supervision of the Department of Modern Languages, which will certify the proficiency in the specified foreign language by signing the Ph.D. program of study in the appropriate place. International students whose native language is not English may satisfy the language requirement in their native language, providing their graduate program approves. In these cases, the basis for proficiency will be the candidate's use of English, rather than the foreign language.

## Doctor of Philosophy Degree: Examinations

A comprehensive/preliminary examination will be required of each student after the greater portion of courses has been completed and any required language proficiency has been certified. This examination consists of a written part and an oral part. After passing the comprehensive/preliminary examination, the student will be formally admitted to candidacy for the Doctor of Philosophy degree. At least one academic semester must elapse between the comprehensive/preliminary examination and the final examination.

The final examination will be taken after the candidate has completed the course work and dissertation. This oral examination will be concerned primarily with the dissertation, but it may also cover material from course work, especially those courses fundamental to the dissertation.

Permission to schedule the comprehensive/preliminary and the final oral examinations must be requested. The request to schedule must be sent to The Graduate School at least 2 weeks prior to the examination. Also, the student should personally meet with The Graduate School to verify that all courses on the plan of study have been completed and that the required grade point average has been attained. The Dean of The Graduate School will formally notify the committee and the student when and where the examination has been scheduled.

The examining committee shall consist of the supervisory committee. The dissertation in a near final form must be given to the committee members at least 7 days prior to the final examination.

At the conclusion of each oral examination, the examining committee shall record, in writing, its approval or disapproval of the candidate and file its report with the Dean of The Graduate School. The committee's decision filed on the Report of the Final Examination signifies that the student has been examined with respect to the knowledge required in the major area and that all course work has been satisfactorily completed. This form should be filed in The Graduate School within 7 days.

A negative vote by more than one member of the student's committee will signify failure of either the comprehensive/ preliminary examination or the final examination. Upon permission of a majority of the supervisory committee members, a candidate is allowed to take each examination twice. The supervisory committee will specify a period of time not less than 1 month that must elapse before the failed examination can be repeated. Exception to this time limit will be considered by the Dean of The Graduate School upon presentation of written justification from the chair of the supervisory committee in consultation with the committee members.

Should both attempts to pass an examination result in failure, the candidate may request to take the examination a third time. A request for a third examination requires the support of the supervisory committee and program administrator, and the approval of the Dean of The Graduate School after consultation with the Graduate Council.

Continuous enrollment is required until all degree requirements are completed.

To participate in commencement, the student must have passed the final examination.

## Doctor of Philosophy Degree: Dissertation

The dissertation must show originality and demonstrate the student's capacity for independent research. It must embody results of research which constitute a definitive contribution to knowledge.

## Doctor of Philosophy IRB, IBC, and/or IACUC Approval

Disquisitions which involve research using humans or animals as subjects or biohazard materials will not be approved by The Graduate School if such research has not been previously approved by the Institutional Review Board (IRB), Institutional Animal Care and Use Committee (IACUC), or Institutional Biosafety Committee (IBC) as appropriate. Every effort should be made by advisers to see that students are aware of these University requirements.

NOTE: If a proposed graduate research project involves human, animal, or biohazard subjects, it must be submitted for review and approval by the Institutional Review Board (IRB), the Institutional Animal Care and Use Committee (IACUC), and/or the Institutional Biosafety Committee (IBC). This process should be initiated by the student after his or her supervisory committee has approved the final research design because IRB, IBC, and/or IACUC approval must be obtained **before** the research project commences and cannot be granted retroactively. Please include a copy of the appropriate approval letters when the dissertation is submitted for editing.

## Doctor of Philosophy Degree: Filing the Dissertation

After the final examination, the student incorporates into the dissertation corrections suggested at the oral examination. The student, major adviser, and program administrator then sign the Checklist for Dissertations, Theses, and Papers; and one copy of the dissertation, printed on regular paper, is presented to The Graduate School for approval by a disquisition editor and the Dean of the Graduate School. This copy must be accompanied by a receipt from the Business Office for the completion package. After approval, 6 final copies of the dissertation, on the required paper are to be presented, unbound, to The Graduate School. Two bound copies of the thesis or paper go to the university library. Three bound copies are for the student, the student's adviser, and the student's program. The sixth copy of the dissertation, accompanied by an additional copy of the title page and an additional copy of the Abstract signed by the major adviser, is sent to Bell & Howell for microfilming.

The student has 1 year from the date of the final examination to deliver the 6 final copies to The Graduate School and complete all other degree requirements. Should the disquisition not be deposited as specified or all other degree requirements not be completed, the student must repeat the final examination. If a period of time two years or greater lapses before the final copies are submitted, the student must reapply to The Graduate School and must register for a minimum of 2 credits. Degree date is based on the date when **final** copies are submitted to The Graduate School.

## General Summary of Procedures

1. Gain admission to The Graduate School.
2. Select, with the major adviser, two other members to serve on the supervisory committee. One of the members must be a full or associate member of the graduate faculty. The other member could be either a faculty member or a qualified off-campus expert in the field, depending upon the program. The fourth committee member is The Graduate School appointee, who must be full member of the NDSU graduate faculty.
3. If appropriate, remove admission deficiencies in order to qualify for full-standing status.
4. Develop a plan of study with the major adviser in consultation with the other supervisory committee members.
5. Submit the plan of study to the Dean of The Graduate School for approval no later than the term immediately after the supervisory committee is formed.
6. If necessary, satisfy foreign language requirements.
7. Complete the majority of courses on the plan of study. Maintain continuous enrollment, or obtain leave of absence from the Dean of The Graduate School.
8. Seek permission to schedule the written and oral comprehensive/preliminary examinations from the major adviser. The request to schedule the oral examination is sent to The Graduate School 2 weeks prior to the oral examination.
9. Personally meet with a student service associate in The Graduate School to verify that all courses on the plan of study have been completed and the required GPA has been attained.
10. Seek permission to schedule the final oral examination from the major adviser. The request to schedule the examination is sent to The Graduate School at least 2 weeks prior to the examination.
11. Submit the dissertation in near final form to the supervisory committee members no fewer than 7 days prior to the oral examination.
12. Be sure that the examining committee immediately reports, in writing, the results of the examination to the Dean of The Graduate School.
13. Submit 1 draft of the dissertation to The Graduate School for approval. Please include a copy of the IRB, IBC, and/or IACUC approval letter(s) on top of this draft. The $250 completion package charge needs to be

submitted with the first draft. Revision(s) of the dissertation may be required.

14. Submit 6 final and approved copies of the dissertation to The Graduate School office no later than 1 year after the oral defense. Failure to do so results in a second oral defense. Degree date is based on the date when **final** copies are submitted to The Graduate School.
15. Submit request to participate in commencement. (Optional)
16. Participate in commencement. (Optional)



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# Certificate Program Policies

## Graduate Certificate Programs

The goal of Graduate Certificate (GC) programs at NDSU is to provide didactic course experiences that form a distinct knowledge or skill set identified as a named certificate. Origination and planning of each GC will occur within Graduate Certificate program committees hosted by an academic program. Interdisciplinary programs are encouraged, and in such cases, primary contributors will be listed as host programs.

## Administration

1. The Graduate School will administer GC programs.
2. Each GC program will be determined by a committee. Each committee will be comprised of three to five graduate faculty members. The committee must determine the program outcome(s) and designate the courses that meet that outcome. Graduate Faculty committee members must indicate their approval by signing the final program description. The host program administrator(s) must also sign in approval. Committee chairs must be full members of the NDSU Graduate Faculty and be selected by the committee. The chair will reconvene the committee at least annually, and whenever program changes are appropriate, to review the program.
3. Committees will provide outcome or descriptive information to The Graduate School that will establish and maintain a Web site to advertise and explain NDSU graduate certificate programs to potential candidates. The site will list courses for each certificate, admission requirements, past completers (with permission), etc. The Graduate School must be sure that the site is updated at least annually.
4. Graduate Certificate program candidates who do not have active Graduate Master's (GM) or Graduate Doctorate (GD) classifications will be classified as GC.
5. Since GC is not a degree track, federal Title IV student financial assistance and tuition waivers will not be available for students classified as GC.
6. Students classified as GM or GD may pursue Graduate Certificate programs.
7. Program administrators will monitor and report GC completions in program reviews, annual reports, and other summative documents. Faculty should be given credit for GC participation in merit/tenure considerations.

## Approval Process for Graduate Certificate Programs

The approval process will be the same as that of degree programs.
The usual supporting documentation is outlined: www.ndsu.nodak.edu/forms/
www.ndsu.nodak.edu/ndsu/administration/committees/academic_affairs/

Signatures are required from

1. Program administrator(s) of the host academic program(s)
2. College Curriculum Committee
3. Academic Dean
4. Graduate Council and dean of Graduate School
5. University Academic Affairs Committee
6. University Senate
7. State Board of Higher Education

## Admission

Applicant must

1. Have a baccalaureate degree from an educational institution of recognized standing.
2. Provide official transcripts documenting any and all degrees.
3. Be approved for admission by the program administrator hosting the graduate certificate program and by the Dean of The Graduate School.
4. Have an academic adviser assigned by the program administrator of the respective Graduate Certificate program before being admitted by The Graduate School.
5. If English is not the applicant's first language, have a TOEFL or IELTS score equivalent to that needed for GM or GD programs in the unit or provide sufficient documentation of adequate or better English language proficiency.
6. Admission into a Graduate Certificate program does not guarantee admission into a graduate degree program nor imply the waiver of any requirements for admission into a graduate degree program.

## Curriculum Development

1. Committees will develop programs with a minimum of 8* credits in specific graduate-level didactic courses which can be completed preferably within one year but no more than three years.
   * Different certificates may have higher credit requirements.
2. No more than 3 transfer credits may be applied towards the certificate. Any transfer credits must be approved by the GC program committee.

## Completion

1. Only grades of C or higher will satisfy requirements for course completion. Cumulative GPA on all credits taken at NDSU since admission as a GC, GM, or GD student must be 3.0 or better.
2. Candidates apply for certificate issuance using a form provided by The Graduate School.
3. The Dean of The Graduate School, using official NDSU transcripts, will verify course completion and issue a certificate. Upon issuance of the certificate, the Dean will notify the program administrator hosting the GC program.
4. Courses used to satisfy the Graduate Certificate program requirements cannot be older than three years at the time the certificate completion is verified.
5. There might be a public recognition of individuals who complete Graduate Certificate programs.
6. Transcripts will list Graduate Certificate program and the names(s) of the completed certificate program(s).

## Review and Maintenance

1. The Graduate School will ask the University Senate Program Review Committee to include Graduate Certificate programs as a separate section of its review of programs.
2. The Graduate School will request that the Provost and Vice President for Academic Affairs ask the State Board of Higher Education to drop a Graduate Certificate program at any such time as 1) there have been no certificates issued in any three-year period or 2) following the recommendation of a Graduate Certificate committee that its program be dropped.
3. The Graduate School will provide a yearly report on the state of NDSU Graduate Certificate programs to the Graduate Council, the University Senate Academic Affairs Committee, the Provost and Vice President for Academic Affairs, each academic dean, and the Director of Distance and Continuing Education.
4. The Dean of The Graduate School or a designee will interview (in person or by phone) each person completing a Graduate Certificate program.
5. The Dean of The Graduate School or designee will obtain evaluative information about NDSU Graduate

Certificate programs from the employers of certificate program completers who give the Dean of The Graduate School permission to obtain such evaluative information and from other sources such as professional associations.



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# Graduate Student Appeals

The North Dakota State University philosophy is to encourage and seek resolution of problems at the level most closely related to the origin of the specific disputes. This means

1. the student is to first discuss the problem(s) with the person(s) directly involved;
2. if the student is not satisfied after discussing the problem with the person(s) directly involved or if discussion of the problem(s) seems inappropriate because of the nature of the student's complaint, the student should seek advice from the administrator of the program; and
3. depending on the nature of the problem(s), the program administrator or student's supervisory committee chair may deal with the situation directly, advise the student to discuss the problem(s) with the appropriate academic dean and/or the Dean of The Graduate School, or advise the student of the appropriate grievance procedure to pursue. Areas of possible graduate student appeal are equal opportunity, academic evaluation via assignment of course grades, sanctions for academic dishonesty, and degree-acquisition processes that are unique to graduate education. The burden of proof by a preponderance of the evidence is on the graduate student making the appeal.

North Dakota State University's general and specific commitment to being an equal opportunity institution is expressed elsewhere in this bulletin. As stated there, inquiries concerning compliance may be directed to the NDSU Director of Equal Opportunity (202 Old Main, 231-7703) or to the Office for Civil Rights, U.S. Department of Education, 10220 N. Executive Hills Blvd., 8th Floor, 07-6010, Kansas City, MO 64153-1367.

The University Senate Grade Appeals Board has the authority to hear charges of inequitable or biased academic evaluations and to provide redress for any improper evaluations as it may find to have actually taken place. This is for course grades assigned by instructors in charge of the courses. This includes grades of disquisition courses. Both the "Rights & Responsibilities of Community: A Code of Student Behavior," which is available from the Office of Vice President for Student Affairs, and Section 337 of the NDSU Policy Manual, which is available at individual academic units, have the procedural details. Salient points repeated here are that the student must initiate a request for a change of grade with the instructor within 3 weeks of the time the grade was awarded; any appeal by a student must be made within 6 weeks after the start of the regular academic semester following the semester for which the grade was awarded; and both the instructor and the student shall have the right at any time during the prerequisites for an appeal to call a meeting of all persons involved in submitting and considering the complaint and, optionally, to invite the Grade Appeals Board to send an observer to that meeting. A natural candidate for the observer in cases dealing with graduate courses would be the Dean of The Graduate School. During an actual appeal, the burden of proof is on the student. The Grade Appeals Board procedures are for student grievances against instructors over course grades assigned.

Procedures dealing with issues of academic dishonesty in meeting course requirements, such as cheating, plagiarism, or other academic improprieties, brought by instructors against students enrolled in their course(s) or other NDSU course(s) or persons not enrolled at NDSU but viewed by the instructor as involved in the academic dishonesty are detailed in both the "Rights & Responsibilities of Community: A Code of Student Behavior" and Section 335 of the NDSU Policy Manual referenced in the preceding paragraph. A substantial range of penalties to the student(s) is available to the instructor(s) and academic deans of the colleges involved, i.e., the college offering the course(s) and the college of which the student (s) is (are) a member. One option available to the deans is to recommend suspension or expulsion from the university to the Academic Standards Committee. A student who has received any penalty or a disciplinary sanction for prohibited academic conduct may appeal the decision. If the penalty is, or

includes, recommendation of suspension or expulsion to the Academic Standards Committee, there are some appeal time lines that are very important for the student(s) to know. The decision to impose any penalty or disciplinary sanction for prohibited academic conduct against a graduate student in meeting the requirements of either an undergraduate or graduate course may be appealed by said graduate student to a graduate student appeals committee provided there is documentation, in writing, of consultation with instructor(s), program administrator(s), and dean(s), in sequence, to resolve the conflict. This appeal starts with a written notice to the Dean of The Graduate School. The written notice must be accompanied by the aforementioned documentation and must be received by the Dean of The Graduate School within 6 weeks of the most recent date on the documentation.

There are processes and activities that are intrinsic to the acquisition of a graduate degree. The processes include specification of degree requirements, preliminary and qualifying examinations, disquisition writing and approval, and possible dismissal from the program or The Graduate School. The activities are contributions to academia for which faculty have primary responsibility. They include instructing students enrolled in courses; mentoring students; collecting, analyzing, and presenting for public consumption the sequent results and conclusions; and possibly working with proprietary information. Problems in these areas are to be discussed with the chair of the graduate student supervisory committee and administrator of the program, in that order. Normally, these faculty members will attempt to work out a resolution of any problem by bringing the parties involved together in an informal, nonadversarial manner. Inquiry at this stage is usually limited to a determination of 1) whether the graduate student has been treated in an arbitrary or capricious manner or in some way not consistent with previously announced policy guidelines or 2) whether the graduate student has acted in a manner inconsistent with formal or traditional standards of academic conduct. Conflicts not satisfactorily resolved at the program level are to be brought to the academic dean who will discuss the problem(s) with all interested parties. If resolution does not result at the academic dean level, an appeal can be brought to a graduate student appeals committee as long as there is documentation, in writing, that the graduate student has consulted the graduate student's supervisory committee chair, the program administrator, and the academic dean in attempts to resolve the conflict. This appeal starts with a written notice to the Dean of The Graduate School. This written notice must be accompanied by the aforementioned documentation and must be received by the Dean of The Graduate School within 6 weeks of the most recent date on the documentation.

The Dean of the Graduate School is responsible for forming a graduate student appeals committees and informing the committee members of their duties. A graduate student appeals committee has 5 members, all of whom must be graduate faculty or currently enrolled graduate students, and will be comprised of the following members:

1. one person not on the Graduate Council appointed by the graduate student initiating the appeal;
2. one person not on the Graduate Council appointed by the party or parties complained against;
3. one person appointed by the Dean of The Graduate School;
4. one graduate student member of the Graduate Council chosen by lot if a graduate student has not been appointed by either contesting party or the Dean of The Graduate School;
5. one current member of the Graduate Council chosen by lot if a graduate student has not been appointed by either contesting party or the Dean of The Graduate School, or two current members of the Graduate Council chosen by lot if a graduate student has been appointed by either contesting party or the Dean of The Graduate School.

The Dean of The Graduate School will serve as an ex-officio and nonvoting member. The administrator(s) and dean(s) of the program(s) and college(s) involved cannot be members of the committee. The 5 appointed committee members elect the chair of the committee from its membership.

The graduate student and the party or parties complained against each have the right to challenge, with cause, to the Dean of The Graduate School one membership of the graduate student appeals committee. The decisions and recommendations of the appeals committee shall be by majority vote and will be advisory to the Dean of The Graduate School, who will then be responsible for taking appropriate action (s). Any further appeal shall be directed to the President of the University. The burden of proof shall be with the appealing graduate student. The appealing graduate student has the right to 1) be given due notice in sufficient detail that the accusation is clear and the circumstances of the accusation are detailed

enough for meaningful response by the accused and 2) be heard by an impartial body. Each contending party may, if it wishes, be accompanied by one counsel, but any counseling is restricted to 1) what to ask, 2) when not to respond to a question, and 3) how to answer a question. Counsel may not intrude on the hearing. The appeals committee is not bound by rules of legal evidence or procedure and may develop procedures that its members consider to be fair and equitable to the particular circumstance(s). All questioning will be done through the chair of the committee. Committee members can make decisions on available information; nonresponse to questions is available information, i.e., a negative inference can be drawn from the lack of a response. The hearing will be closed unless the student signs a release waiving his or her rights to a closed hearing. The hearing, but not the appeals committee's deliberations, will be tape-recorded.



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# Distance Education

NDSU offers several distance education alternatives.

## ND IVN

The North Dakota Interactive Video Network (ND IVN) uses V-Tel, a two-way video system, to transmit live audio and video among several sites. An instructor can see and communicate with students at sites around North Dakota or around the world. There is an abbreviated registration/admission procedure for students taking their first one or two graduate courses via IVN. For additional information, contact the IVN Site Coordinator at 800-830-7160 or 701-231-1090, or visit the Web site at www.ndsu.edu/its/depts/ivn.

## World Wide Web

NDSU has courses that are available through the World Wide Web. For more information, go to www.ndsu.nodak.edu/DCE/html/grad_web_based.html or contact Distance and Continuing Education at 701-231-7015.

North Dakota State University is one of approximately 170 Internet2 institutions and a partner institution of the very high performance Backbone Network System (vBNS). These two memberships provide high-speed network access to desktops and high-speed connections to other universities and federal agencies for research and distance education.

CourseInfo Gateway (CourseInfo TM) is a WWW-based tool suite to build and manage course materials, virtual courses, and classrooms; NDSU instructors can use the graphical, point-and-click interface to seamlessly incorporate learning material from word processing, audio and video, spread-sheets, and presentation files. The URL is www.courseinfo.ndsu.nodak.edu:8080.

## Videoconferencing

NDSU is exploring technologies that will offer classes using videoconferencing programs for classes using the Internet or phone lines. Contact Information Technology Services at 701-231-8688 for information.

Distance education is used to deliver quality postsecondary programs and services to citizens who would not otherwise have access to these services; improve the quality of offerings on each campus by sharing knowledge, courses, services, and resources with each other; and expand services to the state through cooperative arrangements with elementary, secondary, and vocational education; state agencies; and the private sector.

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# Financial Information

**Note:** Fees and expenses shown here are those in effect for the 2006-2007 academic year. All fees are subject to change without notice. Current tuition rates and fees are available on the Business Office website.

**Tuition fee payable each semester**

Resident $2560.00
Minnesota $3142.50
Sask-Manitoba, South Dakota,
Montana $3840.00
Non-resident $6835.50

**University activity fee payable each semester**

All graduate students pay an additional university fee each semester of $473.86 to cover Career Services, ConnectND, Health/Wellness, Technology and the Union bond.

**Total Semester Fees**

Resident $3033.86
Minnesota $3616.36
Sask-Manitoba, South Dakota,
Montana $4313.86
Non-resident $7309.36

The preceding fees will be assessed students carrying 12 credit hours or more. Students registering for fewer than 12 credit hours will pay tuition and fees on a per credit hour basis. Tuition and fees are due on the first day of each semester. Information pertaining to fee payment will be provided within the "Registration Schedule" each term.

Student identification cards may be purchased at the Memorial Union's Bison Card Center. (The student ID card allows use of the library facilities as well as attendance of NDSU athletic events.)

Graduate tuition is waived for graduate teaching and research assistants who work a minimum of 10 hours per week at minimum wage.

In addition to the regular fees previously listed, the following fees are assessed when and as they apply:

**Application fee**

A non-refundable fee must accompany the admission application, including a $35 Application and $10 Processing Fee*. International students must also pay an additional $15* transcript evaluation fee.
**Note: * $10 processing fee and $15 transcript evaluation fee are assessed for each additional application.**

**Other Fees**

A variety of fees are applied to special services. Some of the most common include:

**Continuing Education fees**

Please contact the Division of Distance and Continuing Education, phone 701-231-7015, 209 Engineering Technology Building, Fargo, ND 58105-5819, fax 701-231-7016, or www.ndsu.edu/conted.

**Course audit**

The course audit (not for credit) fee is 50% of the regular tuition charge.

**Diploma replacement**

The Office of Registration and Records provides a replacement service for those who have lost or damaged their diploma. $24
Laboratory/special instructional fees

Unique services and supplies related to special instructional and laboratory courses incur additional fees. Where applicable, these fees are listed in the "Registration Schedule" each term.

**Late payment fee**

A late payment fee is added to the outstanding balance when tuition and fees are not paid within the allotted time. $25

**Completion Package**

A completion fee of $200 is charged to all master's students who are completing a disquisition. The fee covers the costs for

- Completing the format and quality check of the disquisition.
- Binding 5 copies of the thesis or paper.
- Title inscription on the spine of the bound thesis or paper (if possible).
- Shipping up to 2 bound copies of the disquisition.
- Processing of graduation and commencement information.
- Workshops and consultation services for writing the thesis/paper.

A completion fee of $250 is charged to all doctoral students who are completing a dissertation. The fee covers the costs for

- Completing the format and quality check of the disquisition.
- Binding 5 copies of the dissertation.
- Title inscription on the spine of the bound dissertation (if possible).
- Shipping up to bound 2 copies of the disquisition.
- Microfilming the dissertation.
- Processing of graduation and commencement information.
- Workshops and consultation services for writing the dissertation.

Students who are not required to complete a disquisition will be assessed a $25 graduation processing fee.

Additional bound copies of the disquisition are available at a cost of $20 per copy.

**Withdrawals**

Tuition and fees will be refunded at 100% for students who withdraw on or before the end of the seventh instructional class day of a regular term. Nonregular terms will provide for a proportionate refund schedule based on the length of the term. Students who withdraw after the end of the seventh instructional day or proportionate period of a term will have tuition and fee refunds calculated based upon a declining percentage extending through the 60 percent point of the term. Specific dates and refund percentages are published in the Registration Schedule each term.

**Course Drops**

Refunds, where applicable, will be made at 100% for course drops during the first seven instructional class days of a regular term.

Nonregular terms will provide for a proportionate refund schedule based on the length of the term. After the seventh day or proportionate period of a term, there are no refunds for students who drop a class or classes and continue to be enrolled.

**Residence hall deposit**

Refundable, less breakage, upon official withdrawal from the University. $50

**Family student apartment deposit**

Refundable, less breakage, upon official withdrawal from the University. $100

**Parking permits**

All NDSU employees and students are assessed fees to park in University lots. For further information, contact the Campus Police (701-231-8998).

**Photo ID**

All students must have an NDSU photo identification card. Original and replacement of lost cards is $15 per card.

**Student Health Service fees**

Payment of student registration fees entitles a student to the basic services of the Student Health Service. Additional fees are charged for medications, certain studies, and additional services according to rates maintained and available at the clinic.

**Optional medical insurance for non-international students**

A student group accident and sickness insurance plan is available to all graduate and undergraduate students of North Dakota University System institutions, including North Dakota State University.

The insurance plan is available to students and their dependents. The coverage is designed to provide benefits for medical expenses arising from an accident or illness including those that occur off campus and during interim vacations. Any questions about the policy should be directed to Vaaler Insurance, Inc., 2701 South Columbia Rd., P.O. Box 12848, Grand Forks, ND 58208-2848, phone: (701) 775-3131.

The policy is administered by Student Assurance Services, Inc., P.O. Box 196, Stillwater, MN 55082. Most of the benefit dollar amounts are described as Usual and Customary Charges. The medical benefits are for basic injury and sickness (inpatient, outpatient, and other), benefits mandated by North Dakota

law, and accidental death and dismemberment.

Annual premiums are approximately as follows: Student - $695; Student and spouse - $3,125; student and child - $2,435; student, spouse, and child - $4,865; and each additional child - $1,740. Premiums can also be paid for just one of the three academic sessions or for the combination of Spring and Summer Sessions.

The detailed information can be obtained from the NDSU Student Health Service, Wellness Center, phone: (701) 231-7331.

**Required medical insurance for international students**

International students are required by the North Dakota State Board of Higher Education to purchase the Board approved health insurance policy before they are allowed to register. No other policy may be substituted. The fee for health insurance for one year must be paid upon arrival and at the beginning of each subsequent year. Because of the increasing cost of healthcare in the United States, health insurance for a student's spouse and accompanying dependents is highly recommended and is included in the estimate of expenses for accompanying dependents. In addition, the state of North Dakota requires proof of immunity to measles, mumps, and rubella prior to registration for courses.

Contact the Office of International Programs, Ceres 228, Phone: (701) 231-7895, e-mail: ndsu.international@ndsu.nodak.edu, for the details of the international graduate student group policy. The annual costs are approximately $695 for a single student and $3,420 for a married student.
Residency and tuition reciprocity

The North Dakota Century Code, Section 15-10-19.1, governs determination of residency for tuition purposes.

**Resident Guidelines**

A North Dakota resident student, for tuition purposes, is defined as follows:

1. A person less than 18 years of age whose custodial parent or guardian has been a legal resident of North Dakota for 12 months immediately prior to the beginning of the academic term.
2. A person 18 years of age or older who has been a legal resident of North Dakota for 12 months immediately prior to the beginning of the academic term.
3. A dependent child whose parent or guardian has been a legal resident of North Dakota for 12 months immediately prior to the beginning of the academic term or resides in the state with the intent to establish residency in the state for a period of years.
4. A person who graduated from a North Dakota high school within six years prior to the beginning of the academic term.
5. A full-time active duty member of the armed forces assigned to a military installation in North Dakota.
6. A spouse or a dependent of a full-time active duty member of the armed forces assigned to a military installation in North Dakota.
7. A dependent or spouse of an instructor who lives in North Dakota and teaches at an institution of higher education in the state.
8. The spouse of any person who is a resident for tuition purposes.
9. Any other person who was a legal resident of this state for at least three consecutive years within six years prior to the beginning of the academic term.

NOTE: "Dependent" means only a person claimed as a dependent on the most recent federal tax return.

**Minnesota tuition reciprocity**

Effective September 1975, the states of Minnesota and North Dakota enacted a tuition reciprocity agreement. This means that legal residents of the state of Minnesota may qualify for reduced tuition at North Dakota State University. Minnesota residents who enroll at NDSU within 12 months of their graduation from a high school in Minnesota do not have to fill out the standard paper application. All other

Minnesota residents should write for application papers for reciprocity to the following address: Higher Education Coordinating Board, 400 Capitol Square Building, 550 Cedar Street, St. Paul, Minnesota 55101-2292.

Once reciprocity has been granted by the State of Minnesota, the student will receive a letter to that effect, which the student may copy and submit to the NDSU Office of Registration and Records. The Registrar will also be notified of this award, and the Minnesota resident's tuition at NDSU will be reduced accordingly. Residency issues must be resolved by the last day of classes of the first session the student attends. Refunds will not be processed retroactively.

Returning students who have previously filed for tuition reciprocity but have not enrolled in a course or earned credit at NDSU during the past year will need to re-file.

**Financial Aid**

Various types of financial assistance are available to graduate students such as (but not limited to) student loans, scholarships, graduate assistantships, graduate tuition waivers, and part-time employment opportunities both on and off campus.

**Federal Aid**

Students applying for federal aid must be 1) a citizen or eligible non-citizen of the United States with a valid Social Security number, 2) enrolled in an eligible program as a regular student seeking a degree or certificate, 3) registered for a minimum number of credits during each term aid is received, 4) making satisfactory progress toward the completion of a course of study, and 5) current in repayment of previous federal loans. Students owing a refund on a Pell or Supplemental Educational Opportunity Grant are not eligible for federal student assistance.

**Financial Aid for International Students**

Many students from other nations inquire about financial aid. Local fellowships or free tuition are not ordinarily available to international students. The University has international students filling some graduate assistantship positions in several departments. Generally, such students have been required to pay their own way for the first year in order that academic capabilities can be established. All international students must demonstrate adequate funding for the duration of the graduate program; an assistantship can be part of this funding. Such expenses are approximately $17,390 (U.S.) per year for a single person and approximately $23,339 (U.S.) for a married couple. These two dollar figures do not include transportation to and from the U.S.

International students with outstanding ability are encouraged to apply. If the applicant requires an assistantship, the individual should submit an application for graduate school to the Graduate School and a separate inquiry to the major department. Such appointments usually are made before April 15.

North Dakota State University has established a process for verifying communication skills for all personnel whose appointments include classroom instruction. These policies as they apply to graduate students are as follows:

**English Language Proficiency for Teaching Assistants**

North Dakota State University has established a process for verifying communication skills for all personnel whose appointments include classroom instruction. These policies as they apply to graduate students are as follows:

1. Requirements for spoken communication proficiency
Potential teaching assistants whose first language is not English must demonstrate spoken communication proficiency by one of the following methods.

a. Potential teaching assistants whose first language is not English must obtain a minimum score of 26 on

the TOEFL iBT Speaking subscale or a minimum score of 7 on the IELTS Speaking subscale.

b. Potential teaching assistants whose first language is not English must obtain a minimum score of 50 on the Test of Spoken English (TSE). This examination assesses oral language proficiency in English as spoken in North America . It evaluates a person's overall comprehensibility, pronunciation, grammar, and fluency. A score of 50 indicates that the individual is generally comprehensible to Americans who are not used to listening to speakers whose first language is not English. This exam is administered by the North Dakota State University Department of Modern Languages in August, December, and April.

c. Graduate assistants who are serving as a tutor must obtain a minimum score of 25 on the TOEFL iBT Speaking subscale, a minimum score of 7 on the IELTS Speaking subscale, or a minimum score of 48 on the TSE.

d. Graduate assistants who are serving as a grading assistant must obtain a minimum TOEFL score of 79 (internet-based test), 550 (paper-based test), or 213 (computer-based test) or a minimum score of 6 on the IELTS.

2. Requirements for written communication proficiency
All potential teaching assistants must provide evidence of their proficiency in written communication skills by submitting evidence of one or more of the following:

a. Completion of one or more courses in English Composition at an accredited institution of higher learning in the United States with a grade of B or better.

b. Completion of an advanced English writing course, e.g., technical writing, at an accredited institution of higher learning in the United States with a grade of B or better.

c. Completion of the TOEFL iBT Writing subscale with a score of 23 or higher or a score of 7 on the IELTS Writing subscale.

d. Completion of the Language Proficiency Test (LPT) administered by the NDSU Center for Writers with a score of 5 or higher.

e. Completion of the Test of Written English (TWE) with a score of 5.0 or higher for teaching assistants whose first language is not English and who do not meet any of requirements a, b, or c above.

f. Completion of North Dakota State University's Intensive English Language Program for teaching assistants whose first language is not English and who do not meet any of requirements a, b, or c. The program is designed to improve the participant's four language skills: listening, speaking, reading, and writing. See index under Intensive English Language Program for pages in this bulletin that give the details of this program.

g. Completion of English 112-122 (Writing for Non-native Speakers) with a grade of B or better for teaching assistants whose first language is not English and who do not meet any of requirements a, b, or c.

3. Comprehensive English Proficiency
All potential teaching assistants whose first language is not English must provide a Test of English as a Foreign Language (TOEFL) score of not less than 100 (internet-based test), 600 (paper-based test), or 243 (computer-based test) to The Graduate School or a minimum score of 7 on the IELTS.

**General**

**Board of Higher Education Scholarships**

The North Dakota State Board of Higher Education Scholarship consists of a waiver of tuition. This award is made to a limited number of high-quality graduate students nominated by faculty advisers and approved by the Graduate Dean. Selection is based upon need, graduate record, residence, and recommendation of the faculty adviser. Awards are generally made only to students who have completed at least 10 graduate credits, are in full-standing status, and have an approved plan of study. Applications should be submitted by the academic adviser thirty (30) days prior to the beginning of the academic session. Normally, support will be provided for only four semesters (both summer sessions counting as one semester).

**Other Scholarships**

Regular scholarships for graduate students are limited. Interested graduate students should contact the dean of their college and/or their department chair regarding scholarships available within their discipline.

**Teaching or Research Assistantships**

A number of well-qualified graduate students, upon recommendation from the department concerned, are employed either as teaching or research assistants by most academic departments of the university. Inquiries should be directed to the appropriate department chair(s). Tuition, both resident and nonresident, for all graduate credits are waived for individuals officially appointed as research or teaching assistants. Student activity fees are not waived.



E-Mail: The Graduate School

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The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

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# Student Services

## Student Affairs

The Division of Student Affairs at NDSU serves student needs by providing specialized services, educational programs, and offerings directed at academic and student personal growth. Division personnel encourage student involvement within the University and serve as advocates for student concerns. Division functions are provided in the spirit of support for the teaching, research, and public service of the University. Any questions students have about these services can be directed to the Office of the Vice President for Student Affairs.

## Office of the Vice President for Student Affairs

Responsibility for the Division of Student Affairs is centered in the Office of the Vice President for Student Affairs. The vice president also serves as the dean of students. The division is made up of the following areas: Office of Admission, Office of Financial Aid, Orientation and Student Success, Memorial Union, Residence Life, Office of Multicultural Student Services, Student Counseling and Disability Services, Career Center, Student Health Service, Office of TRIO Programs, and Registration and Records.

## Wellness Center

Funded by the student health and wellness fee, the Wellness Center houses four major components: Student Health Service, Fitness Programs, Wellness Education and Child Care Service. These four components work together to promote and develop healthy lifestyle opportunities for members of the University community. Please call 231-5200 for additional information.

## Student Health Service

The Student Health Service, located in the Wellness Center, is a primary healthcare facility that offers integrated professional services to NDSU students. Registered nurses, certified nurse practitioners, physician assistants, and physicians staff the Student Health Service. Medical laboratory and pharmacy services are also available.

The primary health services of the Student Health Service include health promotion and disease prevention, health counseling, care during acute and chronic phases of illness, and referrals to outside providers when appropriate.

Only registered students are eligible to use the Student Health Service. Appointments may be scheduled by calling the Student Health Service reception desk at 231-7331.

Wellness education leaders conduct health education presentations and activities in the wellness education area, residence halls, and various other locations on campus.

## Fitness Programs

Fitness Programs provides activity areas where students, faculty and staff can meet to address their strength and cardiovascular conditioning needs. This area contains cardiovascular and strength

equipment, an indoor track and a group exercise studio. Staff and student fitness specialists are available to conduct orientation classes, specialized training and fitness testing.

An expansion to the Wellness Center was approved by the student body in April 2003 and will include additional cardio and strength space and equipment, basketball/ volleyball courts, racquetball courts, climbing wall, martial arts and spinning studios, additional group exercise studio, suspended running track and the relocation and expansion of the campus intramural program. The expansion will open for student, faculty and staff use in the fall of 2007.

## Wellness Education

The Wellness Education services and programs support all dimensions of wellness, including physical, social, environmental, occupational, intellectual, emotional and spiritual. Services include health education, nutrition counseling and education, massage therapy and wellness resources. Student Wellness Education Leaders promote wellness through peer education by increasing awareness of student health issues and encouraging positive lifestyle choices and decision-making skills.

## Child Care Service

The Child Care is a licensed service provided to NDSU students, faculty and staff on a first-come, first-served basis. Parents may drop off children ages 6 weeks to 6 years old for up to four hours while participating in campus activities. The Child Care Service is primarily drop-off, but limited full- and part-time contracted care is also available. An hourly fee is assessed to patrons of the Child Care Service.

## Office of International Programs

The Office of International Programs provides leadership and support services for all aspects of international education at North Dakota State University.

Students and scholars from other countries are welcome at NDSU. The Office of International Programs provides services that assist international students and scholars prior to and after arrival at the university. These services include preparation for arrival, airport pickup, orientation, advising on personal matters, and assistance with immigration legal compliance. Additional information is provided to international students and scholars through newsletters and informational seminars.

Students from the U.S. and other countries can receive assistance in the Office of International Programs with planning experiences abroad. Information is provided to students through group seminars and individual advising. International student I.D. cards, country and program brochures, and travel related information are available to all students.

International activities are also coordinated through the Office of International Programs. The main event each year is International Week which highlights the advantages of learning about world cultures through displays, lectures, film, and cultural shows. Students can participate in activities off campus, such as the Tri-College Community Welcome Picnic, Public Schools Speaker's Programs, and a variety of local cultural events.
Information on all matters pertaining to international students and scholars as well as prospective study-abroad students is available from the
Office of International Programs

Ceres Hall 338
P.O. Box 5582
Fargo, North Dakota 58105-5582 USA
Tel: 701-231-7895, Fax: 701-231-1014
e-mail: ndsu.international@ndsu.nodak.edu
Online: www.ndsu.edu/International.

A variety of reinforcement programs and services are available at NDSU. Each is aimed at enhancing

student life by assisting students to gain the maximum benefit from their experiences. Questions may be directed to the Office of Vice President for Student Affairs 701-231-7701.



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# Auxiliary Services

## Housing and Dining

Apartments for families and single students are located on and near the NDSU campus. Residence halls are planned to provide a comfortable learning environment and are within walking distance to all classes. They offer excellent opportunities to make new friends and become part of a learning community. The university believes the residence hall program is beneficial to a student's academic, social, and personal growth.

Contracts for residence hall accommodations are for the academic year. Requests for release at the end of the semester are reviewed each semester. Procedures are specified in the General Conditions of License Contract for Residence Halls. Housing is guaranteed for all students requesting residence hall accommodations.

For an application or information regarding food and housing facilities, write to the Department of Residence Life, PO Box 5481, Fargo, ND 58105-5481.(Click here for housing or NDSU residence life)

## Room and Meal Plan

Meal plans can be purchased separately or in conjunction with housing. The actual amount for residence hall and dining services accommodations will be specified in the student's assignment notice for each academic year. Contract rates do not cover break periods, although housing is available on a limited basis.

## Eligibility

Graduate students and graduate assistants enrolled at NDSU may live in the university apartments for a maximum of three years. Marital status or head of household requirements also must be met to be eligible for family housing.

Graduate students, if not registered for the current semester, must follow certain procedures to establish their eligibility. In such cases, the graduate student will receive a letter from the Department of Residence Life asking for a letter from their major adviser to substantiate the academic workload. Upon approval by the Department of Residence Life, the student is eligible for an additional semester of occupancy in family housing.

An application or information may be obtained by e-mail: ndsu.residence.life@ndsu.nodak.edu; by writing to the Department of Residence Life, PO Box 5481, Fargo, ND 58105-5481; or by visiting our Web site: www.ndsu.edu/reslife/.

## Dining Services

The dining facilities for the majority of students residing on campus are connected to adjacent residence halls. Students living near the center of campus will find food facilities easily accessible in the Memorial Union. Students not residing in the residence halls may purchase a meal plan for the dining center of their choice.

Rates have been established for meal service to begin with the breakfast meal on the first day of

orientation Fall Semester and on the first day of classes Spring Semester. The noon meal will be the last meal served prior to the beginning of all holidays or recess periods. Sack lunches will be prepared for those students unable to eat during the scheduled serving hours. A validated campus ID card or cash is required upon entering dining areas. Campus ID cards are not transferable between students or friends. Replacement for a lost campus ID card can be obtained at the ID Card Center, Memorial Union, for a charge of $15.00.

## Varsity Mart

The University bookstore on the campus of NDSU is known as the Varsity Mart. The store is located in the Memorial Union on the southeast end of the main floor. The store is the official source of all required textbooks and supplies. It stocks many convenience items, such as health and beauty aids, gifts, souvenirs, and university embossed clothing. The Varsity Mart is also an excellent source of many computer hardware and software items used by college students.

The business hours vary and are posted in front of the store. The main store has extended hours during "book rush" at the beginning of each semester.

Any questions concerning the operational policies of the store should be directed to the manager's office in the main store located in the Memorial Union. The telephone number is 231-7763.



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# NDSU Policies

## Student Behavior

Every student has the responsibility to observe and to help maintain a code of personal behavior and social relationships that will contribute to the educational effectiveness of the university. The conduct of a student at NDSU is expected to reflect a responsible attitude toward university regulations as well as the laws of the community, the state, and the nation. These standards apply to all students as long as they are enrolled in or associated with NDSU and to all visitors as long as they are on the campus. The complete document on university regulations and policies relevant to student life is titled "Rights & Responsibilities of Community: A Code of Student Behavior" and is available from the Office of Student Affairs, 100 Old Main.

## Privacy of Student Records

The disclosure of student educational records information is governed by policies developed by North Dakota State University in compliance with state law and the Family Educational Rights and Privacy Act of 1974 as amended (FERPA). There are essentially two types of student records, public directory information and nonpublic information. Directory information may be released publicly except in cases where students have specifically requested that the information not be released. Nonpublic information, which includes the academic transcript, is considered confidential and will not be released, other than to authorized personnel or as allowed by law, without the written authorization of the individual. University policies relative to student records are specified in the FERPA annual notice; the "NDSU Policy Manual," Section 600; and contained in the publication titled "Rights & Responsibilities of Community: A Code of Student Behavior," which may be obtained from the Office of Student Affairs, 100 Old Main. Students may restrict the release of directory information no later than the tenth class day of the semester, at Registration and Records, 110 Ceres.

## University Policy on Sexual Harassment

As part of its commitment to equal opportunity, North Dakota State University prohibits sexual harassment of its employees and students, including student-to-student and other peer-sexual harassment.

This policy is in compliance with federal regulations implementing Title VII of the Civil Rights Act of 1964 and Title IX of the Education Amendments of 1972. Sexual harassment is defined as

"Unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature constitute sexual harassment when

1. submission to such conduct is made either explicitly or implicitly a term or condition of an individual's employment or academic achievement,
2. submission to or rejection of such conduct by an individual is used as the basis for employment decisions or academic decisions affecting such individual, or
3. such conduct has the purpose or effect of unreasonably interfering with an individual's work or academic performance or creating an intimidating, hostile, or offensive environment."

Individuals concerned about violations of this policy should request assistance from the University's Director of Equal Opportunity, the University's General Counsel, the Counseling and Disability Services Office, the Associate Director for Student Rights and Responsibilities, or an appropriate administrator. When administrators or supervisors become aware of occurrences of sexual harassment in their areas, they are responsible for stopping the behavior or reporting it to the Director of Equal Opportunity. In addition, the University's equal opportunity grievance procedure shall be available for any person who wishes to file a complaint alleging a violation of this policy.

## Consensual Relationships

Consensual relationships that are of concern to North Dakota State University are those romantic or sexual relationships in which both parties appear to have consented, but where there is a definite power differential within the University between the two parties.

Consenting romantic and sexual relationships between instructor (meaning all who teach at the University--faculty member; other instructional personnel; and graduate or undergraduate students with teaching, advising, or tutorial responsibilities) and student (meaning any person studying with or receiving advising from the instructor), between supervisor (meaning any person in a position of authority over another--to hire and fire, to grant raises and oversee task performance) and employee (meaning any person working for the supervisor), and between employee and student (where there is an instructional, advisory, or an employment relationship between them) have the potential for extremely serious consequences and ought to be avoided. This list is not all-inclusive but gives examples of the types of relationships that are covered by this policy.

Because of the possible difficulties associated with the power differential and because of potential conflicts of interest, North Dakota State University discourages all such consensual relationships. However, if a romantic or sexual relationship develops between individuals having a power differential within the University, the person with the greater power shall report the matter immediately to the program administrator; a teaching assistant shall report it to the professor in charge of the course; and an employee shall report it to his/her supervisor. In each case, the administrative supervisor shall make suitable arrangements for the objective evaluation of the student's, employee's, or prospective employee's academic or job performance and for the protection of individual and university interests.

## Sexual Assault Student Policy

NDSU commits its resources to the following twofold process:

1. to provide crisis intervention and a judicial/disciplinary response for victims and alleged offenders, and
2. to educate and promote discussion on interpersonal abuse and violence.

Sexual assault is viewed as any sexual behavior between two or more people to which one person does not or cannot consent. NDSU relies upon North Dakota state law concerning sexual imposition that is much broader than the traditional concept of rape. NDSU prohibits sexual acts or contacts with others which can involve compelling a victim to submit to sexual acts or contacts by force or threat of force, use of intoxicants to substantially impair the victim's power to give consent, engaging in such acts when there is reasonable cause to believe the other person suffers from a mental state which renders him or her incapable of understanding the nature of the contact, or where the victim is a minor. A complete copy of the policy, reporting procedures, and related information is available at 368 Memorial Union.

## Use of Alcohol and Other Drugs

The University prohibits the unlawful or unauthorized use, possession, storage, manufacture, distribution, or sale of alcoholic beverages and any illicit drugs or drug paraphernalia in University buildings or any public campus area, in University housing units, in University vehicles, or at any University sponsored events held on or off campus, which are sponsored by students, faculty and/or staff, and their respective campus organizations (including all fraternities and sororities). The State Board of Higher Education

specifically prohibits the use or possession of alcohol in residence halls. State and federal laws will be regarded as the only bodies or rules governing the use of alcoholic beverages and other drugs in University faculty housing, married student housing, fraternities and sororities, and the president's house. For further details, refer to the complete text of the "North Dakota State University Policy Statement and Regulations on the Use of Alcohol and Other Drugs by Students, Faculty, and Staff" as printed in the "Registration Schedule" published for each term.

## Campus Security

NDSU complies with the Student Right-to-Know and Campus Security Act of 1990 as amended and the Higher Education Amendments of 1992. Policies, prevention, services, and crime statistics are available at 100 Old Main and are published each term as part of the "Registration Schedule."

## Equal Opportunity

North Dakota State University is fully committed to equal opportunity in employment decisions and educational programs and activities, in compliance with all applicable federal and state laws and including appropriate affirmative action efforts, for all individuals without regard to race, color, national origin, religion, sex, disability, age, Vietnam Era veteran status, sexual orientation, status with regard to marriage or public assistance, or participation in lawful activity off the employer's premises during nonworking hours which is not in direct conflict with the essential business-related interests of the employer.

More specifically, the University abides by the requirements of Title VI of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, and Section 504 of the Rehabilitation Act of 1973, as well as the implementing regulations of the Department of Education (34 CFR Parts 100, 106, and 104, respectively).

Inquiries concerning compliance may be directed to the NDSU Director of Equal Opportunity (202 Old Main, 231-7703) or to the Office for Civil Rights, U.S. Department of Education, 10220 N. Executive Hills Blvd., 8th floor, 07-6010 Kansas City, MO 64153-1367.



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# The Graduate Faculty

## Full Member of the Graduate Faculty

Full-status members of the Graduate Faculty of North Dakota State University (NDSU) consist of all persons who hold a probationary (tenure-track) or tenured appointment and have been appointed to the rank of Assistant Professor, Associate Professor, or Professor in an academic unit or program area at NDSU.

A full-status member of the Graduate Faculty of NDSU may teach graduate courses, serve as a member of supervisory committees, chair supervisory committees, serve as The Graduate School appointee to supervisory and advisory committees, serve as a member of graduate student appeals committees, serve as a member of the Graduate Council, vote at graduate faculty meetings, and serve in any other capacity as required.

## Associate Member of the Graduate Faculty

Persons holding a special appointment (non-tenure track) as academic staff at NDSU who have been appointed to the rank of Assistant Professor, Associate Professor, or Professor in an academic unit or program area at NDSU *may*, upon the application by the faculty of the academic unit, approval of the Graduate Council, and confirmation by the Dean of The Graduate School, be granted the status of Associate Member of the Graduate Faculty of NDSU for a period not to exceed three years or the term of appointment to the academic staff, whichever is less.[1]

Persons holding appointments as members of the graduate faculty at another institution may, upon application by the faculty of an academic unit or program area of NDSU, approval of the Graduate Council, and confirmation by the Dean of The Graduate School, be granted the status of Associate Member of the Graduate Faculty of NDSU for a period not to exceed six years. [1]

Persons who have been granted a courtesy appointment (adjunct) with NDSU may, upon the application by the faculty of the academic unit or program area, approval of the Graduate Council, and confirmation by the Dean of The Graduate School, be granted status as an Associate Member of the Graduate Faculty of NDSU for a period not to exceed six years. The associate membership is renewable. An Associate Member of the Graduate Faculty of NDSU with a courtesy appointment (adjunct) at NDSU who is a full-time employee of either an on-campus unit [2] or a Research and Extension Center and whose position responsibilities involve primarily scholarly activity may serve as a chair of supervisory committees. All Associate Members of the Graduate Faculty at NDSU may teach graduate courses and serve as members of supervisory committees.

[1] The associate membership is renewable.

[2] Examples of on-campus units are the Red River Valley Agricultural Research Center (the Biosciences Research Laboratory, the Northern Crops Science Laboratory, and the Hard Red Spring and Durum Wheat Quality Laboratory), the Upper Great Plains Transportation Institute, and the North Dakota Water Resources Research Institute.

**(Click here for the list of current Associate Graduate Faculty)**

## Documentation for appointment as an Associate Member of the Graduate Faculty

The burden of proof lies with the applying academic department or program to show that the nominee holds the qualifications to be an Associate Member of the Graduate Faculty. The credentials of the applicant should be not less than those for a probationary (tenure-track) appointment in the academic unit or program area. The following information needs to be provided: a letter of endorsement from the program administrator (chair, head, or director), including a rationale for the request and an indication of faculty approval; a current copy of the nominee's curriculum vitae; and any other pertinent documentation.

## Graduate Teaching Waivers

Graduate teaching waivers may be granted to individuals who do not meet the requirements for either full or associate graduate faculty status. Teaching waivers only allow students to serve as the instructor of record for 600 & 700 level courses and carry none of the other privileges of graduate faculty status. Waivers may be granted to qualified individuals who are not students in the department for which the waiver is sought.

The burden of proof lies with the applying graduate program to show that the nominee holds qualifications that merit the granting of a graduate teaching waiver. The following information needs to be provided: a letter of endorsement from the program administrator (chair, head, or director), including a rationale for the request and an indication of faculty approval; a current copy of the nominee's curriculum vitae; and any other pertinent documentation.

Graduate teaching waivers are approved by the Graduate Council and the Dean of the Graduate School . Waivers are granted for 1 academic year and may be renewed twice at the discretion of the Dean of the Graduate School .

## List of Graduate Faculty

The Dean of The Graduate School will, in consultation with the Provost and Vice President for Academic Affairs, maintain a list of the members of the Graduate Faculty of NDSU and publish this list in the Graduate Bulletin. Additions and deletions to the list will be published in the minutes of the Graduate Council.

**NOTE:** Other qualified individuals may participate in certain graduate affairs following approval by the graduate dean upon the recommendation by the appropriate department/program chair and academic dean.

## The Graduate Council

The Graduate Council is composed of 12 faculty members; 2 graduate students; and the Dean of The Graduate School, who serves as the chair. Six of the faculty members are elected by the graduate faculty, and six are appointed by the dean. Members serve rotating three-year terms. The graduate student members are also appointed by the graduate dean and serve rotating two-year terms. The council advises and counsels the graduate dean in formulating administrative policies for graduate study and serves as an executive body for the graduate faculty. Current members of the Graduate Council are David A. Wittrock, Dean, Chair; Ark Aune; Canan Bilen-Green; Joseph Brennan; Harlene Hatterman-Valenti; Jake Glower; Gary Goreham; Qun Huo; Stephen O'Rourke; Judy Pearson; Donna Terbizan; Rodney Traub; Charlene Wolf-Hall; and Amanda Dillard and Ayanava Majumdar (students).

## Graduate Dean

The Dean of The Graduate School is the principal administrative officer of The Graduate School. The dean carries out all assignments made by the President and/or the Provost and Vice President for Academic Affairs with regard to the supervision of graduate programs and graduate students, oversees all academic policies and procedures approved by the graduate faculty, and chairs the Graduate Council.

## Graduate Faculty

**Abdelrahman, Magdy, Assistant Professor of Civil Engineering**
Ph.D., 1996, University of Illinois-Urbana

**Adhikari, Tika, Assistant Professor of Plant Pathology**
Ph.D., 1991, International Rice Research Institute (IRRI), and University of the Philippines at Los Banos

**Akhatov, Iskander, Associate Professor of Mechanical Engineering and Applied Mechanics**
Ph.D., 1983, Lomonosov University of Moscow

**Alberty, Sandy, Assistant Professor of Nursing**
M.S.N., 2001, University of Mary

**Altenburg, Karl, Assistant Professor of Business Administration**
Ph.D., 1999, North Dakota State University

**Ambrosio, Thomas, Assistant Professor of Political Science**
Ph.D. 2000, University of Virginia

**Amlund, Curtis A., Professor Emeritus of Political Science**
Ph.D., 1959, University of Minnesota

**Andersen, Donald A., Associate Professor of Civil Engineering**
Eng.D., 1982, Texas A & M University

**Anderson, Gerald D., Associate Professor of History**
Ph.D., 1973, University of Iowa

**Anderson, Marc D., Assistant Professor of Botany/Biology**
Ph.D., 1995, Iowa State University

**Ashworth, Allan C., Professor of Geosciences**
Ph.D., 1969, University of Birmingham

**Aune, Mark, Assistant Professor of English**
Ph.D., 2002, Wayne State University

**Backer, Leslie F., Associate Professor of Agricultural and Biosystems Engineering**
M.S., 1972, North Dakota State University

**Bahrami, Bahman, Professor of Business Administration**
Ph.D., 1983, University of Nebraska-Lincoln

**Balaz, Stefan, Associate Professor of Pharmaceutical Sciences**
Ph.D., 1986, Slovak Technical University, Bratislava, Slovakia

**Barabanov, Nikita, Associate Professor of Mathematics**
Ph.D., 1979, Leningrad University

**Barker, William T., Professor of Animal and Range Sciences**
Ph.D., 1968, University of Kansas

**Barney, David, Assistant Professor of Health, Nutrition, and Exercise Science**
Ph.D., 2002, Florida State University

**Barnhart, Thomas C., Professor of Health, Nutrition, and Exercise Science**
Ph.D., 1978, University of New Mexico

**Barnhouse, Mark, Assistant Professor of Architecture and Landscape Architecture**
M.Arch, 1988, Pratt Institute

**Bastow-Shoop, Holly E., Professor of Apparel, Textiles, and Interior Design**
Ph.D., 1981, Oklahoma State University

**Bates, Derald, Assistant Professor of Apparel, Textiles, and Interior Design**
M.Ed., 1994, University of Idaho

**Bauer, Marc L., Associate Professor of Animal and Range Sciences**
Ph.D., 1996, University of Kentucky

**Berg, Paul T., Associate Professor of Animal and Range Sciences**
Ph.D., 1975, North Dakota State University

**Berglund, Duane R., Professor of Plant Sciences**
Ph.D., 1971, North Dakota State University

**Berglund, Patricia, Associate Professor of Health, Nutrition, and Exercise Science**
Ph.D., 1989, North Dakota State University

**Berry, Eugene S., Associate Professor of Veterinary and Microbiological Sciences**
Ph.D., 1983, Northeastern University

**Berryhill, David L., Associate Professor of Veterinary and Microbiological Sciences**
Ph.D., 1971, Iowa State University

**Berzonsky, William A., Assistant Professor of Plant Sciences**
Ph.D., 1988, University of Missouri

**Bhandary, Madhusudan, Associate Professor of Statistics**
Ph.D., 1987, University of Pittsburgh

**Biberdorf, Robert, Assistant Professor of Pharmacy Practice**
M.S., 1978, North Dakota State University

**Bierwagen, Gordon P., Professor of Polymers and Coatings Science**
Ph.D., 1968, Iowa State University

**Biondini, Mario E., Professor of Animal and Range Sciences**
Ph.D., 1984, Colorado State University

**Birmingham, Elizabeth, Assistant Professor of English**
Ph.D., 2000, Iowa State University

**Bitzen, John, Adjunct Professor of Agricultural Economics**
Ph.D., 1997, University of Wisconsin-Milwaukee

**Blakeslee, Barbara, Assistant Professor of Psychology**
Ph.D., 1983, University of California-Santa Barbara

**Blanchetot, Alain D., Assistant Professor of Animal and Range Sciences**
Ph.D., 1981, University of Paris

**Bleier, William J., Professor of Zoology**
Ph.D., 1975, Texas Tech University

**Boetel, Mark A., Assistant Professor of Entomology**
Ph.D., 1996, South Dakota State University

**Booker, Darryl, Assistant Professor of Architecture and Landscape Architecture**
M.Arch., 1980, University of Colorado

**Borgersen, Svenn, Adjunct Professor of Civil Engineering**
Ph.D., 1998, University of Minnesota

**Boudjouk, Philip, Professor of Chemistry**
Ph.D., 1971, University of Wisconsin

**Bovard, Richard W., Professor Emeritus of English**
Ph.D., 1973, University of Denver

**Bradley, Carl A., Assistant Professor of Plant Pathology**
Ph.D., 2001, University of Illinois

**Brady, Mark, Asssistant Professor of Psychology**
Ph.D., 1999, University of Minnesota

**Bratteli, Marlys, Assistant Professor of Child Development and Family Science**
Ph.D., 2003, University of North Dakota

**Braun, Juergen H., Adjunct Professor of Polymers and Coatings Science**
Ph.D., 1956, University of Texas

**Brennan, Joseph, Associate Professor of Mathematics**
Ph.D., 1984, University of Illinois

**Brewer, Gary J., Professor of Entomology**
Ph.D., 1984, Kansas State University

**Bromley, Kimble A., Associate Professor of Art**
M.F.A., 1986, Southern Illinois University

**Brooks, Kevin A., Assistant Professor of English**
Ph.D., 1997, Iowa State University

**Brotherson, Sean, Assistant Professor of Child Development and Family Science**
Ph.D., 2000, Oregon State University

**Brown, Muriel J., Associate Professor of English**
Ph.D., 1971, University of Nebraska

**Brown, Wendy, Clinical Assistant Professor of Pharmacy**
Pharm.D., 2001, North Dakota State University

**Brunt, Ardith, Assistant Professor of Health, Nutrition, and Exercise Science**
Ph.D., 1999, Iowa State University

**Burghaus, Uwe, Assistant Professor of Chemistry**
Ph.D., 1995, Free University of Berlin

**Burnett, Ann, Associate Professor of Communication**
Ph.D., 1986, University of Utah

**Butler, Malcolm G., Professor of Zoology**
Ph.D., 1980, University of Michigan

**Cai, Xiwen, Assistant Professor of Plant Sciences**
Ph.D., 1998, Washington State University

**Carena, Marcelo J., Assistant Professor of Plant Sciences**
Ph.D., 1999, Iowa State University

**Carlson, Robert B., Professor Emeritus of Entomology**
Ph.D., 1965, Michigan State University

**Carlson, Thomas, Assistant Professor of Child Development and Family Science**
Ph.D., 2000, Iowa State University

**Carr, Patrick M., Adjunct Professor of Plant Sciences**
Ph.D., 1989, Montana State University

**Carter, Jack F., Professor Emeritus of Plant Sciences**
Ph.D., 1950, University of Wisconsin

**Casey, Francis, Assistant Professor of Soil Science**
Ph.D., 2000, Iowa State University

**Caton, Joel S., Professor of Animal and Range Sciences**
Ph.D., 1987, New Mexico State University

**Cattanach, Allan W., Adjunct Professor of Soil Science**
Ph.D., 1979, University of Minnesota

**Chabora, Pamela D., Assistant Professor of Theatre Arts**
Ph.D., 1994, Michigan State University

**Chakraborty, Monisha, Assistant Professor of Plant Sciences**
Ph.D., 1997, University of Hong Kong

**Chandler, Laurence D., Adjunct Professor of Entomology**
Ph.D., 1986, Texas A & M University

**Chang, Kow Ching, Associate Professor of Cereal and Food Science**
Ph.D., 1980, University of Nebraska-Lincoln

**Chapman, Joseph, Professor of Botany/Biology**
Ph.D., 1970, Oregon State University

**Charlet, Laurence D., Adjunct Professor of Entomology**
Ph.D., 1975, University of California-Riverside

**Chatterjee, Satadal, Associate Professor of Pharmaceutical Sciences**
Ph.D., 1986, Saha Institute of Nuclear Physics, University of Calcutta

**Christensen, Bryan, Assistant Professor of Health, Nutrition, and Exercise Science**
Ph.D., 2000, University of Kansas

**Christensen, Thomas P., Assistant Professor of Pharmacy Practice**
Ph.D., 1995, University of Michigan

**Christoffers, Michael J., Assistant Professor of Plant Sciences**
Ph.D., 1998, University of Missouri-Columbia

**Cihacek, Larry J., Associate Professor of Soil Science**
Ph.D., 1979, Iowa State University

**Clambey, Gary K., Associate Professor of Botany/Biology**
Ph.D., 1975, Iowa State University

**Clark, Jeffrey T., Professor of Anthropology**
Ph.D., 1987, University of Illinois

**Clark, Mark, Assistant Professor of Biological Sciences**
Ph.D., 1996, University of Tennessee

**Collins, Ross, Associate Professor of Communication**
Ph.D., 1992, University of Cambridge

**Colville, Thomas, Professor of Animal and Range Sciences**
Ph.D., 1971, University of Minnesota

**Cömez, Dogan, Professor of Mathematics**
Ph.D., 1983, University of Toronto

**Cook, Gregory, Associate Professor of Chemistry**
Ph.D., 1973, Stanford University

**Cook, John R., Associate Professor of Industrial and Manufacturing Engineering**
Ph.D., 1991, Purdue University

**Cooley, Dennis, Assistant Professor of History**
Ph.D., 1995, University of Rochester

**Cope, Davis, Associate Professor of Mathematics**
Ph.D., 1980, Vanderbilt University

**Cosgrove, William E., Professor of English**
Ph.D., 1972, University of Iowa

**Council, James R., Professor of Psychology**
Ph.D., 1984, University of Connecticut

**Coykendall, James B., Associate Professor of Mathematics**
Ph.D., 1995, Cornell University

**Croll, Stuart G., Professor of Polymers and Coatings**
Ph.D., 1974, University of Leeds, UK

**Cross, Harold Z., Professor Emeritus of Plant Sciences**
Ph.D., 1971, University of Missouri

**Dahleen, Lynn S., Adjunct Professor of Plant Sciences**
Ph.D., 1989, University of Minnesota

**Dai, Wenhao, Assistant Professor of Plant Sciences**
Ph.D., 2001, North Dakota State University

**Danbom, David B., Professor of History**
Ph.D., 1974, Stanford University

**Daniels, Lisa, Assistant Professor of Education**
Ed.D., 2002, Texas A&M University

**Danielson, Russell B., Associate Professor of Animal and Range Sciences**
M.S., 1973, North Dakota State University

**Davis, David G., Adjunct Professor of Botany/Biology**
Ph.D., 1966, Washington State University

**Deal, James E., Associate Professor of Child Development and Family Science**

Ph.D., 1987, University of Georgia

**Deckard, Edward L., Professor of Plant Sciences**
Ph.D., 1970, University of Illinois

**Del Rio, Luis, Assistant Professor of Plant Pathology**
Ph.D., 1999, Iowa State University

**Denton, Alan R., Assistant Professor of Physics**
Ph.D., 1991, Cornell University

**Denton, Anne, Assistant Professor of Computer Science**
Ph.D., 2003, North Dakota State University

**DeVuyst, Cheryl S., Assistant Professor of Agricultural Economics**
Ph.D., 1999, University of Illinois

**DeVuyst, Eric A., Assistant Professor of Agricultural Economics**
Ph.D., 1993, Purdue University

**Dexter, Alan G., Professor of Plant Sciences**
Ph.D., 1969, University of Illinois

**Dietz, Donna, Assistant Professor of Business Administration**
Ph.D., 1989, University of North Dakota

**Disrud, Lowell A., Assistant Professor of Agricultural and Biosystems Engineering**
M.S., 1969, Kansas State University

**Dobitz, Clifford P., Professor Emeritus of Economics**
Ph.D., 1971, Colorado State University

**Dobry, Alberta M., Professor Emeritus of Education**
Ph.D., 1973, Michigan State University

**Doehlert, Douglas C., Adjunct Professor of Cereal and Food Sciences**
Ph.D., 1982, University of Wisconsin

**Donley, Michael S., Adjunct Professor of Polymers and Coatings**
Ph.D., 1987, University of Washington-Seattle

**Dorsam, Glenn, Assistant Professor of Biochemistry**
Ph.D., 1998, Virginia Commonwealth University

**Du, Xiaojiang (James), Assistant Professor of Computer Science**
Ph.D., 2003, University of Mary Land

**Duffield, Stacey, Assistant Professor of Education**
Ph.D., 2003, University of North Dakota

**Duysen, Murray E., Professor Emeritus of Botany/Biology**
Ph.D., 1966, University of Nebraska

**Dyer, Neil W., Associate Professor of Veterinary and Microbiological Sciences**
D.V.M., 1995, Iowa State University

**Edwards, Jane, Assistant Professor of Health, Nutrition, and Exercise Science**
Ph.D., 1974, Purdue University

**Edwards, Michael C., Adjunct Professor of Plant Pathology**

Ph.D., 1983, Cornell University

**Eighmy, Myron A., Assistant Professor of Education**
Ed.D., 1995, University of Minnesota

**Eisele, C. Frederick, Professor Emeritus of Business Administration**
Ph.D., 1971, University of Iowa

**Elder, John, Assistant Professor of Business Administration**
Ph.D., 1995, University of Virginia-Charlottesville

**Elias, Elias M., Associate Professor of Plant Sciences**
Ph.D., 1987, North Dakota State University

**Elnahas, Mohamed, Assistant Professor of Architecture and Landscape Architecture**
Ph.D., 1997, University of South Adelaide

**El-Nashaar, Hossein, Adjunct Professor of Plant Pathology**
Ph.D., 1984, North Dakota State University

**Enz, John W., Professor of Soil Science**
Ph.D., 1976, University of Minnesota

**Erickson, D. Bruce, Associate Professor of Computer Science**
Ph.D., 1973, Yale University

**Erickson, Martin, Assistant Professor of Child Development and Family Science**
Ph.D., 2003, Iowa State University

**Esslinger, Theodore L., Professor of Botany/Biology**
Ph.D., 1974, Duke University

**Ewert, Daniel L., Professor of Electrical and Computer Engineering**
Ph.D., 1989, University of North Dakota

**Farden, David C., Professor of Electrical and Computer Engineering**
Ph.D., 1975, Colorado State University

**Faulkner, Don C., Associate Professor of Architecture**
M.Arch., 1975, University of Utah

**Fawley, Marvin W., Professor of Botany/Biology**
Ph.D., 1985, Miami University

**Fisher, Amy, Associate Professor of Nursing**
M.A.N., 1992, College of St. Catherine

**Fitzgerald, Margaret, Assistant Professor of Child Development and Family Science**
Ph.D., 1997, Iowa State University

**Flaskerud, George K., Professor of Agricultural Economics**
Ph.D., 1970, Oklahoma State University

**Foster, Stephen, Associate Professor of Entomology**
Ph.D., 1983, University of Waikato, New Zealand

**Franckowiak, Jerome D., Professor of Plant Sciences**
Ph.D., 1970, University of Wisconsin

**Franzen, David W., Associate Professor of Soil Science**
Ph.D., 1993, University of Illinois

**Freeman, Douglas A., Professor of Veterinary and Microbiological Sciences**
Ph.D., 1991, University of Idaho

**Freeman, Thomas P., Professor of Plant Pathology**
Ph.D., 1968, Arizona State University

**Friesen, Chris Kelland, Assistant Professor of Psychology**
Ph.D., 2001, University of Alberta

**Froelich, Andrew, Professor of Music**
D.M.A., 1969, Michigan State University

**Froelich, Karen, Associate Professor of Business Administration**
Ph.D., 1994, University of Minnesota

**Frohberg, Richard C., Professor Emeritus of Plant Sciences**
Ph.D., 1964, Iowa State University

**Galitz, Donald S., Professor Emeritus of Botany/Biology**
Ph.D., 1961, University of Illinois

**Garden-Robinson, Julie, Assistant Professor of Health, Nutrition., and Exercise Science**
Ph.D., 1999, North Dakota State University

**Garvey, Roy, Associate Professor of Chemistry**
Ph.D., 1966, University of Utah

**Gerst, Jeffery W., Professor of Zoology**
Ph.D., 1973, University of Nebraska

**Gibbs, Penelope, Assistant Professor of Veterinary and Microbiological Sciences**
Ph.D., 2001, University of Georgia

**Gillispie, Gregory D., Professor of Chemistry**
Ph.D., 1975, Michigan State University

**Gleye, Paul, Professor of Architecture and Architecture Landscape**
Ph.D., 1983, University of California-Los Angeles

**Glower, Jacob, Associate Professor of Electrical and Computer Engineering**
Ph.D., 1988, The Ohio State University

**Goos, R. Jay, Professor of Soil Science**
Ph.D., 1980, Colorado State University

**Goplen, Sherman P., Associate Professor of Mechanical Engineering and Applied Mechanics**
Ph.D., 1977, Texas A & M University

**Gordon, Robert D., Assistant Professor of Psychology**
Ph.D., 1999, University of Illinois at Urbana-Champaign

**Goreham, Gary A., Professor of Sociology**
Ph.D., 1985, South Dakota State University

**Grafton, Kenneth F., Professor of Plant Sciences**
Ph.D., 1980, University of Missouri

**Grant, Linda A., Adjunct Professor of Cereal Science**
Ph.D., 1989, North Dakota State University

**Grazul-Bilska, Anna T., Assistant Professor of Animal and Range Sciences**
Ph.D., 1983, University of Agriculture and Technology, Olsztyn, Poland

**Green, Canan Bilen, Assistant Professor of Industrial and Manufacturing Engineering**
Ph.D., 1998, University of Wyoming

**Green, Roger, Assistant Professor of Electrical and Computer Engineering**
Ph.D., 1998, University of Wyoming

**Greenwald, Beverly, Assistant Professor of Nursing**
Ph.D., 1990, North Dakota State University

**Grier, James W., Professor of Zoology**
Ph.D., 1975, Cornell University

**Gross, Carla J., Assistant Professor of Nursing**
M.S.N., 1987, University of Kentucky

**Gross, Dean, Assistant Professor of Nursing**
D.N.Sc., 1998, Rush University

**Groves, Robert W., Professor of Music**
Ph.D., 1981, University of Iowa

**Grygiel, Carolyn E., Associate Professor of Animal and Range Sciences**
Ph.D., 1983, Colorado State University

**Gudmestad, Neil C., Professor of Plant Pathology**
Ph.D., 1982, North Dakota State University

**Gulya, Thomas J., Jr., Adjunct Professor of Plant Pathology**
Ph.D., 1978, Iowa State University

**Guo, Bin, Assistant Professor of Pharmaceutical Sciences**
Ph.D., 1999, State University of New York at Buffalo

**Gupte, Manjusha, Assistant Professor of Political Science**
Ph.D., 2003, Purdue University

**Gustafson, Cole R., Associate Professor of Agricultural Economics**
Ph.D., 1986, University of Illinois

**Hageman, Jeanne, Assistant Professor of French**
Ph.D., 1991, University of Wisconsin-Madison

**Hall, Clifford A., III, Assistant Professor of Cereal Science**
Ph.D., 1996, University of Nebraska-Lincoln

**Hammond, James J., Professor of Plant Sciences**
Ph.D., 1969, University ofNebraska

**Haney, David W., Assistant Professor of Education**
Ed.D., 1978, University of Montana

**Hannon, J. Wade, Associate Professor of Education**
Ed.D., 1983, University of Arkansas

**Hansen, Angela M., Assistant Professor of Architecture and Landscape Architecture**
MLA., 2002, Kansas State University

**Hansen, Pam, Assistant Professor of Health, Nutrition, and Exercise Science**
Ed.D., 2000, University of South Dakota

**Harrold, Robert L., Professor of Animal and Range Sciences**
Ph.D., 1966, Purdue University

**Harter, Charles, Associate Professor of Business Administration**
Ph.D., 1991, University of Nebraska

**Harvey, Mark, Associate Professor of History**
Ph.D., 1986, University of Wyoming

**Hatlen, Vincen W., Professor of Architecture**
M.Arch., 1963, University of Michigan

**Hatterman-Valenti, Harlene, Assistant Professor of Plant Sciences**
Ph.D., 1993, Iowa State University

**Hawley, D. Carlton, Assistant Professor of Modern Languages**
Ph.D., 1999, University of Iowa

**Hearne, Robert, Assistant Professor of Agricultural Economics**
Ph.D., 1995, University of Minnesota

**Hektner, Joel, Assistant Professor of Child Development and Family Science**
Ph.D., 1996, University of Chicago

**Helgeland, John A., Professor of History and Religion**
Ph.D., 1973, University of Chicago

**Hellevang, Kenneth J., Professor of Agricultural and Biosystems Engineering**
Ph.D., 1989, North Dakota State University

**Helms, Theodore C., Associate Professor of Plant Sciences**
Ph.D., 1986, Iowa State University

**Helstern, Linda Lizut, Assistant Professor of English**
Ph.D., 2001, Southern Illinois University-Carbondale

**Herman, Dale E., Professor of Plant Sciences**
Ph.D., 1966, Purdue University

**Herren, R. Stanley, Professor of Economics**
Ph.D., 1975, Duke University

**Hershberger, John F., Associate Professor of Chemistry**
Ph.D., 1986, Yale University

**Hill, Loren W., Adjunct Professor of Polymers and Coatings Science**
Ph.D., 1965, Pennsylvania State University

**Hinderliter, Anne, Assistant Professor of Pharmacy**
Ph.D., 1994, Cornell University

**Hinsz, Verlin B., Professor of Psychology**
Ph.D., 1983, University of Illinois

**Hofman, Vernon L., Associate Professor of Agricultural and Biosystems Engineering**
M.S., 1969, North Dakota State University

**Holbrook, Sandra, Adjunct Professor of the College of Human Development and Education**
Ph.D., 1984, University of Minnesota

**Holm, Edna T., Professor Emeritus of Food and Nutrition**
Ph.D., 1987, University of Minnesota

**Homan, Paul, Associate Professor of Modern Languages**
Ph.D., 1988, University of Kansas

**Hopkins, David, Assistant Professor of Soil Science**
Ph.D., 1997, North Dakota State University

**Horsley, Richard D., Professor of Plant Sciences**
Ph.D., 1988, North Dakota State University

**Horvath, David P., Adjunct Professor of Plant Sciences**
Ph.D., 1993, Michigan State University

**Horvik, Lori, Associate Professor of Theatre Arts**
**M.F.A., 1994,** Northern Illinois University

**Howatt, Kirk A., Assistant Professor of Plant Sciences**
Ph.D., 1999, Colorado State University

**Hughes, Harlan G., Professor Emeritus of Agricultural Economics**
Ph.D., 1971, University of Missouri

**Ihle, Thomas, Assistant Professor of Physics**
Ph.D., 1996, Aachen

**Isern, Thomas D., Professor of History**
Ph.D., 1977, Oklahoma State University

**Isrow, Denis F., Professor Emeritus of Health, Physical Education, and Recreation**
Ed.D., 1973, University of Utah

**Jacobson, Denley, Associate Professor of Chemistry**
Ph.D., 1984, Purdue University

**Jacobson, Sarah Williams, Associate Professor Emeritus of Business Administration**
Ph.D., 1991, University of Massachusetts at Amherst

**Jan, Chao C., Adjunct Professor of Plant Sciences**
Ph.D., 1974, University of California-Davis

**Jaronski, Stefan T., Adjunct Professor of Entomology**
Ph.D., 1978, Cornell University

**Jaseja, Mahesh, Assistant Professor of Chemistry**
Ph.D., 1987, University of New Brunswick, Canada

**Jauhar, Prem P., Adjunct Professor of Plant Sciences**
Ph.D., 1963, Indian Agricultural Research Institute, New Delhi

**Johnson, Burton, Assistant Professor of Plant Sciences**
Ph.D., 1993, North Dakota State University

**Johnson, Mary Lynn, Adjunct Professor of Animal and Range Sciences**
Ph.D., 1995, North Dakota State University

**Johnson, Virginia L. Clark, Professor of Child Development and Family Science**
Ph.D., 1984, Pennsylvania State University

**Jones, Joseph M., Associate Professor of Business Administration**
Ph.D., 1991, University of Missouri

**Jones, Robert, Associate Professor of Music**
D.M.A., 1991, University of Oklahoma

**Joo, Sung K., Assistant Professor of Electrical and Computer Engineering**
Ph.D., 2004, University of Washington, Seattle

**Juell, Paul, Professor of Computer Science**
Ph.D., 1981, The Ohio State University

**Jung, Jae Min, Assistant Professor of Business Administration**
Ph.D., 2002, University of Cincinnati

**Justitz, Gerritdina, Associate Professor of History**
Ph.D., 1996, University of California-San Diego

**Kallmeyer, Alan, Associate Professor of Mechanical Engineering and Applied Mechanics**
Ph.D., 1995, University of Iowa

**Kapplinger, Kent, Assistant Professor of Art**
M.F.A., 1991, University of Iowa

**Karami, Ghodrat, Associate Professor of Mechanical Engineering and Applied Mechanics**
Ph.D., 1984, Imperial College of Science and Technology, University of London

**Katti, Dinesh, Professor of Civil Engineering**
Ph.D., 1991, University of Arizona-Tucson

**Katti, Kalpana, Assistant Professor of Civil Engineering**
Ph.D., 1996, University of Washington

**Katti, Rajendra, Associate Professor of Electrical and Computer Engineering**
Ph.D., 1991, Washington State University

**Kavasseri, Rajesh, Assistant Professor of Electrical and Computer Engineering**
Ph.D., 2002, Washington State University

**Kegode, George O., Assistant Professor of Plant Sciences**
Ph.D., 1995, Iowa State University

**Khaitsa, Margaret L., Assistant Professor of Veterinary and Microbiological Sciences**
Ph.D., 1999, Ohio State University

**Khan, Eakalak, Assistant Professor of Civil Engineering**
Ph.D., 1997, University of California at Los Angeles

**Khan, Khalil, Professor of Cereal Science**
Ph.D., 1977, University of Manitoba

**Khan, Mohamed, Assistant Professor of Soil Science**
Ph.D., 1998, Clemson University

**Kianian, Shahryar F., Assistant Professor of Plant Sciences**
Ph.D., 1990, University of California-Davis

**Killilea, S. Derek, Professor of Biochemistry and Molecular Biology**
Ph.D., 1972, National University of Ireland (Galway)

**Kim, Jang Chul, Assistant Professor of Business Administration**
Ph.D., 2003, University of Memphis

**Kirby, Donald R., Professor of Animal and Range Sciences**
Ph.D., 1980, Texas A & M University

**Kiser-Larson, Norma, Assistant Professor of Nursing**
Ph.D., 1998, University of Minnesota

**Klamm, Bonnie, Assistant Professor of Business Administration**
Ph.D., 1999, Virginia Commonwealth University-Richmond

**Klenow, Daniel J., Professor of Sociology**
Ph.D., 1977, University of Notre Dame

**Kloberdanz, Timothy J., Associate Professor of Anthropology**
Ph.D., 1986, Indiana University

**Klotz, Karen L., Adjunct Professor of Plant Sciences**
Ph.D., 1995, Ohio State University

**Koo, Won W., Professor of Agricultural Economics**
Ph.D., 1974, Iowa State University

**Kornfeld, Isaac, Professor of Mathematics**
Ph.D., 1975, Tashkent University

**Krishnan, R.S., Professor of English**
Ph.D., 1981, University of Nebraska

**Kroll, Daniel M., Professor of Physics**
Ph.D., 1973, Chicago

**Lambert, David K., Professor of Agricultural Economics**
Ph.D., 1985, Oregon State University

**Lamey, H. Arthur, Professor Emeritus of Plant Pathology**
Ph.D., 1954, University of Wisconsin

**Langley, Linda, Assistant Professor of Psychology**
Ph.D., 1998, University of Minnesota

**LaPalm, George E., Associate Professor Emeritus of Civil Engineering**
Ph.D., 1968, Purdue University

**Lardy, Gregory P., Assistant Professor of Animal and Range Sciences**
Ph.D., 1997, University of Nebraska

**Larew, Donald E., Professor of Theatre Arts**
M.F.A., 1969, University of Iowa

**Larsen, Gerald L., Adjunct Professor of Biochemistry and Molecular Biology**
Ph.D., 1980, North Dakota State University

**Lee, Chiwon W., Professor of Plant Sciences**
Ph.D., 1977, Purdue University

**Leistritz, F. Larry, Professor of Agricultural Economics**
Ph.D., 1970, University of Nebraska

**Leitch, Jay A., Professor of Agricultural Economics**
Ph.D., 1981, University of Minnesota

**Lepper, Kenneth, Assistant Professor of Geosciences**
Ph.D., 2001, Oklahoma State University

**Li, Deying, Assistant Professor of Plant Sciences**
Ph.D., 2001, Iowa State University

**Li, Honglin, Assistant Professor of Computer Science**
Ph.D., 2004, Ohio State University

**Lifton, Paul S., Associate Professor of Theatre Arts**
Ph.D., 1985, University of California-Berkeley

**Light, Harriett K., Professor of Child Development and Family Science**
Ph.D., 1976, Michigan State University

**Liguori, Gary, Assistant Professor of Health, Nutrition, and Exercise Science**
M.S., 1994, East Stroudsburg University

**Lima Jr., Ivan T., Assistant Professor of Electrical and Computer Engineering**
Ph.D., 2003, University of Maryland, Baltimore County

**Lin, Wei, Assistant Professor of Civil Engineering**
Ph.D., 1992, State University of New York at Buffalo

**Lindgren, Jon G., Associate Professor Emeritus of Economics**
Ph.D., 1968, University of Missouri

**Lindley, James A., Associate Professor Emeritus of Agricultural and Biosystems Engineering**
Ph.D., 1972, Purdue University

**Linz, George M., Adjunct Professor of Zoology**
Ph.D., 1982, North Dakota State University

**Littlefield, Robert S., Professor of Communication**
Ph.D., 1983, University of Minnesota

**Logue, Catherine M., Assistant Professor of Veterinary and Microbiological Sciences**
Ph.D., 1996, University of Ulster

**Lulai, Edward C., Adjunct Professor of Plant Sciences**
Ph.D., 1978, North Dakota State University

**Lundeen, Tina, Assistant Professor of Nursing**
M.S., 1985, University of Minnesota

**Lym, Rodney G., Professor of Plant Sciences**
Ph.D., 1979, University of Wyoming

**Maan, Shivcharan S., Professor Emeritus of Plant Sciences**
Ph.D., 1961, Kansas State University

**Macintosh, Gerrard, Associate Professor of Business Administration**
Ph.D., 1992, University of Nebraska-Lincoln

**Mack, Kyle D., Associate Professor of Music**
D.A., 1992, Ball State University

**Magel, Kenneth, Professor of Computer Science**
Ph.D., 1977, Brown University

**Magel, Rhonda, Professor of Statistics**
Ph.D., 1982, University of Missouri-Rolla

**Mahalingam, Ganapathy, Associate Professor of Architecture**
Ph.D., 1995, University of Florida

**Mahinfalah, Mohammad, Associate Professor of Mechanical Engineering and Applied Mechanics**
Ph.D., 1988, Iowa State University

**Maleki, Reza, Assistant Professor of Industrial and Manufacturing Engineering**
Ph.D., 1989, North Dakota State University

**Manikowske, Linda, Assistant Professor of Apparel, Textiles, and Interior Design**
Ph.D., 1993, Iowa State University

**Manthey, Frank, Assistant Professor of Cereal Science**
Ph.D., 1985, North Dakota State University

**Marinov, Valery R., Assistant Professor of Industrial and Manufacturing Engineering**
Ph.D., 1992, Technical University of Sofia

**Martens, Steve C., Associate Professor of Architecture**
M.Arch., 1988, University of Minnesota

**Martin, John C., Associate Professor of Computer Science**
Ph.D., 1971, Rice University

**Martin, William, Associate Professor of Mathematics**
Ph.D., 1993, University of Wisconsin

**Mathsen, Ronald, Professor Emeritus of Mathematics**
Ph.D., 1965, University of Nebraska

**Maughan, Arthur W., Associate Professor of Health, Nutrition, and Exercise Science**
M.S., 1966, North Dakota State University

**McCarthy, Gregory J., Professor of Chemistry**
Ph.D., 1969, Pennsylvania State University

**McCaul, Kevin D., Professor of Psychology**
Ph.D., 1978, University of Kansas

**McClean, Phillip E., Professor of Plant Sciences**
Ph.D., 1982, Colorado State University

**McCourt, Mark E., Professor of Psychology**
Ph.D., 1982, University of California-Santa Barbara

**McCullagh, Marjorie, Assistant Professor of Nursing**
Ph.D., 1998, University of Michigan

**McDonald, Thomas D., Professor of Sociology**
Ph.D., 1972, Southern Illinois University

**McEvoy, John, Assistant Professor of veterinary and Microbiological Sciences**
Ph.D., 2002, University of Ulster, Jordanstown, Co. Antrim, Northern Ireland

**McIntyre, Charles, Assistant Professor of Construction Management and Engineering**
Ph.D., 1996, Pennsylvania State University

**McMullen, Marcia P., Professor of Plant Pathology**
Ph.D., 1983, North Dakota State University

**McMullen, Michael S., Associate Professor of Plant Sciences**
Ph.D., 1976, University of Minnesota

**McWilliams, Denise A., Adjunct Professor of Plant Sciences**

Ph.D., 1988, Iowa State University

**Mehta, Sudhir I., Professor of Mechanical Engineering and Applied Mechanics**
Ph.D., 1982, I.I.T., Bombay

**Meinhardt, Steven W., Associate Professor of Biochemistry and Molecular Biology**
Ph.D., 1984, University of Illinois

**Meister, Mark Andrew, Assistant Professor of Communication**
Ph.D., 1997, University of Nebraska

**Mergoum, Mohamed, Assistant Professor of Plant Sciences**
Ph.D., 1991, Colorado State University

**Merrill, Stephen D., Adjunct Professor of Soil Science**
Ph.D., 1976, University of California-Riverside

**Messersmith, Calvin G., Professor of Plant Sciences**
Ph.D., 1970, North Dakota State University

**Meyer, Dwain W., Professor of Plant Sciences**
Ph.D., 1970, Iowa State University

**Miljkovic, Dragan, Associate Professor of Agribusiness & Applied Economics**
Ph.D., 1996, University of Illinois at Urbana-Champaign

**Miller, Donald R., Professor of Pharmacy Practice**
Pharm.D., 1978, University of Michigan

**Miller, E. John, Professor of Music**
Ph.D., 1991, Northwestern University

**Miller, James D., Adjunct Professor of Plant Pathology**
Ph.D., 1971, University of Minnesota

**Miller, Jerry F., Adjunct Professor of Plant Sciences**
Ph.D., 1976, North Dakota State University

**Miller, Jo Ann, Associate Professor of Music**
D.M.A., 1989, Conservatory of Music, University of Cincinnati College

**Miltenberger, Raymond G., Professor of Psychology**
Ph.D., 1985, Western Michigan University

**Montplaisir, Lisa M., Assistant Professor of Biological Sciences**
Ph.D., 2003, University of Arizona

**Monzingo, John E., Associate Professor Emeritus of Political Science**
Ph.D., 1976, Claremont Graduate School

**Mooney, Mary Margaret, Professor of Nursing**
D.N.Sc., 1980, Catholic University

**Mueller, Neil, Assistant Professor of Music**
D.M.A., 1998, Boston University-School for the Arts

**Musiba, Charles, Assistant Professor of Sociology/Anthropology**
Ph.D., 1999, The University of Chicago

**Nakhai-Jazar, Gholamreza, Assistant Professor of Mechanical Engineering and Applied Mechanics**
Ph.D., 1997, Sharif University of Technology

**Nawrot, Mark, Associate Professor of Psychology**
Ph.D., 1991, Vanderbilt University

**Neate, Stephen, Assistant Professor of Plant Pathology**
Ph.D., 1985, University of Adelaide

**Nelson, Berlin D., Professor of Plant Pathology**
Ph.D., 1979, Washington State University

**Nelson, Dennis R., Adjunct Professor of Biochemistry and Molecular Biology**
Ph.D., 1964, University of North Dakota

**Nelson, Paul E., Professor of Communication**
Ph.D., 1968, University of Minnesota

**Nelson, Robert M., Associate Professor of Electrical and Computer Engineering**
Ph.D., 1987, North Dakota State University

**Nganje, William E., Assistant Professor of Agricultural Economics**
Ph.D., 1998, University of Illinois

**Nguyen, Tang-Hung, Assistant Professor of Construction Engineering**
Ph.D., 1999, Pennsylvania State University

**Nielsen, Robert C., Professor of Education**
Ed.D., 1973, University of Northern Colorado

**Norris, Jim, Associate Professor of History**
Ph.D., 1992, Tulane University

**North, Barbara B., Associate Professor Emeritus of Food and Nutrition**
M.S., 1959, University of Minnesota

**Nuechterlein, Gary L., Professor of Zoology**
Ph.D., 1980, University of Minnesota

**Nygard, Kendall E., Professor of Computer Science**
Ph.D., 1978, Virginia Polytechnic Institute and State University

**O'Connor, Amy, Assistant Professor of Communication**
Ph.D, 2003, Purdue University

**O'Connor, Robert, Professor of English**
Ph.D., 1979, Bowling Green State University

**Odde, Kenneth G., Professor of Animal and Range Sciences**
D.V.M., 1982, Kansas State University
Ph.D., 1983, Kansas State University

**Ode, Paul J. , Assistant Professor of Entomology**
Ph.D., 1994, University of Wisconsin-Madison

**Okigbo, Charles, Professor of Communication**
Ph.D., 1982, Southern Illinois University

**Oleson, Arland E., Professor Emeritus of Biochemistry and Molecular Biology**
Ph.D., 1963, University of Minnesota

**Olfert, Warren, Assistant Professor of Music**
Ph.D., 1992, Florida State University

**Olsen, James H., Professor of Mathematics**
Ph.D., 1968, University of Minnesota

**Olson, Denise, Assistant Professor of Entomology**
Ph.D., 1994, Kansas State University

**Omvig, Kenton T., Assistant Professor of Pharmacy Practice**
Pharm.D., 1993, North Dakota State University

**O'Neill, H. Katherine, Assistant Professor of Psychology**
Ph.D., 1991, University of North Dakota

**O'Relley, Z. Edward, Professor of Economics**
Ph.D., 1972, University of Tennessee

**O'Rourke, Stephen T., Associate Professor of Pharmaceutical Sciences**
Ph.D., 1985, University of Wisconsin

**Oyola-Yemaiel, Arthur, Assistant Professor of Sociology**
Ph.D., 1999, Florida International University

**Padmanabhan, G., Professor of Civil Engineering**
Ph.D., 1980, Purdue University

**Page, Michael, Associate Professor of Chemistry**
Ph.D., 1982, State University of New York at Buffalo

**Panigrahi, Suranjan, Associate Professor of Agricultural and Biosystems Engineering**
Ph.D., 1992, Iowa State University

**Pankow, Debb, Assistant Professor of Child Development and Family Science**
Ph.D., 2002, South Dakota State University

**Park, Chung S., Professor of Animal and Range Sciences**
Ph.D., 1975, Virginia Polytechnic Institute and State University

**Patnode, Matthew, Assistant Professor of Music**
D.M.A., 1999, Arizona State University

**Patterson, Betty, Assistant Professor of Pharmacy Practice**
Ph.D., 1968, University of Iowa

**Patterson, Floyd M., Associate Professor of Electrical and Computer Engineering**
M.S., 1963, North Dakota State University

**Pavicic, Mark, Adjunct Professor of Computer Science**
Ph.D., 1985, Columbia University

**Pearson, Carol, Assistant Professor of Modern Languages**
Ph.D., 1998, University of New Mexico

**Pearson, Judy C., Professor of Communication**
Ph.D., 1975, Indiana University

**Perrizo, William, Professor of Computer Science**
Ph.D., 1972, University of Minnesota

**Peterson, Charles D., Professor of Pharmacy Practice**
Pharm.D., 1977, University of Minnesota

**Peterson, Larry R., Professor of History**
Ph.D., 1978, University of Minnesota

**Petry, Timothy A., Associate Professor of Agricultural Economics**
M.S., 1973, North Dakota State University

**Pieri, Robert V., Professor of Mechanical Engineering and Applied Mechanics**
Ph.D., 1987, Carnegie-Mellon University

**Pinkston, Rebecca, Assistant Professor of Architecture and Landscape Architecture**
MLA., 1984, Harvard Graduate School of Design

**Provder, Theodore, Adjunct Professor of Polymers and Coatings Science**
Ph.D., 1965, University of Wisconsin

**Pruess, Birgit, Assistant Professor of Veterinary and Microbiological Sciences**
Ph.D., 1991, Ruhr-Universitat Bochum, Germany

**Prunty, Lyle D., Professor of Soil Science**
Ph.D., 1978, Iowa State University

**Query, Joy M., Professor Emeritus of Sociology**
Ph.D., 1970, University of Kentucky

**Ramaya, Krishnan, Assistant Professor of Business Administration**
Ph.D., 1997, University of Kansas-Lawrence

**Ramsay, Ronald L. M., Associate Professorof Architecture**
M.Arch., 1991, University of Texas-Austin

**Randall, Brandy, Assistant Professor of Child Development and Family Science**
Ph.D., 2002, University of Nebraska, Lincoln

**Ransom, Joel K., Assistant Professor of Plant Sciences**
Ph.D., 1982, University of Minnesota

**Rasmussen, Jack B., Associate Professor of Plant Pathology**
Ph.D., 1987, Michigan State University

**Rasmussen, Seth C., Assistant Professor of Chemistry**
Ph.D., 1994, Clemson University

**Rathge, Richard W., Professor of Sociology and Agricultural Economics**
Ph.D., 1981, Michigan State University

**Ray-Degges, Susan, Associate Professor of Apparel, Textiles, and Interior Design**
M.S., 1987, University of Missouri

**Redmer, Dale A., Professor of Animal and Range Sciences**
Ph.D., 1983, University of Missouri

**Reed, Wendy, Assistant Professor of Biological Sciences**
Ph.D., 2000, Iowa State University

**Reynolds, Lawrence P., Professor of Animal and Range Sciences**
Ph.D., 1983, Iowa State University

**Rhee, Yeong, Assistant Professor of Health, Nutrition, and Exercise Science**
Ph.D., 1999, Oklahoma State University

**Rider, David A., Associate Professor of Entomology**

Ph.D., 1988, Louisiana State University

**Riley, Thomas J., Professor of Sociology/Anthropology**
Ph.D., 1973, University of Hawaii

**Robinson, Michael D., Assistant Professor of Psychology**
Ph.D., 1996, University of California, Davis

**Rodgers, Kenton R., Associate Professor of Chemistry**
Ph.D., 1988, University of Iowa

**Roehrdanz, Richard, Adjunct Professor of Entomology**
Ph.D., 1974, University of Wisconsin

**Rogers, David A., Professor of Electrical and Computer Engineering**
Ph.D., 1971, University of Washington

**Rokke, Paul D., Professor of Psychology**
Ph.D., 1985, University of Houston

**Rupiper Taggert, Amy, Assistant Professor of English**
Ph.D., 2001, Texas Christian University

**Rusaw, Carol A., Assistant Professor of School of Education**
Ph.D., 1989, Virginia Polytechnic Institute

**Rymph, R. Douglas, Assistant Professor of Business Administration**
Ph.D., 1999, University of South Carolina

**Saini-Eidukat, Bernhardt, Assistant Professor of Geosciences**
Ph.D., 1991, University of Minnesota

**Salah, Akram, Associate Professor of Computer Science**
Ph.D., 1986, University of Alabama at Birmingham

**Sanders, Gregory F., Professor of Child Development and Family Science**
Ph.D., 1983, University of Georgia

**Scherer, Thomas S., Associate Professor of Agricultural and Biosystems Engineering**
Ph.D., 1986, University of Minnesota

**Schmidt, Mark, Assistant Professor of Education**
Ph.D., 2000, The Florida State University

**Schneider, Amy, Assistant Professor of Music**
MUS.A.D., 2000, Boston University

**Schnell, R. Craig, Professor of Pharmaceutical Sciences**
Ph.D., 1969, Purdue University

**Schroeder, Jerome W., Assistant Professor of Animal and Range Sciences**
Ph.D., 1999, North Dakota State University

**Schroeder, Mark, Assistant Professor of Electrical and Computer Engineering**
Ph.D., 1999, University of Texas

**Schwarz, Paul B., Associate Professor of Cereal Science**
Ph.D., 1987, North Dakota State University

**Schwert, Donald P., Professor of Geosciences**
Ph.D., 1978, University of Waterloo

**Scott, David, Associate Professor of Pharmacy Practice**
Ph.D., 1987, University of Minnesota

**Secor, Gary A., Professor of Plant Pathology**
Ph.D., 1978, University of California-Davis

**Sedivec, Kevin K., Associate Professor of Animal and Range Sciences**
Ph.D., 1994, North Dakota State University

**Sellnow, Deanna, Associate Professor of Communication**
Ph.D., 1992, University of North Dakota

**Sellnow, Timothy L., Professor of Communication**
Ph.D., 1987, Wayne State University

**Shaw, Richard M., Associate Professor of English**
Ph.D., 1985, Ball State University

**Shelver, William H., Professor Emeritus of Pharmaceutical Sciences**
Ph.D., 1962, University of Virginia

**Sheng, Jonathan, Assistant Professor of Pharmaceutical Sciences**
Ph.D., 1998, State University of New York at Albany

**Sheridan, Mark A., Associate Professor of Zoology**
Ph.D., 1985, University of California-Berkeley

**Sherman, William, Associate Professor Emeritus of Sociology**
M.A., 1965, University of North Dakota

**Shi, Jing, Assistant Professor of Industrial and Manufacturing Engineering**
Ph.D., 2004, Purdue University

**Shreve, Warren, Professor of Mathematics**
Ph.D., 1967, University of Nebraska

**Shumate, Michelle, Assistant Professor of Communication**
Ph.D., 2003, University of Southern California

**Sibi, Mukund P., Professor of Chemistry**
Ph.D., 1980, City University of New York

**Simmons, Bret L., Assistant Professor of Business Administration**
Ph.D., 2000, Oklahoma State University

**Singh, Amrik, Assistant Professor of Apparel, Design, Facilities, Hospitality Management**
Ph.D., 2004, The Pennsylvania State University

**Singh, Jagdish, Professor of Pharmaceutical Sciences**
Ph.D., 1982, Banaras Hindu University, Varanasi, India

**Sinha, Mahendra K., Professor Emeritus of Physics**
Ph.D., 1961, Pennsylvania State University

**Slanger, William D., Professor of Animal and Range Sciences**
Ph.D., 1975, Cornell University

**Slator, Brian, Associate Professor of Computer Science**
Ph.D., 1988, New Mexico State University

**Slobin, Kathleen, Associate Professor of Sociology**

Ph.D., 1991, University of California-San Francisco

**Smith, David J., Adjunct Professor of Animal and Range Sciences**
Ph.D., 1990, Washington State University

**Smith, Donald A., Professor Emeritus of Electrical and Computer Engineering**
Ph.D., 1968, University of Minnesota

**Smith, Gary, Professor of Engineering**
Ph.D., 1986, Purdue University

**Smith, Ronald C., Professor of Plant Sciences**
Ph.D., 1973, The Ohio State University

**Snyder, Herbert, Associate Professor of Business Administration**
Ph.D., 1994, Syracuse University

**Sommer, Carol A., Assistant Professor of Education**
Ph.D., 2003, Southern Illinois University

**Sparks, Robert B., Associate Professor of Biochemistry and Molecular Biology**
Ph.D., 1972, University of South Dakota

**Spilde, LeRoy A., Associate Professor Emeritus of Plant Sciences**
Ph.D., 1975, North Dakota State University

**Srivastava, D. K., Professor of Biochemistry**
Ph.D., 1980, Banaras Hindu University, India

**Stack, Robert W., Professor of Plant Pathology**
Ph.D., 1976, Cornell University

**Stammen, Ronald M., Professor of Education**
Ph.D., 1990, The Ohio State University

**Staricka, James A., Adjunct Professor of Soil Science**
Ph.D., 1990, University of Minnesota

**Steele, Dean D., Associate Professor of Agricultural and Biosystems Engineering**
Ph.D., 1991, University of Minnesota

**Stegman, Earl C., Professor of Agricultural and Biosystems Engineering**
Ph.D., 1966, Michigan State University

**Stevens, Charles D., Assistant Professor of Business Administration**
Ph.D., 1998, University of Kansas

**Stewart, Mary J., Assistant Professor of Zoology**
Ph.D., 1992, Kansas State University

**Stewart, Michael, Assistant Professor of Mechanical Engineering and Applied Mechanics**
Ph.D., 1979, University of Illinois

**Stickney, Gwen, Assistant Professor of English**
Ph.D., 2004, Indiana University

**Stockwell, Craig A., Assistant Professor of Zoology**
Ph.D., 1995, University of Nevada-Reno

**Stone, James J. S., Associate Professor of Mechanical Engineering and Applied Mechanics**
Ph.D., 1992, University of Wisconsin-Madison

**Strand, Bradford, Professor of Health, Nutrition, and Exercise Science**

Ph.D., 1988, University of New Mexico

**Strom, Claire, Assistant Professor of History**
Ph.D., 1998, Iowa State University

**Strommen, Gordon L., Associate Professor Emeritus of Pharmacy Practice**
Pharm.D., 1984, University of Nebraska

**Stuehm, Donald L., Professor Emeritus of Electrical and Computer Engineering**
Ph.D., 1972, Colorado State University

**Sublet, Virginia, Associate Professor of Music**
D.M.A, 1997, University of California, San Diego

**Sullivan, Dale, Professor of English**
Ph.D., 1988, Rensslelaer Polytechnic Institute

**Sun, Wenfang, Assistant Professor of Chemistry**
Ph.D., 1995, Institute of Photographic Chemistry, Chinese Academy of Sciences

**Suttle, Jeffrey C., Adjunct Professor of Botany/Biology**
Ph.D., 1980, Michigan State University

**Swenson, David G., Assistant Professor of Art**
M.F.A., 1992, University of Minnesota

**Swenson, Orven, Associate Professor of Physics**
Ph.D., 1982, Air Force Institute of Technology

**Sylvester, Robert K., Associate Professor of Pharmacy Practice**
Pharm.D., 1976, University of Minnesota

**Szmerekovsky, Joseph G., Assistant Professor of Business Administration**
Ph.D., 2003, Case Western Reserve University

**Tallman, Dennis E., Professor of Chemistry**
Ph.D., 1968, The Ohio State University

**Tareski, Val G., Associate Professor of Electrical and Computer Engineering**
M.S., 1969, North Dakota State University

**Terbizan, Donna J., Associate Professor of Health, Nutrition, and Exercise Science**
Ph.D., 1982, The Ohio State University

**Terpstra, Jeff T., Assistant Professor of Statistics**
Ph.D., 1997, Western Michigan University

**Thompson, Asunta L., Assistant Professor of Plant Sciences**
Ph.D., 1998, University of Idaho

**Thompson, Kevin M., Professor of Sociology**
Ph.D., 1986, University of Arizona

**Thrasher, Michael, Assistant Professor of Music**
D.M.A., 1997, University of North Texas

**Tollefson, Wayne E., Associate Professor Emeritus of Art**
M.A., 1962, Michigan State University

**Tolliver, Denver D., Adjunct Professor of Civil Engineering**
Ph.D., 1989, Virginia Polytechnic Institute

**Traub, Rodney D., Associate Professor of Business Administration**
Ph.D., 1994, Purdue University

**Turner, Jason L., Assistant Professor of Animal and Range Sciences**
Ph.D., 2001, Kansas State University

**Ubhaya, Vasant, Professor of Computer Science**
Ph.D., 1971, University of California-Berkeley

**Ungar, Abraham, Professor of Mathematics**
Ph.D., 1973, Tel-Aviv University

**Urness, Cindy, Assistant Professor of Architecture and Landscape Architecture**
M.Arch., 1988, Pratt Institute

**Varma, Amiy, Associate Professor of Civil Engineering**
Ph.D., 1993, Purdue University

**Venette, James R., Professor of Plant Pathology**
Ph.D., 1975, University of Minnesota

**Vick, Brady A., Adjunct Professor of Biochemistry and Molecular Biology**
Ph.D., 1975, North Dakota State University

**Wachenheim, Cheryl J., Assistant Professor of Agricultural Economics**
Ph.D., 1994, Michigan State University

**Wageman, Justin J., Assistant Professor of Education**
Ph.D., 1999, University of North Dakota

**Wagner, C., Alexander, Assistant Professor of Physics**
Ph.D., 1997, Oxford University

**Wagner, John J., Associate Professor of Pharmaceutical Sciences**
Ph.D., 1991, University of Washington

**Wagner, Sarah, Assistant Professor of Animal and Range Sciences**
Ph.D., 19 , Iowa State University

**Wallman, George H., Associate Professor of Education**
Ph.D., 1980, Michigan State University

**Walter, Joshua F., Associate Professor of Landscape Architecture**
M.L.A., 1991, Kansas State University

**Weber, Michael, Associate Professor of Music**
D.M.A., 1990, University of Arizona

**Webster, Dean, Professor of Polymers and Coatings**
Ph.D., 1984, Virginia Polytechnic Institute and State University

**Weiland, John, Adjunct Professor of Plant Pathology**
Ph.D., 1992, Oregon State University

**Wells, David L., Professor of Industrial and Manufacturing Engineering**

Ph.D., 1996, University of Missouri-Rolla

**Wicks, Jr., Zeno W., Professor Emeritus of Polymers and Coatings Science**
Ph.D., 1944, University of Illinois

**Wiesenborn, Dennis P., Professor of Agricultural and Biosystems Engineering**
Ph.D., 1989, Rice University

**Williams, Robyne C., Assistant Professor of Apparel, Textiles, and Interior Design**
Ed.D., 1984, University of North Dakota

**Wilson, Jennifer, Assistant Professor of Sociology**
Ph.D., 2000, Florida International University

**Wilson, William W., Professor of Agricultural Economics**
Ph.D., 1980, University of Manitoba

**Windels, Carol E., Adjunct Professor of Plant Pathology**
Ph.D., 1980, University of Minnesota

**Withnell, Gary D., Adjunct Professor of Physics**
Ph.D., 1980, North Dakota State University

**Wittrock, David A., Associate Professor of Psychology**
Ph.D., 1990, State University of New York at Albany

**Wolf-Hall, Charlene, Assistant Professor of Cereal and Food Science**
Ph.D., 1995, University of Nebraska-Lincoln

**Wolfe, Kara L., Assistant Professor of Apparel, Textiles, and Interior Design**
Ph.D., 2002, Kansas State University

**Wood, Robert A., Associate Professor of Political Science**
Ph.D., 1983, University of Missouri

**Xu, Dianxiang, Assistant Professor of Computer Science**
Ph.D., 1995, Nanjing University

**Yadav, Om Prakash, Assistant Professor of Industrial and Manufacturing Engineering**
Ph.D., 2002, Wayne State University

**Yazdani, Frank, Professor of Civil Engineering**
Ph.D., 1987, University of New Mexico

**Yocum, George, Adjunct Professor of Entomology**
Ph.D., 1992, Ohio State University

**Youngs, George A., Professor of Sociology**
Ph.D., 1981, University of Iowa

**Yuvarajan, Subbaraya, Professor of Electrical and Computer Engineering**
Ph.D., 1981, I.I.T., Madras

**Zhong, Weihong, Associate Professor of Mechanical Engineering and Applied Mechanics**
Ph.D., 1994, Beijing University of Aeronautics and Astronautics, China

**Ziejewski, Mariusz, Associate Professor of Mechanical Engineering and Applied Mechanics**
Ph.D., 1986, North Dakota State University

**Zimmerman, Robert A., Adjunct Professor of Civil Engineering**
Ph.D., 1991, North Dakota State University

**Zollinger, Richard K., Associate Professor of Plant Sciences**
Ph.D., 1987, Michigan State University



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The Graduate School
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North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
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NDSU
Campus Building Directory
NDSU

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- Researchers :
- Alumni & Friends

# Alphabetical Building List:

**NDSU's Detailed Campus Map rev.2005**
**(Printable PDF: 156KB)**

- Agricultural and Biosystems Engineering
- Alba Bales House
- Alien Technology
- Alumni, Development Center
- Animal Nutrition and Physiology Center/Occupational Safety and Environmental Health
- Architecture and Landscape Architecture
- Askanase Hall
  Little Country Theatre, Reineke Fine Arts Center, Walsh Studio Theatre
- Auxiliary Enterprises
- Bentson/Bunker Fieldhouse
  Atletics, HNES, ROTC
- Biosciences Research Labratory
- Bison Court
  Dining Services, Residence Life, Residence Halls

- Bison Sports Arena
  BSA, Athletic Media Relations, Athletics, Campus Recreation/Intramural, HNES
- Burgum Hall
  Residence Halls
- Candlewood Suites
  Hotel
- Ceres Hall
  Admission, Career Center, Cooperative Education, Counseling and Disability Services, Financial Services, International Programs, Multicultural Students Services, Orientation and Student Success, Registration and Records, TRIO Programs
- Churchill Hall
  Residence Halls
- Civil and Industrial Engineering
- Co-op Building
- Construction Management
- Credit Union (Northland Educators)
- Criminal Justice and Public Policy
  Criminal Justice, Political Science
- Dacotah Field
- Dinan Hall
  Residence Halls
- Dolve Hall
  Mechanical Engineering
- Dunbar Laboratories
  Chemistry
- E. Morrow Lebedeff Hall
  Human Development and Education
- Ehly Hall
  Architecture and Landscape Architecture
- Electrical and Computer Engineering
- Engineering and Technology
- Engineering Center
- Engineering Quonset
- Equine Center
  3 miles west of campus on 19th Ave N.
- Harris Hall
  Cereal Sciences
- Hastings Hall

Herbarium
- Heating Plant
- Hultz Hall
  Animal and Range Science, Entomology
- Industrial Agriculture and Communications Center
  IACC, Computer Network, Computer Science, Computing Help Desk, Industrial Agriculture, Information Technology Services, Upper Great Plains Transportation Institute
- Johansen Hall
  Seed Research, State Seed Department
- Katherine Klibourne Burgum Family Life, 4-H Center
  Education, FLC
- Ladd Hall
- Library
- Living Learning Center
  Residence Halls, LLC
- Loftsgard Hall
  Biochemistry, Plant Sciences
- Lord and Burnham Greenhouses
- Lutheran Student Center
- Maintenance Buildings
- Memorial Union
  Bookstore, Copies, Electronics, Food Court/Restaurants, Graphic Services, Ticketmaster, Student Government, Student Newspaper, Varsity Mart
- Metered Parking Lot
- Minard Hall
  Arts Humanities and Social Sciences
- Morrill Hall
  Agricultural Communication, Agribusiness and Applied Economics, Agricultural Administration, Document Publishing Center
- Music Education Building
  Beckwith Recital Hall, Festival Concert Hall, Reineke Fine Arts Center
- NDSU Downtown
  NDSU Downtown, Architecture and Landscape Architecture, Art, Tri-College, Visual Arts
- Nelson Building
  C.I. Nelson Building
- Northern Crops Institute
- Northern Crops Science Lab
  Sugar beets, sunflowers

- Old Main
  Administration, Business Office, Student Affairs, University Relations
- Pavek Hall
  Residence Halls
- Phoenix International
- Plant Sciences Greenhouse
  Agronomy Greenhouse Plant Diagnostic Laboratory
- Post Office
  Mail
- Potato Research-Pesticide Storage
- Presidents House
- Putnam Hall
  Business
- Reed-Johnson Halls
  Residence Halls
- Research and Technology Park
- Research I
- Research II
- Residence Dining Center
- Residence Life Facilities Services
  Laundry
- Robinson Hall
  Veterinarian Research
- Seim Hall
  Residence Halls
- Service Center, Pilot Plant
- Sevrinson Hall
  Residence Halls
- Shepperd Arena
- Skill and Technology Training Center
  STTC
- South Engineering
  Physics
- St. Paul Chapel
  Newman Center
- Stevens Auditorium
- Stevens Hall
  Natural Sciences

- Stockbridge Hall
  Residence Halls
- Sudro Hall
  Nursing, Pharmacy
- Sugar Beet Research
- Thompson Hall
  Residence Halls
- Thordarson Hall
  Independent Study, State Film Library
- Thorson Maintenance Center
  Campus Parking, Campus Police, Facilities management
- United Campus Ministry
- University Village
  Residence Halls
- Van Es
  Microbiological Sciences, Vet Science
- Waldron Laboratory
  Agriculture, Soil Testing lab, Statistics
- Walster Hall
  Agriculture
- Weible Halls (North and South)
  Residence Halls
- Wellness Center
  Excercise, Health, YMCA of NDSU
- West Dining Center
- Widakas Lab
  Corn Seed House, Plant Sciences

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## Graduate Faculty

701-231-7441

**Cheryl S. DeVuyst, Ph.D.**
University of Illinois, 1999
Research Interests:
Agribusiness

**Eric A. DeVuyst, Ph.D.**
Purdue University, 1993
Research Interests:
Production and Resource Economics, Farm Management, Operations Research

**George K. Flaskerud, Ph.D.**
Oklahoma State University, 1970
Research Interests:
Grain Marketing

**Justin Garosi, Ph.D.**
University of Michigan, 2005
Research Interests:
Public Finance, Taxation Policy

**Robert Hearne, Ph.D.**
University of Minnesota, 1995
Research Interests:
Natural Resource and Environmental Economics

**Robert S. Herren, Ph.D.**
Duke University, 1975
Research Interests:
Economic History, Labor, Money and Banking

**Siew Hoon Lim, Ph.D.**
University of Georgia, 2005
Research Interests:
Production Economics, Transportation, Industrial Organization

**Won W. Koo, Ph.D.**
Iowa State University, 1974
Research Interests:

# Agribusiness and Applied Economics

## Program Description

The Department of Agribusiness and Applied Economics offers two Master of Science degrees:(1) Agribusiness and Applied Economics, and (2) International Agribusiness. Graduates of both programs are prepared to analyze important agricultural development, finance, marketing, policy, production, resource, international trade, and transportation and logistical issues facing society.

The Agribusiness and Applied Economics Master of Science degree include areas of specialization in applied economics, agribusiness, and transportation and logistics.

The Applied Economics area emphasizes course work in economic theory, research methods, and quantitative techniques. The option is designed to prepare students for careers in agricultural economics research in private and public sectors and for Ph.D. programs at other institutions.

The Agribusiness specialization is a broad-based program which combines training in agribusiness management, economic analysis, and agricultural sciences. Training may include biotechnology, processing, and food and environmental safety. Students in the Agribusiness Option must complete a thesis or a comprehensive study paper. Students are prepared for a variety of successful careers in agribusiness by fulfilling the requirements for expertise in quantitative methods and developing a rigorous background in economic theory and research.

The departments of Agribusiness and Applied Economics and Civil Engineering, in conjunction with the Upper Great Plains Transportation Institute, offer an interdisciplinary graduate program in multimodal transportation. The program includes rural and non-metropolitan planning, highway and railroad engineering, freight transportation operations and economics, and agribusiness logistics and distribution. Both thesis and comprehensive study options are available.

A Master of Science program in Natural Resource Management, with an emphasis in social science, is also available (see the section on Natural Resource Management).

Students of all options have complete access to well-equipped research facilities and to faculty supervision time. (A favorable faculty to student ratio is maintained.) The department has an excellent placement record with national and international agricultural and business firms as well as government agencies.

## Admissions Requirements

The Department of Agribusiness and Applied Economics graduate program is open to all qualified

International Trade, Grain Marketing

**David K. Lambert, Ph.D.**
Oregon State University, 1985
Research Interests: Production Economics

**F. Larry Leistritz, Ph.D.**
University of Nebraska, 1970
Research Interests: Economic Development, Resource Economics

**Gregory McKee, Ph.D.**
University of California, Davis, 2006
Research Interests: Industrial Organization, Agribusiness, Cooperatives

**Dragan Miljkovic, Ph.D.**
University of Illinois, 1996
Research Interests: Agricultural Prices, International Trade, Agricultural and Food Marketing and Policy

**William E. Nganje, Ph.D.**
University of Illinois, 1998
Research Interests: Agribusiness, Food Safety, Finance

**David M. Saxowsky, J.D.**
The Ohio State University, 1979
Research Interests: Agricultural Law

**Cheryl J. Wachenheim, Ph.D.**
Michigan State University, 1994
Research Interests: Agribusiness

**William W. Wilson, Ph.D.**
University of Manitoba, 1980
Research Interests: Commodity Marketing, Agribusiness, Industrial Organization

graduates of universities and colleges of recognized standing. To be admitted with full status to the program, an applicant must

1. Hold a baccalaureate degree from an educational institution of recognized standing.
2. At the baccalaureate level, have earned a cumulative grade point average (GPA) of at least 3.0 or equivalent.
3. Have adequate preparation in economic theory, calculus, and statistics for the selected degree option.
4. Show potential to undertake advanced study and research as evidenced by academic performance and experience.

Students who do not meet all requirements for admission or have deficiencies in prerequisite course work, but show potential for successful graduate study, may be admitted under a conditional status. Evidence must be provided showing that the applicant's potential is not adequately reflected by his/her record. After meeting the specified standards of performance set by the department, the student, in consultation with the major adviser, may request a change to full graduate standing.

It is desirable that students begin their program in the fall semester, although students may also begin their programs of study in January. The application for admission should be received by The Graduate School by February 1 if the student wishes to be considered for financial assistance. Application for admission to graduate school should be as far in advance as possible, in all cases at least one month prior to the next registration date. International students are advised to submit applications by no later than March 1st to ensure VISA documents will be completed for a fall matriculation.

Application information and forms are available at The Graduate School. Three letters of recommendation are generally required before action is taken on any application.

The TOEFL examination is required of international applicants. A minimum score of 550 (paper test) or 213 (computer test) must be achieved.

## Financial Assistance

The Department offers assistantships on a competitive basis. Information about other forms of financial assistance may be obtained from the Financial Aid Office in Ceres Hall. Two types of assistantships are available: the Graduate Research Assistantship (GRA), and the Teaching Assistantship (TA).

The GRA and TA provide a monthly stipend plus tuition waiver. Regardless of the type of assistantship, the student must pay an activity fee each semester. An assistantship normally begins the first semester the student is both at full graduate standing and enrolled in courses that apply to the student's graduate program of study.

Application for financial assistance should be made to the department at the same time as application to the graduate school. Applicants to graduate school who are accepted in less than full standing will not be eligible for an assistantship until their status changes to full standing. Granting assistantships depends on academic performance, departmental needs, and availability of assistantships. Application forms may be obtained from the department.

Most assistantships are half time. Students on assistantships are expected to perform research and other duties in the department in return for their stipend. All half-time assistants are expected to be available for performing services related to research or other duties for an average of 20 hours per week. Time expended on the student's research project is recognized as partial fulfillment of this requirement.

## Degree Requirements

Candidates meeting all prerequisites for the M.S. degree in Agribusiness and Applied Economics may complete their program in 15-18 months. The degree requires the completion of 30 credit hours of letter-graded course work with an overall GPA of 3.0 or higher. A faculty seminar and an oral defense of either a research-based thesis or paper are required. Each student chooses a thesis adviser during his/her first semester of graduate school. Plans of study are developed to meet both disciplinary requirements and special interests of the student.

Students pursuing a Master of Science in Agribusiness and Applied Economics (thesis option or comprehensive study option) must complete all core courses. Students select elective courses (with approval of their adviser and supervisory committee) to fulfill the remaining Graduate School credit requirements. The core requirements assure breadth and competence in key areas of knowledge and professional activity. It is required that students **have competence in calculus, multiple regression, and intermediate economic theory** before enrolling in core courses. The following courses, or their equivalent, constitute the core of the Master of Science program for each area of specialization:

# M.S. in Agribusiness and Applied Economics

## Applied Economics

**Required:**
AgEc 701 - Research Philosophy
AgEc 710 - Econometrics
AgEc 739 - Analytical Methods for Applied Economics
AgEc 741 - Advanced Microeconomics
AgEc 743 - Advanced Macroeconomics
AgEc 797 or 798 - Comprehensive Study or Thesis

**Electives:**
Three additional courses in Applied Economics

## Agribusiness

**Required:**
AgEc 701 - Research Philosophy
AgEc 710 - Econometrics
AgEc 739 - Analytical Methods for Applied Economics
AgEc 741 - Advanced Microeconomics
AgEc 744 - Agribusiness I
AgEc 746 - Agribusiness II
AgEc 797 - Comprehensive Study

**Electives:**
Business Management Courses and Electives

## Transportation

**Required:**
AgEc 701 - Research Philosophy
AgEc 710 - Econometrics
AgEc 739 - Analytical Methods for Applied Economics
AgEc 741 - Advanced Microeconomics
AgEc 771 - Economics for Transportation Systems
AgEc 797 or 798 - Comprehensives Study or Thesis Electives

# Courses Offered

**644 Crops Marketing 3**
Capstone course for commodity marketing option. Advanced work on topics related to marketing of crops. 2 lectures. Prereq: AgEc 344.

**646 Agribusiness Finance 3**
Application of financial theory to investment and liability management problems of agribusiness and farm firms.Characteristics, operations, and management of agricultural financial institutions. 3 lectures. Prereq: AgEc 346, Busn 340.

**670 Agricultural Trade 2**
Introduction to trade theory and policies, and their applications to agricultural product trade. 2 lectures. Prereq: AgEc 201, 202.

**656 History of Economic Thought 3**
Development of economic thought from the mercantilists to Keynesian economics. Prereq: Econ 341 or Busn 451 and Econ 324 or 343.

**661 Economic Development 3**
Analysis of the main causes of economic development. Prereq: Econ 341 or Busn 451.

**665 Labor Economics 3**
Theoretical analysis and survey of empirical studies relating to labor markets, human capital formation, and nature and causes of unemployment. Prereq: Econ 341 or Busn 451.

**670 Public Finance 3**
Taxation, intergovernmental fiscal relations, and public expenditures; implications of various taxation policies. Prereq: Econ 341 or Busn 451.

**672 International Trade 3**
Theories of international trade, payments, and foreign exchange markets. Prereq: Econ 341 or Busn 451.

**676 Monetary Theory and Policy 3**
Analysis of relationships among money, credit, employment, price stability, and national monetary policy. Prereq: Econ 324 or 343.

**680 Industrial Organization 3**
Introduction to trade theory and policies, and their applications to agricultural product trade. 2 lectures. Prereq: AgEc 201, 202.

**681 Natural Resource Economics 3**
Application of economic tools to evaluate natural resource policies. Concepts such as property rights, non-market goods, resource allocation over time, externalities, open access, and public goods are discussed in an inter mediate micro-economics and calculus-based format. Prereq: Econ 341. Cross listed with NRM.

**701 Research Philosophy 1**
Role of the scientist, reasoning, values, and decisions. Problem formulation, literature review, hypothesis development, data collection, analysis, and interpretation. 1 lecture. Prereq: Stat 330.

**710 Econometrics 3**
Applications of statistical methods to specification, estimation, and forecasting of linear economic models, including multiple regression models, cross-section data analysis, time-series data analysis, and qualitative dependent variable models. 4 lectures for first half of semester. Prereq: AgEc 701, Stat 331.

**711 Advanced Topics in Econometrics 1-3**
Advanced econometric methods appropriate to a variety of research areas in economics and agribusiness will be offered. Analytical methods covered will vary by semester. Repeated enrollment allowed. Prereq: AgEc 710 or consent of instructor.

**739 Analytical Methods for Applied Economics 3**
Study and application of operations research techniques and other decision methods to problems in agriculture, transportation, and resource management. 3 lectures. Coreq: AgEc 710, Econ 741.

**741 Advanced Microeconomics 3**
Advanced analysis of demand, production, and costs; pricing output; and resource allocation under various market structures. Prereq: Econ 341, Math 146 or equivalent.

**743 Advanced Macroeconomics 3**
Advanced analysis of macroeconomic theories, economic growth, business fluctuations, and inflation. Prereq: Econ 343, Math 146 or equivalent.

**744 Agribusiness I: Agricultural Product Marketing and Agribusiness Strategy 3**
Conceptual foundations of agribusiness strategic planning are presented. Emphasis is placed on quantitative strategic decision making for the agribusiness firm. Prereq: AgEc 741.

**746 Agribusiness II: Agrifinance and Commodity Trading 3**
Conceptual foundations of agribusiness finance, trading, and strategy are presented. Emphasis is placed on financial instruments and planning for agribusiness firms, and trading and risk management in agricultural commodities. Prereq: AgEc 741.

**771 Economics of Transportation Systems 3**
The course will provide an understanding of transportation economics and policy issues facing society. Topics include transportation demand, modal costs, transportation competition and market power, transportation regulation, transportation investment, and the economics of transportation safety. Prereq: Math 146; Stat 331; Econ 341 or equivalent calculus, statistics, and economics course work.



E-Mail: The Graduate School
Prospective students may schedule a visit by calling 1-800-488-NDSU.
The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701-231-7261

**Leslie F. Backer, M.S.**
North Dakota State University, 1972
Research Interests:
Crop Quality and Processing

**Robert Evans (adjunct), Ph. D.**
Colorado State University, 1981
Irrigation engineering

**Prabhakar R. Guduru (adjunct), MD.**
Kakatiya Medical College, India, 1980
Biomedical research

**Kenneth J. Hellevang, Ph.D.**
North Dakota State University, 1989
Research Interests:
Post Harvest Technology

**Suranjan Panigrahi, Ph.D.**
Iowa State University, 1992
Research Interests:
Machine Systems, Machine Vision, Artificial Intelligence

**Scott W. Pryor, Ph.D.**
Cornell University, 2005
Research Interests:
Biorenewable products and bioprocessing

**Thomas S. Scherer, Ph.D.**
University of Minnesota, 1986
Research Interests:
Soil and Water Resources Management

**Dean D. Steele, Ph.D.**
University of Minnesota, 1991
Research Interests:
Irrigation and Environmental Engineering

**Dennis P. Wiesenborn, Ph.D.**

# Agricultural and Biosystems Engineering

## Program Description

The Department of Agricultural and Biosystems Engineering offers graduate study leading to M.S. and Ph.D. degrees. The program emphasizes solving problems of agricultural production, food and value-added processing, and environmental resources management. Advanced work may involve specialized training in the following areas: irrigation engineering and management, food engineering, value-added processing, bioprocessing, agricultural machine systems, machine vision and intelligent systems, post-harvest handling and storage of biological materials, agricultural hydrology, soil and water resources management, and biorenewable energy.

Student research and academic programs are tailored to individual student needs and interests. Interdisciplinary approaches to agricultural and biosystems engineering programs are fostered.

## Admissions Requirements

The Department of Agricultural and Biosystems Engineering graduate program is open to all qualified graduates of universities and colleges of recognized standing. To be admitted with full standing to the program, the applicant must

1. Hold a baccalaureate degree in engineering or have taken the equivalent of the basic undergraduate engineering courses from an educational institution of recognized standing.
2. Show potential to undertake advanced study and research as evidenced by academic performance and experience.
3. At the baccalaureate level, have earned a cumulative grade point average (GPA) of at least 3.0 on a 4.0 point scale or equivalent.

Applications should be submitted to The Graduate School, preferably before April 15 of the upcoming academic year. However, applications will be considered at any time they are submitted.

Official transcripts (having an appropriate seal or stamp) of all previous undergraduate and graduate records must be received by The Graduate School before the application is complete. When a transcript is submitted in advance of completion of undergraduate or graduate studies, an updated transcript showing all course credits and grades must be provided prior to the initial registration at North Dakota State University.

Three letters of recommendation are generally required before action is taken on any application. Personal reference report forms are available from The Graduate School or the Graduate Bulletin.

The TOEFL examination is required of international applicants if English is not their native language. A minimum score of 550 (paper test) or 213 (computer test) must be achieved.

Rice University, 1989
Research Interests:
Food and Added Value
Process Engineering

## Financial Assistance

Research assistantships are available and dependent on the grant funding of faculty research programs. Applicants are considered on the basis of scholarship and potential to undertake advanced study and research. Students must be accepted into The Graduate School before they are eligible for an assistantship.

## Degree Requirements

The M.S. degree program requires completion of 30 semester credit hours beyond the baccalaureate degree. Twenty-four credit hours are from course work while six credit hours are typically provided for a master's thesis. A Plan of Study should be developed with the adviser by the end of the first semester of work. An oral examination covering the research-based paper or thesis and the academic subject matter is required. Students typically require two years to complete their MS degree.

Students entering the MS program usually have a BS degree in engineering; however, students without an engineering degree may pursue the MS degree following the completion of basic engineering science courses.

The Ph.D. program requires a minimum of 90 semester credit hours successfully completed beyond a B.S. degree. Included in those 90 hours are credits awarded for an M.S. degree and 30 hours (minimum) awarded for the Ph.D. dissertation. Candidates for the Ph.D. are required to take a preliminary written and oral examination directed at academic subject matter and a final oral defense of a research-based dissertation. Candidates are encouraged to indicate their research interests when applying for admission and to select an adviser before entering the program. Typically, three years are required to complete the Ph.D. program after the completion of an MS degree.

The degree requirements are in accordance with the NDSU Graduate School requirements. The student's academic advisor will usually be selected during the acceptance process. Prior to the end of the first academic year, the student and academic advisor will arrange for appointment of a Graduate Advisory Committee.

The student and major advisor will prepare a plan of study by the end of the first year in residence. The student's Graduate Advisory Committee, the ABEN Department Chair, Dean of the College of Engineering and Architecture, and the Graduate School Dean shall approve the program of study. The plan of study must be filed in the Graduate School of NDSU. The Graduate School requires the program of study for the Ph.D.. degree to include not less than 90 semester graduate credits, and 15 of these credits must be at the 700-789 level. An overall GPA of 3.0 or above must be maintained.

The program requirements are:

- 90 credits after the B.S. or 60 credits after M.S.
- Minimum of 12 credits in cognate and minor areas
- Minimum of 24 credits in area of concentration (may be multi-disciplinary)
- Minimum of total course work (M.S. and Ph.D.) is 51 credits
- Minimum dissertation and seminar is 30 credits
- It is the expectation that one or more journal articles will be submitted prior to the award of the degree.

## Examinations

Comprehensive Examinations: Both a written and an oral examination will be taken after completion of the greater portion of the course work phase of the Ph.D. program. The written

examination will consist of questions relating to the courses from the area of concentration and from the minor area of study in the program. It must be successfully completed prior to scheduling of the oral examination. The oral examination will be based on the student's presentation of a non-dissertation research proposal that the student will submit in the form of a research proposal to an appropriate granting sponsor. Successful completion of both examinations will formally admit a student to candidacy for the Ph.D. in Agricultural and Biosystems Engineering. At least one academic semester must elapse between admission to candidacy and oral defense of the dissertation.

Final Examination (Defense of the Dissertation). Under the mentorship of the major advisor and in consultation with the student's graduate committee, the student will design an original research project that contributes new knowledge in one of the department's research program areas. The student will perform the research and then describe it in a public seminar and dissertation. The student must defend this dissertation in a final oral examination given by the graduate committee.

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## Courses Offered

**644 Transport Processes 3**
Energy and mass transport principles applied to biological and environmental systems. Prereq: MATH 266 and CE309 or ME 352.

**652 Bioenvironmental Systems Design 3**
Study of Psychometrics, heat and mass transfer, and physiological requirements for livestock and bioproducts. Design of environmental modification and control systems. 3 lectures. Prereq: CE 309, ME 350.

**658 Food Process Engineering 3**
Analysis and design of food processing equipment and plants. Emphasis is on application of fluid flow, thermodynamics, and heat and mass transfer principles. 3 lectures.

**664 Resource Conservation and Irrigation Engineering 4**
Engineering principles and design of systems for soil and water resource management and environmental protection. 3 lectures and 1 three-hour laboratory. Prereq: CE 309.

**673 Agricultural Power 3**
Theory, analysis, and testing of internal combustion engines, traction, power trains, hydraulic systems, vehicle dynamics, stability, and ergonomics in tractor design. Electrical power units including motors. Alternative energy systems. 2 lectures and 1 three-hour laboratory. Prereq: ME 350.

**678 Machinery Analysis and Design 2**
Principles of design, development, and testing of agricultural machines and machine systems. Applications of computer-aided design and FMEA. 2 lectures. Prereq: ME 223.

**682 Instrumentation and Measurements 3**
Application of instrumentation and sensor concepts to measurement and control of environmental, biological, and mechanical parameters. Includes sensor principles, signal conditioning, data collection, and data analysis methods. 2 lectures and 1 three-hour laboratory. Prereq: ME 223, Phys 252.

**758 Applied Computer Imaging and Sensing for Biosystems 3**
Sensors and non-destructive principles (e.g., computer vision, spectroscopy, imaging, fiber optic sensing) for bioproduction and processing applications. Data/signal acquisition, signal conditioning/analysis, signal interpretation, and pattern recognition using statistical, neural networks, and fuzzy logic techniques. 3 lectures. Prereq: Graduate standing.

**763 Theory of Drying Biological Products 3**
Theory used to describe the drying processes of biological products. 3 lectures. Prereq:

Graduate standing.

**765 Small Watershed Hydrology and Modeling 3**
Study and representation of hydrologic processes on small watersheds. Application of hydrologic models for surface flow, subsurface flow, nutrient and sediment transport, and water quality. Prereq: ABEN 464/664.

**773 Advanced Agricultural Power and Machinery 3**
Theory and design of agricultural power units and field machines. 3 lectures. Prereq: ABEN 473/673.

**783 Advanced Structures and Environmental Systems 3**
Detailed analysis of building components and advanced design problems relating to agricultural and environmental systems. 3 lectures. Prereq: ABEN 383.

The following variable credit courses are also offered:

**790 Seminar 1-3**

**793 Individual Study 1-5**

**795 Field Experience 1-5**

**696/796 Special Topics 1-5**

**797 Master's Paper 1-3**

**798 Master's Thesis 1-10**

**799 Doctoral Dissertation 1-15**

The following are Agricultural Systems Management graduate courses offered by the department:

**654 Principles of Site-Specific Agriculture 3**
Principles and practices of site-specific farming, including data acquisition, data management, modeling, equipment management, GPS, and GIS. 2 lectures and 1 three-hour laboratory. Prereq: Graduate standing.

**675 Management of Agricultural Systems 2**
Capstone learning experience involving team solution to problems in agricultural systems management. Oral and written communications are emphasized. 2 lectures. Prereq: Graduate standing.



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The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701-231-7641

**Vernon L. Anderson, Ph.D.**
North Dakota State University, 1999
Research Interests:
Nutrition with an Emphasis on Cow/Calf and Feedlot Beef, Bison Research

**William T. Barker, Ph.D.**
University of Kansas, 1968
Research Interests:
Vascular Plant Systematics, Floristics and Range Ecology of the Northern Great Plains

**Marc L. Bauer, Ph.D.**
University of Kentucky, 1996
Research Interests:
Nutritional Physiology with Emphasis on Nutrient Metabolism and Utilization in Ruminants

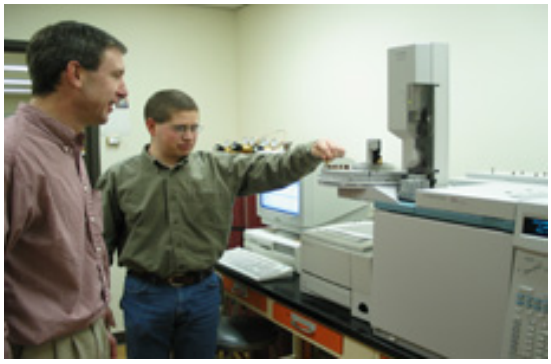
**Paul T. Berg, Ph.D.**
North Dakota State University, 1975
Research Interests:
Genetic Selection and Production Parameters, Genetic Implications in Meat Production and Consumer Acceptance, Nutritive Evaluation of Meat

**David L. Berryhill, Ph.D.**
Iowa State University, 1971
Research Interests:
Zoonotic Diseases

**Mario E. Biondini, Ph.D.**
Colorado State University, 1984
Research Interests:
Study and Analysis of Ecosystems, Use of Multivariate Statistical Techniques in the Study of Ecosystems, Modeling of Ecological Systems, Landscape Ecology, Plant-Soil Relationships

**Joel S. Caton, Ph.D.**
New Mexico State University,

# Animal and Range Sciences



## Program Description

The Department of Animal and Range Sciences offers graduate study leading to M.S. and Ph.D. degrees. Advanced work may involve specialized training in the following areas: animal breeding, animal nutrition, physiology of reproduction, nutritional physiology, meat science, range ecology, vascular plant systematics, and natural resources management.

Student research and academic programs are tailored to individual student needs and interests. Interdisciplinary approaches to animal and range sciences programs are fostered.

## Admissions Requirements

The Department of Animal and Range Sciences graduate program is open to all qualified graduates of universities and colleges of recognized standing. To be admitted with full status to the program, the applicant must

1. Hold a baccalaureate degree from an educational institution of recognized standing.
2. Have adequate preparation in animal or range sciences or in a complementary area of natural sciences, have a background or interest in agriculture, and show potential to undertake advanced study and research as evidenced by academic performance and experience.
3. At the baccalaureate level, have earned a cumulative grade point average (GPA) in all courses of at least 3.0 or equivalent.

Preferably, applications should be submitted directly to The Graduate School by April 15 prior to the upcoming academic year. However, applications will be considered at any time they are submitted.

Official transcripts (transcripts having an appropriate seal or stamp) of all previous undergraduate and graduate records must be received by The Graduate School before the application is complete. When a transcript is submitted in advance of completion of undergraduate or graduate studies, an updated transcript showing all course credits and grades must be provided prior to initial registration at North Dakota State University.

Three letters of recommendation are required before action is taken on an application. Personal reference report forms are available from The Graduate School.

The TOEFL examination is required of international applicants, and a minimum score of 525 (paper test) or 193 (computer test) must be achieved.

1987
Research Interests:
Ruminant Nutrition with Emphasis on Forage Utilization and Digestive Physiology of Beef Cattle

**Thomas P. Colville, DVM, M.Sc.**
University of Minnesota, 1971
Research Interests:
Veterinary Technology

**Russell B. Danielson, M.S.**
North Dakota State University, 1973
Research Interests:
Productions Systems and Management of Beef Cattle

**John W. Finley, Ph.D.**
Washington State University, 1989
Research Interests:
Absorption and Metabolism of Essential Trace Elements in Humans

**Anna T. Grazul-Bilska, Ph.D.**
University of Agriculture and Technology, Olsztyn, Poland, 1983
Research Interests:
Applied and Basic Aspects of Embryology and Ovarian Function in Livestock Species

**Carolyn E. Grygiel, Ph.D.**
Colorado State University, 1983
Research Interests:
Landscape Ecology with Emphasis on Small Scale Disturbances, Prairie Restoration, Natural Resource Management

**Carolyn Hammer, DVM, Ph.D.**
Iowa State University, 2003
Research Interests:
Equine Preventative Medicine, Growth and Development, Immunology

**Robert L. Harrold, Ph.D.**
Purdue University, 1967
Research Interests:
Nutrient Requirements of Swine and the Availability of Nutrients in Feedstuffs Fed to Swine

**Donald R. Kirby, Ph.D.**
Texas A & M University, 1980
Research Interests:
Range Ecology, Grazing Management and Systems,

## Financial Assistance

Research assistantships are available. Applicants are considered on the basis of scholarship and potential to undertake advanced study and research. To be considered for an assistantship, a completed Graduate School application, official transcripts, three letters of reference, and a TOEFL score for international applicants must be submitted to The Graduate School no later than April 15.

## Degree Requirements

The animal and range sciences program has two options for the M.S. degree: the thesis option and the comprehensive study option. The M.S. program requires completion of 30 semester credits of approved graduate and letter-graded course work with an overall GPA of 3.0 or better. The Ph.D. program requires the completion of 90 semester credits (or the equivalent) of graduate approved and letter graded course work with an overall GPA of 3.0 or better.

Each student must choose an adviser, usually based upon area of academic and research interest, within the first program year. By the end of the first year of residence, the student must have selected an advisory/supervisory committee and have an approved graduate plan of study, including a research proposal. The advisory/supervisory committee advises the student and administers the graduate exams to the student. Students are referred to the Animal and Range Sciences Graduate Student Handbook for information regarding additional requirements.

Candidates for the M.S. normally complete their degree requirements in two years. Candidates for the Ph.D. generally complete their degree requirements in three to four years.

The M.S. candidates are required to take an oral examination which covers both the research and academic subject matter covered in their program. Candidates for the Ph.D. are required to take a preliminary written and oral examination directed toward the academic subject matter of their chosen discipline and a final defense of a research based thesis.

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# Courses Offered

**635 Nutrition Laboratory Techniques 3**
Theory and basic laboratory techniques associated with nutritional research and current information regarding advanced techniques and developments. 2 lectures and laboratory by arrangement. Offered even years; fall. Prereq: Chem 260.

**650 Range Plants 3**
Identification, distribution, and forage value of important U.S. range plants. 1 lecture and 2 two-hour laboratories. Prereq: Bot 314. Cross-listed with Biol.

**652 Geographic Information Systems in Range Survey 3**
Analysis of methods for determining range composition, condition, and productivity. Emphasis will be given to the use of Geographic Information Systems. 3 lectures. Offered odd years; fall. Prereq: ARSc 336.

**653 Rangeland Resources and Watershed Management 3**
Study of the management of physical/biological settings and processes along with human activities on water and watersheds considering preventative and restorative strategies in a natural resources rangeland setting. Prereq: ARSc 336.

**656 Range Habitat Management 3**
Capstone course to include specific techniques and systems approaches to maintenance and improvement of rangeland ecosystems. 3 lectures. Offered odd years; spring. Prereq: ARSc 336.

Range Animal Nutrition

**Kim B. Koch, Ph.D.**
Kansas State University, 1990
Research Interests:
Feed Manufacturing Technology with an Emphasis on Digestibility and Nutrient Uptake, Grain and Oilseed Co-product Utilization, Integrated Animal Production Systems.

**Greg Lardy, Ph.D.**
University of Nebraska, 1997
Research Interests:
Cow-Calf Nutrition, By-product Utilization, Range Nutrition

**Justin Luther, Ph.D.**
North Dakota State University, 2006
Research Interests:
Nutrition and Reproductive Physiology of Sheep

**Martin J. Marchello, Ph.D.**
Virginia Polytechnic Institute and State University, 1968
Research Interests:
Carcass Evaluation, Nutrient Composition of Meats Related to Human Health

**Bert L. Moore, Ph.D.**
North Dakota State University, 1975
Research Interests:
Live Animal Evaluation, Production, Management and Applied Nutrition of Sheep and Beef

**Kenneth G. Odde, DVM, Ph.D., Diplomate, ACT**
Kansas State University 1983
Research Interests:
Beef Cattle Reproduction and Health

**Chung S. Park, Ph.D.**
Virginia Polytechnic Institute and State University, 1975
Research Interests:
Nutritional Regulation of Animal Growth, Mammary Development and Lactation

**Dale A. Redmer, Ph.D.**
University of Missouri, 1983
Research Interests:
Regulation of Ovarian Function, Including Angiogenesis and

**658 Grazing Ecology 3**
Grazing processes and systems, and their effects on plants and herbivores. 3 lectures. Offered even years; spring. Prereq: ARSc 336.

**660 Plant Ecology 3**
See Botany for description.

**663 Physiology of Reproduction 3**
Comparative anatomy, physiology, and endocrinology of reproduction in mammals. 3 lectures. Cross-listed with ZOO.

**663L Physiology of Reproduction Laboratory 1**
Experience in practical application of reproductive technologies in farm animal species. One two-hour lab.

**716 Agrostology 3**
Identification and description of U.S. grasses and grass-like plants. 2 lectures, 2 two-hour laboratories. Offered even years; fall. Prereq: Biol 314. Cross-listed with Biol.

**717 Aquatic Vascular Plants 2**
Identification and description of aquatic vascular plants. 1 lecture, 2 two-hour laboratories. Offered odd years; fall. Prereq: Biol 314. Cross-listed with Biol.

**721 Biology of Lactation 2**
Mammary gland development and mechanisms controlling lactation. 2 lectures. Prereq: Bioc 460.

**728 Advanced Reproductive Biology 3**
Discussion of reproductive physiology research with emphasis on current topics in cellular and molecular biology. 3 lectures. Offered even years; spring. Prereq: ARSc 463, Bioc 460.

**730 Growth Biology 3**
Regulation of growth at the cell/tissue, organ systems, and whole animal levels. 3 lectures. Offered odd years; spring. Prereq: Bioc 460.

**736 Experimental Nutrition Methods 1**
Design, conductance, analysis, and reporting of experiments taken in conjunction with ARSc 730, 773, 774, 775, or 776. Prereq: ARSc 470, Bioc 460.

**755 Advanced Meat Science 2**
Physical, chemical, and structural characteristics of the postmortem meat animal. 2 lectures. Offered even years. Prereq: ARSc 340, Bioc 460.

**765 Analysis of Ecosystems 3**
Introduction to advanced statistical techniques to evaluate plant communities, plant-animal interactions, and plant-soil relationships. Emphasis on multivariate analysis. 2 lectures, 1 two-hour laboratory. Offered even years; spring. Prereq: Stat 330.

**773 Energy Metabolism 3**
Methods of measuring energy values and the metabolic processes involved in the production of useful biological energy from organic compounds. 3 lectures. Offered odd years; spring. Prereq: ARSc 470, Bioc 701.

**774 Nitrogen Metabolism 3**
Detailed overview of nitrogenous compounds, including metabolism and function. Considerable emphasis on current research from the literature. 3 lectures. Offered even years; spring. Prereq: ARSc 470, Bioc 701.

**775 Vitamins and Minerals 3**
Metabolism of vitamins and minerals and their application in animal nutrition and the feed industry. 3 lectures. Offered even years; fall. Prereq: ARSc 470, Bioc 701.

**776 Digestive Physiology 3**

Endocrine Control of Follicular Development in Farm Animals

**Lawrence P. Reynolds, Ph.D.**
Iowa State University, 1983
Research Interests:
Maternal and Placental Physiology During Pregnancy in Livestock Including Cellular and Molecular Aspects

**Eric Scholljerdes, Ph.D.**
University of Wyoming, 2005
Research Interests:
Nutritional Impacts on Pregnancy in the Beef Cow

**Jerome W. Schroeder, Ph.D.**
North Dakota State University, 1999
Research Interests:
Metabolic and Nutritional Relationships of Dairy Cattle Related to Milk Quality and Composition

**Kevin K. Sedivec, Ph.D.**
North Dakota State University, 1994
Research Interests:
Grazing Systems and Upland Nesting Birds, Leafy Spurge Control Using Grazing, Range Nutrition

**David J. Smith, Ph.D.**
Washington State University, 1990
Research Interests:
Absorption, Distribution, Metabolism, Elimination of Xenobiotics in Food Producing Animals

**Charles L. Stoltenow, DVM, Diplomate, ACVPM**
Iowa State University, 1985
Research Interests:
Equine Medicine, Bovine Medicine, Epidemiology, Public Health and Bioterrorism

**Kimberly Vonnahme, Ph.D.**
University of Wyoming, 2003
Research Interests:
Nutritional Impacts on Placental Function in Livestock

**Sarah A. Wagner, DVM, Ph.D.**
Iowa State University, 2003
Research Interests:
Food Animal Pharmacology and

Investigation of digestive and absorptive events occurring within farm animals. Emphasis on enzyme action, nutrient transport, gut motility, gastro-intestinal endocrinology, and current research. 3 lectures. Offered odd years; fall. Prereq: ARSc 470, Bioc 701.

The following variable credit courses are also offered:

**790 Graduate Seminar 1-3**

**793 Individual Study/Tutorial 1-5**

**795 Field Experience 1-15**

**796 Special Topics 1-5**

**797 Master's Paper 1-3**

**798 Master's Thesis 1-10**

**799 Doctoral Dissertation 1-15**

Therapeutics, Dairy Cattle Health



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The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701-231-7678

**Glenn Dorsam,Ph.D.**
Virginia Commonwealth University,1998
Research Interests:
Transcriptional Regulation

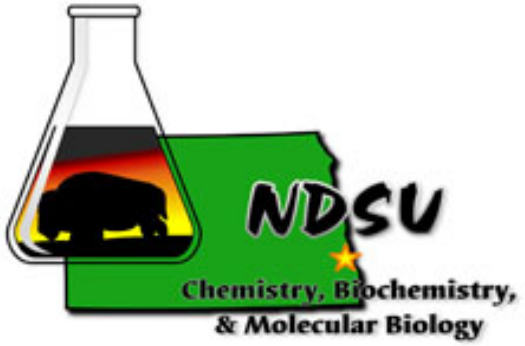
**Heldur Hakk, Ph.D. (adjunct)**
North Dakota State University, 1997
Research Interests:
Fate and Metabolism of Environmental Contaminants

**S. Derek Killilea, Ph.D.**
National University of Ireland (Galway), 1972
Research Interests:
Metabolic Regulation via Protein Kinases and Phosphatases

**Robert B. Sparks, Ph.D.**
University of South Dakota, 1972
Research Interests:
Regulation of Gene Expression

**D. K. Srivastava, Ph.D.**
Banaras Hindu University, 1980
Research Interests:
Mechanistic Enzymology

# Biochemistry and Molecular Biology




The Department of Biochemistry and Molecular Biology has merged with the Depatment of Chemistry. The new entity is called the Department of Chemistry and Molecular Biology which better describes the connection between Biology and Chemistry at the molecular level. All existing programs in Biochemistry and Molecular Biology described on this website remain intact. For additional information see the Department of Chemistry and Molecular Biology.

## Program Description

The Program in Biochemistry and Molecular Biology offers graduate study leading to the M.S. and Ph.D. degrees. The department also participates in the interdisciplinary Ph.D. program in Cellular and Molecular Biology.

The chemistry, biochemistry, and molecular biology of plant, animal, insect, and microbial systems are studied through advanced course work and research. Selection of the area of emphasis depends on the interests of the student. Academic advisers and research mentors may be selected from the list of graduate and adjunct faculty provided in this section. Modern research instrumentation is available, and interdisciplinary research is encouraged in both the physical and biological sciences.

## Admissions Requirements

The Department of Chemistry and Molecular Biology is open to qualified graduates of universities and colleges of recognized standing. To be admitted with full status to the program, the applicant must

1. Hold a baccalaureate degree from an educational institution of recognized standing.
2. Have adequate preparation for the study of biochemistry and molecular biology at the graduate level, and show potential to undertake advanced study and research as evidenced by academic performance and experience.
3. At the baccalaureate level, have earned a minimum cumulative grade point average (GPA) of 3.0 or equivalent in all courses.

Preferably, applications should be submitted directly to The Graduate School before April 1 of the upcoming academic year. However, applications will be considered at any time they are submitted.

Official transcripts (transcripts having an appropriate seal or stamp) of all previous undergraduate and graduate records must be received by The Graduate School before the application is complete. When transcripts are submitted prior to completion of the undergraduate or graduate degrees, updated transcripts showing all course credits and grades must be provided prior to the initial

registration at NDSU.

A complete application consists of :

1. The Application for Admission to Graduate School form, which is also your application for financial assistance in the form of a Teaching Assistantship.
2. Reasons for Graduate Study Statement. Please indicate your desired area of study: Organic, Inorganic, Analytical, Physical, Biochemistry, Molecular Biology or undecided. (Multidisciplinary interests are also encouraged, but please state the major areas of study).
3. Three letters of recommendation from individuals able to comment on you're academic and research potential.
4. An official transcript from all institutions of higher education that you have attended.

Additional requirements for International students :

Test score results for the GRE General and GRE Subject (in Chemistry or Biochemistry) and TOEFL examinations. Note that official score reports are reqired; photocopies are not acceptable.

## Financial Assistance

Both research and teaching assistantships are available. Applicants are considered on the basis of scholarship and potential to undertake advanced study and research. To be considered for an assistantship, a completed Graduate School application, official transcripts, and three letters of reference, as well as a TOEFL score and GRE general test scores for international applicants must be submitted to The Graduate School.

## Degree Requirements

At the start of the first year of study, entering graduate students take entrance examinations in chemistry and biochemistry. These exams are used by the graduate student progress committee for advisory purposes in recommending graduate coursework during the first year. As a consequence, programs are individually tailored to the needs of each student. Typically, coursework is completed in 1-1.5 years for M.S. candidates, and two years for Ph.D. candidates, leaving later years for full-time thesis research. The time to complete a graduate degree averages 2-3 years for the M.S. degree and approximately 5 years for the Ph.D.

Each student chooses a thesis adviser within 6 months of beginning graduate school. As this is one of the most important decisions made in graduate school, students are strongly urged to visit multiple faculty members to discuss research opportunities. In addition, faculty seminars during the fall semester are designed to acquaint new students with the available research programs.

By the end of the first academic year, each student selects an advisory and examination committee, which consists of the thesis advisor, two other faculty members in the chemistry department, and one faculty member from a department outside the College of Science and Mathematics.

Admission to candidacy for the Ph.D. degree is accomplished by satisfying three requirements:

1. Satisfactory performance in coursework with a minimum 3.0 grade-point average.
2. Satisfactory performance in cumulative examinations (administered six times per year).
3. Satisfactory defense of an original research proposal on a topic approved by the student's advisory committee.

Following completion of dissertation research, the candidate must complete a written dissertation and an oral presentation to the department and advisory committee. The following chemistry and molecular biology departmental courses are available for graduate credit toward advanced degrees

in chemistry. With the approval of the advisory committee, advanced courses in related departments may be used toward degree requirements as well.

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## Courses Offered

**665 Principles of Physical Chemistry and Biophysics 4**
Conceptual approach to physical chemistry and biophysics, molecular structure, energy, equilibria, and kinetics. Application of fundamental concepts and related instrumental techniques to the life sciences. 4 lectures. Prereq: Math 147, Phys 212; Coreq: Bioc 460.

**673 Methods of Biochemical Research 3**
Advanced separation, characterization, and enzymological techniques for research in the biological sciences are emphasized. 1 lecture and 2 three-hour laboratories. Prereq: Bioc 461 or 701, or Coreq: Bioc 701.

**674 Methods of Recombinant DNA Technology 3**
Principles and techniques of recombinant DNA construction, gene cloning, and analysis of gene structure. 1 lecture and 2 three-hour laboratories. Prereq: Bioc 461 or 702, or Coreq: Bioc 702.

**675 Computer Applications in Biochemistry and Molecular Biology 3**
This course will cover basic and advanced biochemical calculations and the use of computer programs to make these calculations. Programs for the presentation of data and seminars will also be presented. Prereq: Bioc 460 or 701.

**683 Cellular Signal Transduction Processes and Metabolic Regulation 3**
Advanced topics in regulation of metabolic processes including signal transduction, reversible and irreversible covalent modification, hormonal effects, protein turnover, and related phenomena. 2 lectures. Prereq: Bioc 461 or 702.

**685 Industrial Biotechnology 3**
Discussion of commercial biochemical processes, including industrial fermentation and fermentor design, immobilized cell and enzyme bioreactors, product recovery methods, relevant metabolic pathways, and other aspects of industrial biotechnology. 3 lectures. Spring. Prereq: Bioc 460 or 702, Micro 350.

**701, 702 Comprehensive Biochemistry I, II 4 each**
Comprehensive treatment of the chemistry and biochemistry of proteins, nucleic acids, carbohydrates, lipids, vitamins, hormones, and the specific metabolism of these substances. 4 lectures. Prereq for 701: Chem 342; Prereq for 702: Bioc 701.

**716 Protein and Enzyme Biochemistry 3**
Advanced topics in protein properties and structure, and the influence of these factors on enzyme kinetics and mechanism. 3 lectures. Alternate years; spring. Prereq: Bioc 702.

**717 Carbohydrate/Lipid Biochemistry 3**
Advanced topics in the structure, reactions, biosynthesis, and properties of carbohydrate and lipid materials of plant and animal origin. 3 lectures. Alternate years; spring. Prereq: Bioc 702.

**719 Molecular Biology of Gene Expression and Regulation 3**
Advanced topics in molecular biology and regulation in prokaryotes, eukaryotes, and archaea; early events in developmental gene expression. 3 lectures. Alternate years; fall. Prereq: Bioc 702.

The following variable credit courses are also offered:

**790 Seminar 1-3**

**793 Individual Study 1-5**

**796 Special Topics 1-5**

**798 Master's Thesis 1-10**

**799 Doctoral Dissertation 1-15**



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Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701-231-7087

**Marc D. Anderson, Ph.D.**
Iowa State University, 1995
Research Interests:
Plant Stress Physiology and Plant Metabolism, Responses of Plants to Low Temperature, Influence of Stress on Amino Acid Metabolism in Plants

**William T. Barker, Ph.D. (adjunct)**
University of Kansas, 1968
Animal and Range Sciences, NDSU, Fargo, N.D.

**William J. Bleier, Ph.D.**
Texas Tech University, 1975
Research Interests:
Blackbirds, Animal Depredation, Avian Ecology

**Deborah P. Buitron, Ph.D. (adjunct)**
University of Minnesota, 1982
Research Interests:
Behavioral Ecology of Aquatic Birds

**Malcolm G. Butler, Ph.D.**
University of Michigan, 1980
Research Interests:
Aquatic Ecology, Limnology, Fisheries, Water Quality, Wildlife Management

**Gary K. Clambey, Ph.D.**
Iowa State University, 1975
Research Interests:
Ecology and Biogeography, Environmental Analysis and Planning, Structure Function Relations in Midwestern Ecosystems, Human Ecology

**Mark E. Clark, Ph.D.**
University of Tennessee, 1996
Research Interests:
Fish and Wildlife Ecology, Population Biology, Ecological Modeling, Quantitative Ecology

# Biological Sciences

## Program Description

The Department of Biological Sciences offers graduate study leading to Master of Science and Doctor of Philosophy degrees. Master of Science degrees are available in Biology, Botany, Environmental and Conservation Sciences, Natural Resources Management, and Zoology. Doctor of Philosophy degrees are available in Botany, Environmental and Conservation Sciences, Genomics, Cellular and Molecular Biology, Environmental and Conservation Sciences, Natural Resources Management, and Zoology. Advanced work may involve specialized training in the following areas: aquatic biology, behavior, cell biology, comparative biochemistry and physiology, conservation biology, ecology, endocrinology, evolution, fisheries biology, lichenology, molecular biology, plant biology, population biology, prairie pothole ecology, systematics, vertebrate pest management, and wildlife biology.

Student research and academic programs are tailored to individual needs and interests. Interdisciplinary approaches to biological problems are encouraged.

Correspondence with one or more departmental faculty members before and during the application process is essential.

For e-mail addresses for faculty members and for additional information about our programs, please visit our Web site at http://biology.ndsu.nodak.edu/.

## Admissions Requirements

The graduate programs in the Department of Biological Sciences are open to all qualified graduates of universities and colleges of recognized standing. To be admitted with full status to the program, the applicant must

1. Hold a baccalaureate degree from an educational institution of recognized standing.
2. Have adequate preparation in the desired area of advanced study and show potential to undertake advanced study and research as evidenced by academic performance and experience.
3. At the baccalaureate level, have earned a cumulative grade point average (GPA) in all courses of at least 3.0 or equivalent. Students with a graduate degree with a cumulative GPA of at least 3.0 or equivalent may be admitted in full standing.

An applicant who does not meet all requirements for admission or has deficiencies in prerequisite course work, but shows potential for successful graduate study, may be admitted under a conditional status. Evidence must be provided showing that his/her record does not adequately reflect the applicant's potential. After meeting the specified standards of performance by the

**Theodore L. Esslinger, Ph.D.**
Duke University, 1974
Research Interests:
Lichenology; Taxonomy, Chemosystematics, and Floristics of Lichens; Emphasis on the Parmeliaceae and Physciaceae

**Ned H. Euliss, Jr., Ph.D. (adjunct)**
Oregon State University, 1989
Research Biologist, U.S. Geological Survey, Northern Prairie Wildlife Research Center, Jamestown, N.D.
Research Interests:
Wetland Ecology

**Karen P. Fawley, Ph.D.**
North Dakota State University, 1998
Research Interests:
Phycology and Aquatic Community Ecology

**Marvin W. Fawley, Ph.D.**
Miami University, 1985
Research Interests:
Evolution, Diversity, and Systematics of Algae, Particularly Green Algae; Application of Molecular Techniques to Ecological Studies and Identification of Algae.

**Jeffery W. Gerst, Ph.D.**
University of Nebraska, 1973
Research Interests:
Comparative Physiology and Biochemistry, Neuroendocrine Regulation of Dipteran Reproductive Biology

**James W. Grier, Ph.D.**
Cornell University, 1975
Research Interests:
Eagles and Other Birds of Prey, Herpetology, Aquatic Organisms, Fossils, Animal Population Dynamics, Habitat Ecology

**Mark A. Hanson, Ph.D. (adjunct)**
North Dakota State University, 1990
Research Scientist, Wetland Wildlife Populations and Research Group, Minnesota

department, the student, in consultation with the major adviser, may request a change to full graduate standing. The major adviser must submit the request for a change to the Dean of The Graduate School after approval by the department chair.

Preferably, applications should be submitted directly to The Graduate School before March 1 of the upcoming academic year. Most students initiate their graduate programs in the fall semester, but starting a graduate program in January or June also is possible; therefore, applications will be considered at any time they are submitted.

Official transcripts (transcripts having an appropriate seal or stamp) of all previous undergraduate and graduate records must be received by The Graduate School before the application is complete. When a transcript is submitted in advance of completion of undergraduate or graduate studies, an updated transcript showing all course credits and grades must be provided prior to initial registration at NDSU.

Three letters of recommendation are generally required before action is taken on any application. Personal reference report forms are available from The Graduate School or online at www.ndsu.edu/ndsu/academic/bulletins/graduate/.

The general Graduate Record Examination scores are required of all applicants.

The TOEFL examination is required of international applicants. A minimum score of 550 (paper test) or 213 (computer test) must be achieved.

## Financial Assistance

Research assistantships and teaching assistantships are available. Applicants are considered on the basis of scholarship, potential to undertake advanced study and research, as well as financial need. A student must first be accepted by The Graduate School before consideration for financial assistance. Assistantships include a waiver of tuition.

In addition to research and teaching assistantships, there are other types of financial support. A limited number of State Board of Higher Education Scholarships and Presidential Fellowships are available through The Graduate School. Outstanding scholarship and financial need are primary considerations for these fellowships. Scholarships in specific areas are also available through the Department of Biological Sciences. These are generally supplemental and do not include tuition waivers. Students are considered for these awards after enrollment, with primary considerations being scholastic performance and research at NDSU.

## Degree Requirements

The Master of Science program generally requires a minimum of 24 months of full-time study, during which an overall GPA of 3.0 or better must be maintained. The Master of Science degree may be earned by either of two options. The thesis option emphasizes completion of a research project. The comprehensive study option requires more course work, and instead of conducting research and presenting a thesis, the candidate presents a paper or papers approved by the adviser to the examining committee, demonstrating ability for scholarly study and written expression. Candidates under both options must present a seminar on the thesis research or comprehensive study, and must pass an oral examination.

The Ph.D. program generally requires a minimum of 36 months of full-time study, during which an overall GPA of 3.0 or better must be maintained. Candidates for the Ph.D. are required to take a preliminary written and oral examination directed to academic subject matter and a final defense of the dissertation.

Most students have selected a major adviser prior to their arrival for graduate studies; however, if a student has not made such a decision, then he/she must select a major adviser within nine months of beginning graduate school. By the end of the first year in residence, the student must select an advisory/supervisory committee. The committee advises/supervises the student and administers preliminary and final oral examinations.

Department of Natural Resources, Bemidji, Minn.
Research Interests: Wetland Ecology

**Douglas H. Johnson, Ph.D. (adjunct)**
North Dakota State University, 1986
Senior Scientist, USGS, Northern Prairie Wildlife Research Center, St. Paul, MN.
Research Interests: Quantitative Ecology, Population Biology, Grassland Birds.

**George M. Linz, Ph.D. (adjunct)**
North Dakota State University, 1982
Project Leader, Wildlife Biologist, USDA/APHIS Wildlife Services, National Wildlife Research Center, Great Plains Field Station, Bismarck, N.D.
Research Interests: Development of Methodologies of Managing Blackbird Damage to Sunflower

**Andrew M. Marry, Ph.D. (adjunct)**
John Innes Centre, 1998
Biology Department, Minnesota State University, Moorhead, MN.
Research Interests: Plant Cell Walls

**Lisa M. Montplaisir, Ph.D.**
University of Arizona, 2003
Science Education, Teaching and Learning, Curriculum Development.

**Gary L. Nuechterlein, Ph.D.**
University of Minnesota, 1980
Research Interests: Behavioral Ecology of Birds; Wildlife Ecology, Particularly of Non-game Species

**Wendy L. Reed, Ph.D.**
Iowa State University, 2000
Research Interests: Physiological Ecology, Evolution of Life Histories, Behavioral Endocrinology

**M. Hildegard Reiser, Ph.D.**

## Research Facilities and Equipment

The Department of Biological Sciences occupies approximately 20,000 square feet of floor space in Stevens Hall for research and teaching. The NDSU Library has extensive holdings of journals, monographs, books, and other reference materials covering various fields in biology. The library offers full access to online catalogs and databases.

Faculty in the department have research programs ranging from molecular biology to ecosystem ecology and work with a wide variety of organisms (algae, lichens, angiosperms, invertebrates, and vertebrates). Modern equipment is available for conducting research in cell and molecular biology and field ecology and behavior. The department has access to a vascular plant herbarium with 240,000 specimens emphasizing Northern Great Plains flora, a lichen herbarium consisting of about 15,000 specimens with a worldwide representation of taxa, and a vertebrate collection with approximately 10,000 specimens.

The department offers access to a range of equipment and facilities necessary for laboratory research including greenhouses, animal rooms, growth chambers, tissue culture facilities, ultracentrifuges, spectrophotometers, electrophoresis, light microscopes, gas chromatography, GC-mass spectrometry, and high performance liquid chromatography. Facilities are available for protein and DNA sequencing; oligonucleotide synthesis; interactive laser cytometry; scanning transmission and electron microscopy, and confocal microscopy.

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# Courses Offered

**Bot 631 Intermediate Genetics 3**
See Plant Sciences for description. Prereq: Bot 315.

**Biol 640 Biotechnology and Ethics 2**
Study of ethical issues associated with the development of emerging technologies and their application in solving biological problems. Prereq: Biol 150.

**Zool 640 Microbial Ecology 3**
Microbial ecology introduces the student to basic, applied, and current concepts in microbiology and the environment. It considers the roles of microorganisms in maintaining environmental quality and the role of environment in determining microbial diversity. Prereq: Zoo 364.

**Bot 650 Range Plants 3**
See Animal and Range Sciences for description.

**Zool 650 Invertebrate Zoology 4**
Survey of the biology, classification, and evolution of invertebrates. Emphasis on major phyla, marine, and parasitic taxa. Offered spring. Prereq: Biol 151, 151L.

**Bot 652 Plant Structure 3**
See Plant Pathology for description.

**Zool 652 Ichthyology 3**
Biology and taxonomy of fishes. Offered; fall. Prereq: Biol 151, 151L.

**Zool 654 Herpetology 3**
Primarily a field and laboratory course focusing on amphibians and reptiles. Students must make a commitment to participate in at least one of two 4-day field trips plus an independent review project. Offered odd years; fall. Prereq: Biol 151, 151L.

**Zool 656 Ornithology 3**
Introduction to the biology, classification, and identification of birds, especially local forms. Early morning field trips required. Offered fall. Prereq: Biol 151, 151L.

**(adjunct)**
Northern Arizona University, 1988
Program Manager, National Park Service, Chihuahuan Desert Network Inventory & Monitoring Program, Carsbad, N.M.
Research Interests: Conservation Biology and Ecosystem Management

**Nancy Shappell, Ph.D. (adjunct)**
Virginia Polytechnic Institute and State University, 1988
Research Physiologist, Animal Metabolism Unit, Biosciences Research Laboratory, USDA/ ARS, Fargo, N.D.
Research Interests: Effect of Xenobiotics (with Potential Agricultural Impact) on Animals

**Mark A. Sheridan, Ph.D.**
University of California-Berkeley, 1985
Research Interests: Animal Physiology/ Endocrinology; Control of Growth, Development, and Metabolism in Vertebrates, Especially Fish; Aquaculture; Signal Transduction; in vitro Diagnostics

**Craig A. Stockwell, Ph.D.**
University of Nevada, Reno, 1995
Research Interests: Evolutionary Ecology of Vertebrate Populations, Conservation Biology, Fisheries Biology

**Jeffrey C. Suttle, Ph.D. (adjunct)**
Michigan State University, 1980
USDA/ARS, Fargo, N.D.
Research Interests: Plant Physiology

**Gerald Van Amburg, Ph.D. (adjunct)**
Texas A & M University, 1969
Biology Department, Concordia College, Moorhead, Minn.

**Alan R. White, Ph.D. (adjunct)**
University of North Carolina,

**Zool 658 Mammalogy 3**
Biology and taxonomy of mammals. Offered fall. Prereq: Biol 151, 151L.

**Biol 659 Evolution 3**
Discussion of the mechanisms of evolution, including population genetics, selection, speciation, adaptation, and molecular evolution. Prereq: Biol 315, 364.

**Bot 660 Plant Ecology 3**
Ecological structure, processes, and patterns observed with plant communities and populations as influenced by environmental conditions. Illustrations provided with local fieldwork. Prereq: Bot 372. Cross-listed with ARSc.

**Zool 660 Animal Physiology 3**
Development of basic quantitative descriptions of physical and chemical principles governing cell and organ function. Offered spring. Prereq: Biol 151, 151L, Chem 341.

**Zool 662 Physiological Ecology 3**
Comparative physiology of the vertebrates. Study of biochemical, morphological, and behavioral mechanisms involved with compensatory changes in response to changes in ontogeny and/or external environment. Offered spring. Prereq: Biol 151, 151L.

**Zool 663 Physiology of Reproduction 4**
See Animal and Range Sciences for description.

**Zool 664 Endocrinology 3**
Physiology and anatomy of endocrine glands, chemistry and interrelations of their secretions. Offered fall. Prereq: Biol 151, 151L.

**Zool 670 Limnology 4**
Biological, physical, and chemical features of fresh-water ecosystems. Offered odd years; fall. Prereq: Biol 151, 151L, Biol 364, and one year chemistry.

**Bot 671 Phycology 3**
Identification, systematics, evolution, ecology, life histories, physiology, cytology, and culture of algae. Prereq: Bot 372.

**Bot 672 Lichenology 3**
Biology, ecology, and systmatics of lichen fungi. Prereq: Bot 372.

**Zool 672 Fisheries Biology 3**
Principles of ecology and limnology applied to fish production. Offered odd years; spring. Prereq: Biol 364.

**Zool 674 Fisheries Management 3**
Techniques used in the study and management of fish. Offered even years; spring. Prereq: Zoo 472.

**Zool 675 Conservation Biology 3**
Integrative approach to the study and conservation of biodiversity. Application of principles from various sub-disciplines of the biological and social sciences to current conservation problems. Offered fall. Prereq: Zoo 315, 315L.

**Zool 676 Wildlife Ecology and Management 3**
Application of ecological principles to management of game and nongame wildlife populations. Field trips required. Offered spring. Prereq: Biol 364.

**Zool 677 Wildlife and Fisheries Management Techniques 3**
Students will learn traditional and state-of-the-art techniques in the study of management of fish, wildlife, and other animal populations. Topics will include assessment of population characteristics, habitat, behavioral ecology, and genetic structure. Offered spring. Prereq: Zool 476.

**Bot 680 Plant Tissue Culture 2**

1981
Biology Department, East Carolina University, Greenville, North Carolina
Research Interests: Plant Cell Biology; Biosynthesis of Cell Wall Polysaccharides in the Golgi Apparatus; Structure of Polysaccharides and Glycoprotein Oligosaccharides; Science and Mathematics Education

Introduction to the culture of plant cells, tissues, organs, and protoplasts; and its applications. Prereq: Bot 372.

**Zool 682 Developmental Biology 3**
Analysis of the processes of development with an emphasis on animal development. Topics range from classical embryology to the cellular and molecular basis of development. Offered fall. Prereq: Biol 151, 151L.

**Zool 705 Teaching College Science 3**
Curriculum development and delivery as related to student learning.

**Bot 714 Advanced Systematic Botany 2**
Discussion of cytotaxonomy, biochemical systematics, experimental biosystematics, and mathematical systematics. Emphasis on using related data in the study of systematic problems. Prereq: Bot 314.

**Bot 716 Agrostology 3**
See Animal and Range Sciences for description.

**Bot 717 Aquatic Vascular Plants 2**
See Animal and Range Sciences for description.

**Bot 720 Advanced Cell Biology 3**
In-depth survey of cell biology, including studies of membranes, secretion cytoskeleton, cellular movement organelles, and gene regulation. Prereq: Bioc 702.

**Biol 722 Current Topics in Cell and Molecular Biology 3**
Advanced studies on selected current topics in cellular and molecular biology.

**Zool 760 Evolutionary Ecology 3**
Lecture-discussion course on recent developments in evolutionary theory and their implications in the study of animal adaptation, ecology, and behavior. Offered odd years; spring. Prereq: Biol 364.

**Bot 762 Environment and Adaptation 3**
Environmental factors and responses evidenced with life-history patterns, genetic variation, population dynamics, species-interactions, and physiological processes. Prereq: Bot 460/660.

**Bot 764 Ecological Processes 3**
Ecosystem dynamics (short-term, successional, evolutionary), component interactions, ecological energentics, and biogeochemical transfers, with consideration of anthropogenic aspects. Historical and theoretical viewpoints included. Prereq: Bot 460/660.

**Zool 764 Neuroendocrine and Endocrine Systems 3**
Topics in molecular endocrinology. Emphasis on signal transduction and effects of hormones on gene expression. Offered even years; spring. Prereq: Zoo 464.

**Zool 766 Neurophysiology 3**
Function of neurons and simple neural networks. Emphasis on quantitative description of processes and characterizations of the neurological basis of simple behaviors. Prereq: Zoo 460 or Psyc 465.

**Zool 770 Aquatic Community Ecology 4**
Nature and ecological roles of the freshwater biota. Discussion of contemporary issues in aquatic ecology. Offered even years; fall. Prereq: Zoo 470.

**Zool 776 Population Dynamics 4**
Principles and mechanics of animal population dynamics. Offered even years; fall. Prereq: Biol 364 and an interest in working with numbers.

**Bot 780 Plant Metabolism and Plant Stress Physiology 4**
A detailed study of the dynamics, compartmentation, and interactions among metabolic processes in plants and the changes that occur in response to various biotic and abiotic

stresses. Prereq: Bot 380 or Bioc 460.

**Bot 782 Regulation of Plant Growth 4**
Role of hormones, water, and mineral elements in plant growth. Ion and water absorption and translocation. Hormone dynamics. Emphasis on recent molecular studies of hormonal regulation. Prereq: Bot 380, Bioc 460.

**Biol 785 Photobiology 3**
Photosynthesis, pigments, light regulated metabolism, photoreceptors, photoperiodism, photomorphogenic responses. Emphasis on recent molecular studies of photoregulation. Prereq: Bot 380, Bioc 460.

## The following variable credit courses are also offered:

**790 Seminar 1**

**793 Individual Study 1-3**

**795 Field Experience 1-15**

**796 Special Topics 1-5**

**797 Master's Paper 1-3**

**798 Master's Thesis 1-10**

**799 Doctoral Dissertation 1-15**



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The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701-231-8651

**Karl Altenburg, Ph.D.**
North Dakota State University, 1999
Field:
Management Information Systems

**Bahman Bahrami, Ph.D.**
University of Nebraska-Lincoln, 1983
Field:
Managerial Economics, Management Information Systems, Labor Relations and Negotiation

**John Bitzan, Ph.D.**
University of Wisconsin-Milwaukee, 1997
Field:
Economics

**Jinanxin "Daniel" Chi, Ph.D.**
Texas A&M University, Mays Business School
Field:
Corporate Finance

**Donna Dietz, Ph.D.**
University of North Dakota, 1989
Field:
Business Education

**Thomas D. Dowdell, Ph.D.**
Temple University, 2004
Field:
Accounting

**C. Frederick Eisele, Ph.D. (professor emeritus)**
University of Iowa, 1971
Field:
Labor Management and Negotiation

**John Elder, Ph.D.**
University of Virginia-Charlottesville, 1995
Field:

# Business Administration

## Program Description

The Master of Business Administration program at North Dakota State University is a non-thesis, professional program structured to serve qualified students with undergraduate degrees in various fields. The program is designed to provide the student with an effective set of analytical skills, a broad view of the way organizations work, and an understanding of the functional areas of business. The NDSU program takes a generalist approach to graduate business education while providing a variety of electives to give the student the opportunity to pursue a particular area of interest in business or a related discipline.

The NDSU business faculty use a variety of teaching methods: case studies, group and individual projects, field research, computer applications, class discussion, and lecture. The student is able to acquire and improve problem-solving and communication skills and to apply these skills in business situations.

## Admissions Requirements

Applicants for admission to the MBA program must hold a four-year bachelor's degree from a regionally accredited college or university. Applications must be complete before being considered by the College of Business for admission. A complete application includes the completed Application for Admission into Graduate School and the $45 application fee, an official transcript from each college or university attended, official Graduate Management Admission Test (GMAT) scores, a letter of intent, and three letters of recommendation. International students also must submit an official TOEFL examination report with a minimum acceptable score for admission of 550 (paper test) or 213 (computer test). Students are not permitted to register in graduate courses prior to admission to The Graduate School.

## Financial Assistance

The College of Business Administration offers financial assistance through graduate assistantships and scholarships. Applicants must be admitted on a conditional or full-standing basis. Assistantships include a stipend and tuition waiver in exchange for work within the College.

The tuition waiver is limited to graduate course work and six semester hours of foundation courses. Awards are based on academic excellence as determined by grade point average, high potential as measured by the GMAT score, and the financial needs of the student. Applications may be obtained from the The Graduate School or the MBA director's office.

Finance, Economics

**Karen Froelich, Ph.D.**
University of Minnesota, 1994
Field:
Strategic Management

**Charles Harter, Ph.D.**
University of Nebraska, 1991
Field:
Financial Accounting

**Ronald D. Johnson, D.B.A.**
Indiana University, 1970
Field:
Organizational Behavior

**Joseph M. Jones, Ph.D.**
University of Missouri-Columbia, 1991
Field:
Marketing

**Jae Min Jung, Ph.D.**
University of Cincinnati, 2002
Field:
Marketing, Cross-Cultural Consumer Behavior, Marketing Ethics.

**Jang Chul Kim, Ph.D.**
University of Memphis, 2003
Field:
Market Microstructure, Corporate Finance

**Bonnie Klamm, Ph.D., CPA**
Virginia Commonwealth University-Richmond, 1999
Field:
Accounting Information System

**Terry W. Knoepfle, J.D., CPA**
University of North Dakota, 1981
Field:
Business Law and Tax Accounting

**Gerry Macintosh, Ph.D.**
University of Nebraska-Lincoln, 1992
Field:
Sales and Sales Management

**R. Douglas Rymph, Ph.D.**
University of South Carolina, 1999
Field:
Organizational Behavior

**Herbert Snyder, Ph.D.**
Syracuse University, 1994
Field:
Auditing, Forensic Accounting

## Degree Requirements

The total course requirements necessary to complete the MBA degree will vary depending on the background of the student. An adequate background in the functional areas of business is necessary for all students. Foundation courses include 3 semester credits in the areas of accounting, economics, marketing, management, legal environment, finance, quantitative methods, and management information systems. Foundation courses may be waived for students who have previously completed equivalent courses with satisfactory grades.

All students must complete 30 semester hours of graduate work. Graduate courses include the following core courses: managerial accounting, strategic marketing, operations management, organizational behavior, financial management, management information systems, strategic management, and business conditions analysis, for a total of 24 semester hours. Students must take an additional six semester hours of approved elective courses.

### Joint MBA-Pharm.D. Degree Program

The College of Business Administration and the College of Pharmacy offer a dual degree program where students receive a Pharm.D. degree and an MBA. Pharm.D. students meet the business foundation course requirement through the pharmacy curriculum, and the choice of MBA elective courses is flexible for students in the dual degree program. To be eligible for this joint degree program, students must apply to and be accepted into both the Pharm.D. and the MBA programs. The MBA course work can be completed in one year following completion of the Pharm.D. degree.

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# Courses Offered

## Accounting Electives

**610 Forensic Accounting 3**
Study of the pervasiveness and causes of fraud in society; exploration of methods of fraud detection, investigation, and prevention; and detection of financial statement fraud. Prereq: Acct 201 or equivalent.

**615 Advanced Accounting 3**
Study of special problems in accounting, including consolidated statements, international operations, partnerships, corporate liquidations, corporate reorganizations, estates, and trusts. Prereq: Acct 312.

**618, 619 Tax Accounting I, II 3 each**
Study of the theory and principles related to the determination of taxable income and computation of federal income taxes for individuals, partnerships, corporations, trusts and estates, and other specialized tax issues. Prereq: Acct 201.

**620 Accounting Information Systems 3**
Examination of accounting information systems with emphasis on systems planning and design and on application of appropriate software and hardware technology. Prereq: Acct 201, Busn 370.

**621, 622 Auditing I, II 3 each**
Study of audit objectives and procedures, auditing standards, legal liability, ethics, internal controls, and report writing. Prereq: Acct 312.

**625 Accounting Theory 3**
Critical examination and study of the current literature and official releases of professional and regulatory bodies in accounting. Prereq: Acct 312.

**Charles D. Stevens, Ph.D.**
University of Kansas, 1998
Field:
Human Resource Management

**Jeffrey Stinson, Ph.D.**
University of Oregon, Lundquist College of Business
Field:
Marketing

**Joseph G. Szmerekovsky, Ph.D.**
Case Western Reserve University, 2003
Field:
Operations

**Rodney D. Traub, Ph.D.**
Purdue University, 1994
Field:
Operations Management

# Business Electives

**630 Legal and Social Environment of Business 3**
Study of legal and regulatory environment in which business firms operate as well as the social environment. Includes business ethics and social responsibility issues.

**635 International Business Law 3**
Study of public and private international law as it relates to international business: international contracts and sales; international business organizations; and international trade, tariffs, and agreements. Prereq: Busn 430.

**641 Investment Analysis and Management 3**
Evaluation of various securities for investment (stocks, bonds), investment analysis (fundamental and technical), concepts of efficient markets, and market risk. Portfolio management and international investment aspects are briefly covered. Prereq: Busn 340 or 540.

**642 Speculative Markets 3**
Evaluation of options, futures, and other derivative securities used for hedging, speculation, and arbitrage. Related market structure, trading strategies, and risks are examined. Prereq: Busn 441/641 or 444/644.

**643 Management of Financial Institutions 3**
Development, role, and functions of depository financial institutions. Emphasis on domestic and international regulation, structure, management, and operations of commercial banks. Prereq: Busn 340 or 540.

**644 Money and Capital Markets 3**
Examination of saving-investment decisions, flow of funds, interest rate theories, risk structure, and function of financial markets. Security pricing and portfolio strategies in money, bond, tax exempt, and foreign exchange markets. Prereq: Busn 340 or 540.

**645 International Finance 3**
Concerns international financial markets, exchange rates, currency futures, and options. Includes financial aspects of international corporations, such as management of corporate assets and liabilities, capital structure, cost of capital, capital budgeting, and international risks. Prereq. Busn 340.

**650 Human Resource Management 3**
Survey of human resource management, including job analysis, recruitment, selection, performance appraisal, compensation, training, and labor relations. The impact of environmental influences, such as legislation, court decisions, and unions, on human resource activities are addressed. Prereq. Busn 350.

**652 Compensation Management 3**
Study of the human resource management function of compensation. Topics include job analysis, job evaluation, wage determination, pay-for-performance, and employee benefits. The impact of compensation on recruitment, satisfaction and performance is examined. Prereq: Busn 350.

**654 International Management 3**
Focused on management challenges associated with business activity across national boundaries. Development of management skills for global contexts. Prereq: Busn 350.

**660 Consumer Behavior 3**
Examination of dimensions of consumer buying theories. Aimed at understanding the buying behavior of customers. Prereq: Busn 360.

**661 Advertising and Integrated Marketing Communication 3**
Examination of the use of advertising as part of the worldwide marketing function; prepares the student to analyze and plan integrated marketing communication campaigns. Prereq: Busn 360.

**662 Sales and Sales Force Management 3**
Examination of different aspects of effective personal selling with focus on decision areas pertaining to sales force management. Prereq: Busn 360.

**664 International Marketing 3**
Focused on identifying and satisfying global customer needs better than the competition, both domestic and international, and coordinating marketing activities within the context of the global environment. Prereq: Busn 360.

**683 Organizational Communication 3**
See Communication for description.

**761 Marketing Research 3**
Study of research methods with focus on research design, data collection, and analysis techniques. Prereq. Busn 760.

## Common Body of Knowledge Courses

**720 Advanced Managerial Accounting 3**
Study of various forms of control in business organizations with emphasis on accounting controls such as budgets, variances, and performance measurement. Prereq. Acct 102 or Acct 201.

**740 Advanced Financial Management 3**
In-depth coverage of concepts and decision-making tools in financial analysis, cost of capital, capital structure, capital budgeting, and dividend policy. Emphasis on risk analysis, international perspectives, and current topics in corporate finance. Prereq. Busn 340.

**750 Advanced Organizational Behavior 3**
Study of theory and current management research dealing with individual and small-group behavior in organizations. Topics include motivation, reward, job satisfaction, stress, communication, and conflict resolution. Prereq. Busn 350.

**751 Advanced Operations Management 3**
Advanced study of concepts and technologies used by service and manufacturing firms with emphasis on process analysis and improvements. Includes demonstration and application of techniques such as simulation, linear/integer programming, and project scheduling. Prereq: Stat 330.

**760 Strategic Marketing Management 3**
Focus on the major decision areas that marketing executives face in their efforts to match the objectives and resources of the organization with the needs and opportunities in the marketplace. Prereq. Busn 360.

**770 Information Resources Management 3**
Examination of the role of information resources in supporting a wide range of organizational functions by providing a managerial perspective on the use, design, and evaluation of information systems. Focus is managerial rather than technical. Prereq: Departmental approval.

**780 Business Conditions Analysis 3**
Preparation of students to analyze domestic and global economic factors that impact the United States and world economy. Prereq. Econ 201 or 202.

**789 Business Policy and Strategy 3**
Process and tools of strategy formulation and implementation in a variety of organizational environments. Prereq. Busn 720, 740, 750, 751, and 760.

The following variable credit courses are also offered:

**792 Case Studies 1-3**

**793 Individual Study/Tutorial 1-5**

**696/796 Special Topics 1-3**



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Fax: (701) 231-6524

## Graduate Faculty

701-231-6488

**Marc D. Anderson, Ph.D.**
Iowa State University, 1995
Field:
Plant Stress Physiology/Plant Metabolism
Department:
Biological Sciences

**Marc L. Bauer, Ph.D.**
University of Kentucky, 1996
Field:
Digestive Physiology
Department:
Animal and Range Science

**Eugene S. Berry, Ph.D.**
Northeastern University, 1983
Field:
Animal Virology
Department:
Veterinary and Microbiological Sciences

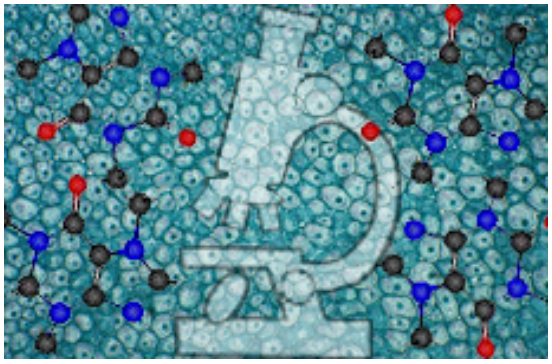
**Kow Ching (Sam) Chang, Ph.D.**
University of Nebraska, 1980
Field:
Protein Metabolism
Department:
Cereal and Food Sciences

**Wun Chao, Ph.D. (adjunct)**
University of California, Riverside, 1996
Field:
Plant Genetics and Molecular Biology
USDA, Adj.
Department:
Plant Sciences

**Lynn S. Dahleen, Ph.D. (adjunct)**
University of Minnesota, 1989
Field:
Plant Tissue Culture, Plant Biotechnology
USDA, Adj.
Department:
Plant Sciences

**Michael Edwards, Ph.D.**

# Cellular and Molecular Biology



## Program Description

North Dakota State University offers an interdisciplinary program leading to the Ph.D. degree in Cellular and Molecular Biology (CMB). The program includes a series of required CMB core courses; additional elective courses; written and oral preliminary examinations; a doctoral dissertation based on independent, original research in the area of cellular and molecular biology; and an oral defense of the dissertation.

The departments participating in this program and the cellular and molecular biology-related research areas in each department are listed below:

### Animal and Range Sciences
Animal reproduction, endocrinology, lactation, cell and tissue culture, gene expression

### Biochemistry and Molecular Biology
Metabolic regulation, protein structure and function, membrane structure and function, enzymology, molecular biology, gene structure and function, cell culture

### Biological Sciences
Plant cell and tissue culture, photosynthesis, polysaccharide biosynthesis, plant Golgi structure/function, evolutionary biology, phytochrome; animal physiology, neurophysiology/neuroendocrinology, gene regulation, signal transduction, and endocrinology.

### Cereal and Food Sciences
Enzymology, protein, and carbohydrate chemistry

### Entomology
Cell and organ culture, regulation of cell development

### Food and Nutrition
Lipid and protein metabolism, enzymes, cell membranes

### Plant Pathology
Cell and protoplast culture, cloning, disease resistance screening, host/parasite genetics

### Plant Sciences
Plant cell culture, selection and transformation, cytogenetics, molecular genetics, cell manipulation, chromosome manipulation, gene regulation

### Veterinary and Microbiological Sciences
Immunology, virology, bacterial genetics, pathogenic mechanisms, bacterial physiology

**(adjunct)**
Cornell University, 1983
Field:
Molecular Plant Virology
USDA, Adj.
Department:
Plant Pathology

**Marvin W. Fawley, Ph.D.**
Miami University, 1985
Field:
Evolutionary Biology
Department:
Biological Sciences

**John Finley, Ph.D.**
Washington State University, 1989
Field:
Animal and Human Trace Element Nutrition
USDA, Adj.
Department:
Animal and Range Sciences

**Thomas P. Freeman, Ph.D.**
Arizona State University, 1968
Field:
Electron Microscopy, Cell Ultrastructure
Department:
Plant Pathology

**Jeffery E. Gerst, Ph.D.**
University of Nebraska, 1973
Field:
Animal Physiology and Neurophysiology/ Neuroendocrinology
Department:
Biological Sciences

**Anna T. Grazul-Bilska, Ph.D.**
University of Agriculture and Technology,
Poland, 1983
Field:
Animal Embryology and Reproductive Biology
Department:
Animal and Range Sciences

**Ron Hutchinson, Ph.D.**
University of Illinois, 1994
Research Interests:
Biological Sciences
Department:
Molecular biology, Plant biochemistry

**Shahryar Kianian, Ph.D.**
University of California-Davis, 1990
Research Interests:
HRS and Durum Wheat

## Admissions Requirements

The Cellular and Molecular Biology Ph.D. program is open to qualified graduates of universities and colleges of recognized standing. To be admitted with full status to the program, the applicant must

1. Hold a baccalaureate degree from an educational institution of recognized standing.
2. Have adequate preparation and show potential to undertake advanced study and research as evidenced by academic performance and experience.
3. At the baccalaureate level, have earned a cumulative grade point average (GPA) in all courses of at least 3.0 or equivalent. Students with a previous graduate degree with a GPA of 3.0 or equivalent may be admitted in full standing. Applications can be submitted directly to The Graduate School at any time.

Official transcripts (transcripts having an appropriate seal or stamp) of all previous undergraduate and graduate records must be received by The Graduate School before the application is complete. When a transcript is submitted in advance of completion of undergraduate or graduate studies, an updated transcript showing all course credits and grades must be provided prior to the initial registration at North Dakota State University.

Three letters of recommendation are required before action is taken on any application. Personal reference report forms are available from The Graduate School.

The general test score from the Graduate Record Examination (GRE) must be submitted.

If possible, applicants should identify at least one cellular and molecular biology faculty member with whom they wish to study.

International students must also demonstrate a proficiency in English by obtaining a minimum score of 525 (paper test) or 193 (computer test) on the Test of English as a Foreign Language (TOEFL). International students who wish to obtain appointments as teaching assistants must attain a TOEFL score of 600 (paper test) or 247 (computer test); pass an oral examination of their linguistic abilities in English; and demonstrate English writing skills by at least one of several ways, for example, scoring 5.0 or above on the Test of Written English.

**The following undergraduate courses have been identified as required for graduate work in the CMB program:**

### Biology
One year of general biology with laboratory and one course in genetics are required. Cellular biology or cellular physiology, animal or plant physiology, and microbiology are recommended.

### Chemistry
One year of general chemistry with laboratory and two sequential terms of organic chemistry with laboratory are required. Biochemistry is recommended.

### Mathematics
Two terms of life sciences calculus are required.

### Physics
Two sequential terms of general physics with laboratories (above the concept level) are required.

In addition, introductory courses in computer science, statistics, and technical writing are recommended.

Deficiencies in required courses may be made up within the first year of resident study without graduate credit.

Germplasm Enhancement
Department:
Plant Sciences

**S. Derek Killilea, Ph.D.**
National University of Ireland, Galway, 1972
Field:
Metabolic Regulation
Department:
Biochemistry and Molecular Biology

**Catherine M. Logue, Ph.D.**
University of Ulster, 1996
Research Interests:
Food Safety
Department:
Veterinary and Microbiological Sciences

**Phillip E. McClean, Ph.D.**
Colorado State University, 1982
Field:
Plant Molecular Genetics
Department:
Plant Sciences

**Steven Meinhardt, Ph.D.**
University of Illinois at Urbana, Champaign, 1984
Field:
Bioenergetics, Protein Structure/ Function
Department:
Biochemistry and Molecular Biology

**Chung S. Park, Ph.D.**
Virginia Polytechnic Institute and State
University, 1975
Field:
Lactation Biology
Department:
Animal and Range Sciences

**Jack B. Rasmussen, Ph.D.**
Michigan State University, 1987
Field:
Molecular Biology and Biochemistry of Cereal Rust Diseases
Department:
Plant Pathology

**Dale A. Redmer, Ph.D.**
University of Missouri, 1983
Field:
Reproductive Biology/Cell Biology
Department:
Animal and Range Sciences

## Financial Assistance

Financial support, if required, is usually provided by the department in which the student will carry out research. In reviewing each application, the Steering Committee will contact the faculty member(s) identified by the applicant to determine if financial support is available. Students seeking financial support also can contact either the CMB faculty member(s) with whom they wish to study or the chair of the CMB Steering Committee.

## Degree Requirements

By the end of the first academic year, the student will select an academic adviser from among the CMB faculty and arrange for the appointment of a Graduate Advisory Committee. This committee will consist of at least four members of the graduate faculty. This includes the student's major adviser, at least one additional CMB faculty member, and an appointee of The Graduate School. One committee member must be from outside the student's academic college.

The plan of study will be prepared by the student, in consultation with the major adviser, by the end of the first year in residence. The plan shall be approved by the student's Graduate Advisory Committee, the CMB Program Director, the department chair, the academic dean, and The Graduate School dean. The plan of study must be filed in The Graduate School prior to scheduling the comprehensive written examination.

The Graduate School requires the plan of study for the Ph.D. degree to include not less than 90 semester graduate credits. Of this total, not less than 27 credits must be in courses other than seminar or research credits. Of the 27 course credits, 15 must be at the 700-789 level. The CMB program requires students to complete a series of 7 courses totaling 21-23 semester credits in 4 core areas. The student will complete additional elective courses to fulfill The Graduate School requirement of 27 semester credits in academic courses. An overall GPA of 3.0 or better must be maintained.

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# Courses Offered

**1. Biochemistry and Molecular Biology (all are required)**
Bioc 701, 702 Comprehensive Biochemistry I and II
Bioc 673 Methods of Biochemical Research

**2. Cellular Biology**
Bot/Zoo 720 Advanced Cell Biology, required
Biol 722 Current Topics in Cell and Molecular Biology, optional

**3. Molecular Biology**
Bioc 674 Methods of Recombinant DNA Technology, required
One of the following is required:
Bioc 719 Molecular Biology of Gene Expression and Regulation
Micr 783 Advanced Bacterial Genetics and Phage
PlSc 731 Plant Molecular Genetics

**4. Technique Courses (one is required)**
Bot 680 Plant Tissue Culture
PPth 756 Techniques in Electron Microscopy
PlSc 684 Plant Tissue Culture and Micropropagation
Micr 645 Animal Cell Culture Techniques

The core courses will normally be completed by the end of the second year in residence. These courses must be completed before the student takes the preliminary written examinations, whereas the elective courses may be taken at any time during the program prior to defense of

**Lawrence P. Reynolds, Ph.D.**
Iowa State University, 1983
Field:
Reproductive Biology/Cell Biology
Department:
Animal and Range Sciences

**Mark A. Sheridan, Ph.D.**
University of California-Berkeley, 1985
Field:
Control of Growth, Development, and Metabolism
Department:
Biological Sciences

**Robert B. Sparks, Ph.D.**
University of South Dakota, 1972
Field:
Molecular Biology
Department:
Biochemistry and Molecular Biology

**D. K. Srivastava, Ph.D.**
Banaras Hindu University, India, 1980
Field:
Enzyme Mechanisms and Regulation
Department:
Biochemistry and Molecular Biology

**Mary J. Stewart, Ph.D.**
Kansas State University, 1992
Field:
Cell Growth in Signaling and Development
Department:
Biological Sciences

**Alan R. White, Ph.D.**
University of North Carolina, 1981
Field:
Plant Cell Biology, Cell Wall Biosynthesis
Department:
Biological Sciences

the dissertation. The elective courses will normally be classes offered by the department in which the student is doing research or other departments participating in the CMB program. Each student is expected to attend all CMB seminars and present at least one seminar per year throughout the program.

## Examination

1. Written Preliminary Examination covers the first three core areas (biochemistry and molecular biology, cellular biology, and molecular biology) and is normally taken at the end of the second year in residence. The written preliminary examination must be passed before the comprehensive oral examination can be scheduled.
2. Comprehensive Oral Examination shall be taken no later than the end of the third year in residence. This examination will be based on a non-dissertation research topic that will be submitted in the format of a National Institutes of Health or National Science Foundation postdoctoral fellowship research proposal. After successful completion of the comprehensive oral examination, the student will be formally admitted to candidacy for the Doctor of Philosophy degree. At least one academic semester, and preferably two semesters, shall elapse between the preliminary oral examination and the oral defense of the research-based dissertation.

## Dissertation Research

A short proposal describing research suitable for preparation of a dissertation in Cellular and Molecular Biology shall be prepared and submitted to the student's Graduate Advisory Committee and the CMB Steering Committee for review and approval. The dissertation must show originality and demonstrate the student's capacity for independent research. It must embody results of research that constitutes a definitive contribution to knowledge.

In addition to the defense of the dissertation in the final oral examination, the candidate will present a final public seminar based on the dissertation research.

## Program Administration

This interdisciplinary graduate program is administered by the CMB Steering Committee. The committee is composed of five CMB faculty members representing five different academic departments. Steering Committee members, who serve overlapping three-year terms, are elected at a yearly meeting of the CMB faculty. A committee chair/program director is elected annually by the committee.

The duties of the Steering Committee include 1) review of each CMB student's plan of study, proposed research topic, and general progress; 2) review of applications for membership in the CMB faculty; and 3) implementation of the CMB program by established procedures.



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The Graduate School
201 Old Main
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Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701-231-7711

**Kow Ching (Sam)Chang, Ph.D.**
University of Nebraska-Lincoln, 1980
Research Interests:
Legumes, Processing and Chemistry

**Douglas C. Doehlert, Ph.D. (adjunct)**
University of Wisconsin, 1982
Research Interests:
Oat Variety Development, Quality of Oats and Oat Products

**Linda A. Grant, Ph.D. (adjunct)**
North Dakota State University, 1989
Research Interests:
Durum and Hard Red Spring Wheat Quality

**Clifford A. Hall III, Ph.D.**
University of Nebraska-Lincoln, 1996
Research Interests:
Flaxseed, Antioxidants, Phytochemical Stability in Food Systems

**Gary A. Hareland, Ph.D. (adjunct)**
North Dakota State University, 1987
Research Interests:
Durum and Hard Red Spring Wheat Quality

**Khalil Khan, Ph.D.**
University of Manitoba, 1977
Research Interests:
Electrophoresis, Proteins and Enzymes, Wheat Quality

**Dennis P. Wiesenborn, Ph.D. (adjunct)**
Rice University, 1988
Research Interests:
Food Engineering, Process Development, Oilseeds Processing

# Cereal and Food Sciences

## Program Description

The of Cereal and Food Sciences program offers graduate study leading to the M.S. and Ph.D. degrees in Cereal and Food Sciences. Advanced work may involve research in the areas of proteins, carbohydrates, enzymes, and lipids of cereals, legumes, and other northern-grown crops; barley malting and brewing; wheat milling, baking, and pasta processing.

The department has a close working relationship with the Northern Crops Institute and the USDA Hard Red Spring and Durum Wheat Quality Laboratory housed in the Harris Hall complex.

Students are strongly urged to visit faculty members to discuss research opportunities. During the first year in the program, the student will, with his or her adviser, prepare a research proposal.

## Admissions Requirements

The Cereal and Food Sciences graduate program is open to all qualified graduates of universities and colleges of recognized standing. To be admitted with full standing status to the program, the applicant must

1. Hold a baccalaureate degree from an educational institute of recognized standing.
2. Have adequate preparation in chemistry and the biological sciences, and show potential to undertake advanced study and research as evidenced by academic performance and experience.
3. At the baccalaureate level, have earned a cumulative grade point average (GPA) in all courses of at least 3.0 or equivalent.

Students who do not meet all requirements for admission or have deficiencies in prerequisite course work, but show satisfactory potential for graduate study may be admitted conditionally. Dependent upon the student's academic performance after the first or second semester of study, the conditional status may be changed to full graduate standing.

Preferably, applications should be submitted directly to The Graduate School before May 1 of the upcoming academic year, although applications will be considered at any time they are submitted. Official transcripts (transcripts having an appropriate seal or stamp) of all previous undergraduate and graduate records must be received by The Graduate School before the application is complete. When a transcript is submitted in advance of completion of undergraduate or graduate studies, an updated transcript showing all course credits and grades must be provided prior to initial registration at North Dakota State University.

**Charlene Wolf-Hall, Ph.D. (adjunct)**
University of Nebraska-Lincoln, 1995
Research Interests:
Food Microbiology and Food Safety

Three letters of recommendation are generally required before action is taken on any application. Personal reference report forms are available from The Graduate School.

The TOEFL examination is required of international applicants. A minimum score of 550 (paper test) or 213 (computer test) must be achieved.

## Financial Assistance

The number of assistantships varies from year to year, depending on industrial support, grants, and the number of students in residence. Applicants are considered on the basis of scholarship, academic performance, and financial need. The application to The Graduate School, including the three letters of reference and official transcripts, is required to be considered for an assistantship. International students must also submit a TOEFL score. The minimum annual stipends for M.S. and Ph.D. students are $12,000 and $13,200, respectively for a half time assistantship. In addition, graduate tuition is waived for students with assistantships.

## Degree Requirements

The Master of Science program requires a minimum of 20 semester credits of course work with an overall GPA of 3.0 or better. The Ph.D. program requires the completion of a minimum of 40 semester credits of course work with an overall GPA of 3.0 or better.
With assistance from the adviser, a supervisory/advisory and examining committee is established and a plan of study developed. The student is required to prepare and defend a written research proposal.

For M.S. candidates, a written examination on course work is required prior to scheduling the final oral examination at which the student defends the thesis and is asked questions covering academic subject matter.

Ph.D. candidates are required to take a preliminary written and oral examination covering academic subject matter and a final oral defense of a research-based dissertation.

## Research Facilities and Equipment

The department maintains specialized equipment that evaluates cereal and food quality including laboratory equipment, such as spectrophotometers, gas chromatographs, a particle size analyzer, LC-MS, GC-MS, high-performance liquid chromatographs, various electrophoretic devices, a differential scanning calorimeter, Rapid ViscoAnalyzer, and computer terminals. Flour mills, ranging up to pilot-plant size; three completely equipped bake shops; continuous bread-baking equipment; rheological instruments for dough testing; several pasta-processing units; malting equipment; Asian noodle making equipment; soymilk/tofu processing machines; a wet processing pilot plant; labscale HT/ST extruder; and a microbrewery are some examples of the specialized equipment.

In addition, the department has access to equipment and instrumentation in the Northern Crops Institute and USDA Hard Red Spring and Durum Wheat Quality Laboratory housed in the same building complex.

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# Courses Offered

**630 Food Unit Operations 2**
Thermodynamics, materials and energy balance, fluid flow, heat transfer, all related to food processing. Prereq: Math 147; Phys 211, 211L. Coreq: CFS 631.

**631 Food Unit Operations Laboratory 1**
Experiments relevant to CS 630, with emphasis on application of mass and energy balances, and heat transfer to food processing operations. Coreq: CFS 630.

**650 Cereal Technology 3**
Discussion of cereal grains, their properties, evaluation, and utilization.

**653 Food Microbiology 3**
Study of the nature, physiology, and interactions of microorganisms in foods. Introduction to foodborne diseases, effects of food processing on the microflora of foods, principles of food preservation, food spoilage, and foods produced by microorganisms. Prereq: Biol 202L or Micr 350L.

**660 Food Chemistry 3**
Study of food components, including water, carbohydrates, lipids, proteins, vitamins, minerals, and enzymes. Prereq: CS 210; Chem 341, 341L; Bioc 460.

**661 Food Chemistry Laboratory 1**
Laboratory isolation, observation of characteristics, and quantitation of food components. Coreq: CS 460/660.

**664 Food Analysis 3**
Principles, applications, and practice of methods for quantitative determination of food components. Two lectures and one 3-hour laboratory. Prereq: Bioc 460, CFS 460/660, or departmental approval.

**670 Food Processing 3**
Capstone course integrating principles of food chemistry, food microbiology, food engineering, nutrition, statistics, and sensory evaluation through the discussion of food processing operations. Prereq: CS 450, 460, or departmental approval.

**671 Food Processing Laboratory 1**
Field trips, experiments on freezing, freeze drying, spray drying, canning, beverage production, water activity measurements, shelf life, and quality control. Coreq: CS 470/670.

**758 Fundamentals of Flour Testing and Baking 3**
Flour testing, industrial, and experimental bread baking. Production methods, ingredients, and baking reactions. Lectures and laboratories. Prereq: CS 450/650.

**759 Milling 3**
Experimental and industrial feed and flour milling. Production, equipment, and factors involved in the milling process. Lectures and laboratories. Prereq: CS 450/650.

**760 Pasta Processing 2**
Durum wheat quality, pasta production, and pasta quality evaluation. Lectures and laboratories. Prereq: CS 450/650.

**761 Malting and Brewing 2**
Barley and malt quality; malting and brewing. Lectures and laboratories. Prereq: CS 450/650.

**765 Advanced Cereal and Food Chemistry I 4**
Physiochemical, structural, and functional properties of cereal and food carbohydrates and lipids in food systems.

**766 Advanced Cereal and Food Chemistry II 4**
Physiochemical, structural, and functional properties of cereal and food proteins and the biochemical characteristics of enzymes in food systems

The following variable credit courses are also offered:

**690, 790 Seminar 1-3**

**793 Individual Study/Tutorial 1-5**

**695, 795 Field Study 1-15**

**696, 796 Special Topics 1-5**

**798 Master's Thesis 1-10**

**799 Doctoral Dissertation 1-15**



E-Mail: The Graduate School

Prospective students may schedule a visit by calling 1-800-488-NDSU.

The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701-231-8694

**Gregory R. Cook, Ph.D.**
Michigan State University, 1993; Postdoctoral, Stanford University, 1994-1996
Research Area:
Synthetic Organic Chemistry

**Uwe Burghaus, Ph.D.**
Free University of Berlin, 1995; Postdoctoral, Univ. of Genoa, Italy, 1995-1997
Research Area:
Surface Physical Chemistry

**John F. Hershberger, Ph.D.**
Yale University, 1986; Postdoctoral, Columbia University, 1986-1989
Research Area:
Experimental Physical Chemistry, Laser Kinetics

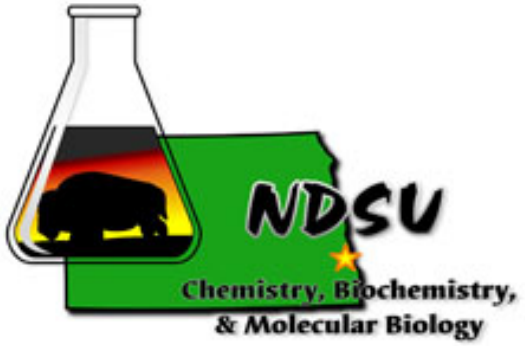
**Denley Jacobson, Ph.D.**
Purdue University, 1984; Postdoctoral, California Institute of Technology, 1984-1986
Research Area:
Gas Phase Ion Chemistry

**Michael Page, Ph.D.**
State University of New York at Buffalo, 1982; Postdoctoral, National Research Council/U.S. Army Ballistic Research Laboratory, 1982-1984
Research Area:
Theoretical Chemistry

**Seth C. Rasmussen, Ph.D.**
Clemson University, 1994; Postdoctoral, University of Oregon, 1995-1999
Research Area:
Inorganic/Organic Materials Chemistry, Chemical History

**Kenton R. Rodgers, Ph.D.**
University of Iowa, 1988; Postdoctoral, Princeton University, 1989-1993

# Chemistry




## Program Description

The Department of Chemistry offers programs leading to the Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degree in Chemistry. At the start of the first year of study, entering graduate students take entrance examinations in analytical, inorganic, organic, and physical chemistry. The graduate student progress committee uses these exams for advisory purposes in recommending course work during the first year. As a consequence, programs are individually tailored to the needs of each student. Typically, coursework is completed in one to one-and-a-half years for M.S. candidates, and two years for Ph.D. candidates, leaving later years for full-time thesis research. The typical time to complete a graduate degree averages three years for the M.S. degree and approximately five years for the Ph.D.

## Admissions Requirements

The Department of Chemistry graduate program is open to all qualified graduates of universities and colleges of recognized standing. To be admitted with full status to the program, the applicant must

1. Hold a baccalaureate degree from an educational institution of recognized standing.
2. Have adequate preparation in chemistry and show potential to undertake advanced study and research as evidenced by academic performance and experience.
3. At the baccalaureate level, have earned a cumulative grade point average (GPA) in all courses of at least 3.0 or equivalent. Students with a previous graduate degree with a GPA of at least 3.0 or equivalent may be admitted in full standing.

Students who do not meet all requirements for admission or have deficiencies in prerequisite course work, but show potential for successful graduate study may be admitted under a conditional status. Evidence must be provided showing that the applicant's potential is not adequately reflected by his/her record. After meeting the specified standards of performance by the department, the student in consultation with the major adviser may request a change to full graduate standing. The student may not earn more than 12 semester hours of graduate credit in the conditional status. The request for change must be submitted to the Dean of The Graduate School by the major adviser and approved by the department chair.

Preferably, applications should be submitted directly to The Graduate School before March 15 of the upcoming academic year. However, applications will be considered at any time. Official transcripts (having an appropriate seal or stamp) of all previous undergraduate and graduate records must be received by The Graduate School before the application is complete. When a transcript is submitted in advance of completion of undergraduate or graduate studies, an

Research Area:
Inorganic and Bioinorganic Chemistry

**Mukund P. Sibi, Ph.D.**
City University of New York, 1980; Postdoctoral, Dartmouth College, 1980-1982; Postdoctoral, University of Waterloo, 1982-1985
Research Area:
Synthetic Organic Chemistry; Natural Products

**Wenfang Sun, Ph.D.**
Institute of Photographic Chemistry, Chinese Academy of Sciences, 1995; Postdoctoral, University of Alabama, Birmingham, 1997-1999
Research Area:
Organic Materials Chemistry

**Dennis E. Tallman, Ph.D.**
The Ohio State University, 1968; Postdoctoral, Cornell University, 1968-1970
Research Area:
Electrochemistry, Materials

updated transcript showing all course credits and grades must be provided prior to initial registration at North Dakota State University.

Three letters of recommendation are generally required before action is taken on any application. Personal reference report forms are available from The Graduate School. The Graduate Record Examination (General and Chemistry Subject Tests) is preferred, but not required, for domestic students.

The TOEFL examination is required of international applicants whose first language is not English. Proficiency in oral and written communication in English must be demonstrated through on-campus exams/courses and officially documented minimum scores of 50 for the TSE (Test of Spoken English) and 5.0 for the TWE (Test of Written English) before a student can become a teaching assistant. The Graduate Record Examination (General and Chemistry Subject Tests) also is required for international students.

## Financial Assistance

The student must first apply to The Graduate School and be accepted in full or conditional status before he/she is eligible for an assistantship in the Department of Chemistry.

Graduate students in the Department of Chemistry are supported during both the academic year and during summer months by either teaching assistantships (TA) or research assistantships (RA). As of the 2003-2004 academic year, the standard monthly stipend is $1,583 per month for TAs and RAs. University tuition (except for an activity fee of $240/ semester) is waived for all TAs and RAs in good academic standing.

University scholarships of up to $3,000 also are available to outstanding applicants as well as various fellowships, including the North Dakota EPSCoR New Graduate and Doctoral Dissertation Assistantships, and NDSU Graduate School Fellowships. These competitive fellowships offer stipends up to $5,000 more than the departmental assistantships.

## Degree Requirements

The Master of Science program requires the completion of a total of 30 graduate semester credits with an overall GPA of 3.0 or better. This total is comprised of both class work and research credit, but must consist of at least 16 semester credits from letter-graded course work. The Ph.D. program requires the completion of a total of 90 graduate semester credits with an overall GPA of 3.0 or better. This total is comprised of both class work and research credit, but must consist of at least 27 semester credits from letter-graded course work.

Each student chooses a thesis adviser within six months of beginning graduate school. As this is one of the most important decisions made in graduate school, students are strongly urged to visit multiple faculty members to discuss research opportunities. In addition, faculty seminars during the fall semester are designed to acquaint new students with the available research programs.

By the end of the first academic year, each student selects an advisory and examination committee, which consists of the thesis adviser, two other faculty members in the chemistry department, and one faculty member from a department outside the College of Science and Mathematics.

Admission to candidacy for the Ph.D. degree is accomplished by satisfying three requirements: 1) satisfactory performance in course work with a minimum 3.0 grade-point average, 2) satisfactory performance in cumulative examinations which are administered six times per year, and 3) satisfactory defense of an original research proposal on a topic approved by the student's advisory committee. The defense of this proposal must occur at least eight months prior to the final oral examination. Following completion of dissertation research, the candidate must complete a written dissertation and an oral presentation to the department and advisory committee.

## Research Opportunities and Infrastructure

The Department of Chemistry and Molecular Biology has more than 10 externally funded faculty research programs. Research programs are available in environmental science, spectroscopy, electrochemistry, materials characterization, synthetic inorganic chemistry, bioinorganic chemistry, inorganic materials, organometallics, synthetic organic chemistry, bioorganic chemistry, polymer chemistry, natural products chemistry, surface chemistry, laser kinetics, biochemistry, and theoretical chemistry. Research expenditures have averaged $1.8 million over the last 10 years, with more than $2.2 million in the last 2 years.

All research and most teaching activities within the department are located in two connected buildings, Ladd Hall and Dunbar Laboratory, and the nearby IACC building, containing over 100,000 square feet of floor space. Most departmental offices, classrooms and teaching labs, and some research labs are located in Ladd Hall while Dunbar primarily consists of research laboratories. Ladd Hall also houses departmental glass, machine, and electronics shops. Both buildings have been extensively renovated and modernized within the last decade. Most biochemistry research labs are located on the third floor of the new IACC building.

Modern instrumentation is vital to research in the chemical sciences. The quality and quantity of instrumentation within the chemistry department have been greatly enhanced in the last few years through aggressive fund-raising efforts and university matching support. In addition to the department equipment discussed below, several on-campus facilities are available, including scanning and transmission electron microscopes and an EPR spectrometer.

The Organic Spectroscopy Laboratory is primarily devoted to maintenance and operation of Nuclear Magnetic Resonance (NMR) spectrometers. The recently upgraded facility includes three modern high-field instruments: Varian 500, 400, and 300 MHz spectrometers. All have multinuclear, 2-D, and variable temperature capabilities. This laboratory also houses Bio TOF and LC-MS mass spectrometers, FTIR, UV-Vis, and CD instruments. Students have full access to these and all departmental instruments.

The department's Materials Characterization Laboratory has a Bruker single crystal CCD X-ray diffractometer with low temperature capabilities, as well as a Philips X-ray powder diffractometer.

A recent addition is the Core Biology Facility, which contains a variety of instrumentation useful in Molecular Biology.

Research laboratories within the department house a wide variety of additional instrumentation, including electrochemistry equipment, surface analysis equipment, numerous laser, computer workstations, etc.

The chemistry library, located in Ladd Hall, provides graduate students and faculty with convenient 24-hour access to more than 200 journals and approximately 10,000 volumes. Literature searching via SciFinder is supported.

Prospective students are encouraged to visit the Department of Chemistry Web site (www.chem.ndsu.nodak.edu) for the latest descriptions of research programs and instrumentation.

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# Courses Offered

**625 Inorganic Chemistry I 3**

Electronic structure and bonding, acid-base and redox chemistry, symmetry and point groups, main group and transition metal chemistry. Prereq: Chem 364.

**626 Crystallography/Crystal Chemistry 2**

Geometric and space group crystallography. Structure and bonding in common minerals and industrially important solids. Structure-property relationships. Half

semester. Cross-listed with Geol.

**627 X-Ray Diffraction 2**
Analytical X-Ray powder diffraction for qualitative and quantitative analysis of crystalline solids. Crystal structure analysis using powder methods. Introduction to X-Ray fluorescence spectrometry. Half semester. Cross-listed with Geol.

**628 Geochemistry 3**
See Geology for description.

**632, 632L Analytical Chemistry II, Lab 4**
Theory and application of modern instrumental techniques, including spectroscopy and electrochemistry. Prereq: Chem 431, 431L.

**724 Group Theory 1**
Molecular symmetry and its application to spectroscopy and bonding. Half semester.

**725 Inorganic Chemistry II 3**
Molecular orbital and valence bond theories, spectroscopy, inorganic reactions, and mechanisms. Prereq: Chem 625, 724.

**726 Inorganic Photochemistry 2**
Principles underlying the photochemical reactivity of coordination and organometallic compounds, photochemical and photophysical experimental techniques. Half semester. Prereq: Chem 625, 724.

**727 Organometallic Chemistry 2**
Synthesis, reactivity, and bonding in organometallic compounds. Half semester. Prereq: Chem 625, 724.

**728 Physical Methods in Inorganic Chemistry 2**
Physical methodology especially appropriate to the characterization of inorganic and organometallic compounds. Includes electronic, vibrational, electron spin resonance, Mössbauer, and nuclear magnetic resonance spectroscopy. Prereq: Chem 625, 724.

**729 X-Ray Structure Determination 2**
Use of single crystal X-Ray diffraction data to determine molecular crystal structures. Half semester. Prereq: Chem 626 or 627.

**730 Separations 2**
Theory, instrumentation, and analytical applications of chemical separation methods. Major emphasis is placed on modern chromatographic techniques and electrophoresis. Prereq: Chem 432/632 or equiv.

**732 Electrochemistry 4**
Theory and application of modern electrochemical methods, including potentiometry, voltammetry, electrochemical impedance spectroscopy, kinetics and mechanisms of electrode processes, corrosion, simulation techniques, and instrumentation. Prereq: Chem 432/632.

**734 Instrumentation Electronics 5**
Design and operation of digital and analog circuits used in chemical instrumentation, computer interfacing. Includes laboratory. Prereq: Chem 432/632.

**736 Mass Spectrometry 2**
Theory and application of mass spectrometry in analysis, tandem mass spectrometry, ionization techniques. Half semester. Prereq: Chem 432/632.

**737 Gas Phase Ion Chemistry 2**
Principles and applications of gas phase ion techniques to the study of the chemical and physical properties of reactive intermediates. Half semester. Prereq: Chem 736.

**741 Physical Organic Chemistry I 4**
Principles governing the reactivity of organic compounds and the methods of

determining reaction mechanisms.

**742 Physical Organic Chemistry II 2**
Aromaticity, electrophilic substitution, Woodward-Hoffman rules. Half semester. Prereq: Chem 741.

**743 Reactive Intermediates 2**
Radicals, carbenes, nitrenes, arynes, carbenium ions, survey of other reactive intermediates. Half semester. Prereq: Chem 741.

**744 Organic Spectroscopy 2**
Structure elucidation by spectrometric methods, including infrared, mass spectroscopy, UV, and nuclear magnetic resonance. Interpretation of 2-D NMR spectra. Half semester.

**745 Organic Synthesis 2**
Functional group synthesis, synthetic design, stereochemical control. Half semester. Prereq: Chem 741.

**746 Advanced NMR Spectroscopy 2**
Theory of pulsed FT-NMR, instrumentation, pulse sequences (with emphasis on multipulse experiments), 2-D NMR, and applications. Half semester. Prereq: Chem 744.

**754 Organic Spectroscopy Laboratory 1**
Laboratory to accompany Chemistry 744, with emphasis on NMR techniques. Half semester. Coreq: Chem 744.

**759 Intermediate Physical Chemistry 3**
Fundamental principles of physical chemistry, including quantum chemistry, spectroscopy, molecular thermodynamics, and kinetics.

**760 Statistical Thermodynamics 4**
Macroscopic and microscopic models for the study of equilibrium properties of pure phases and solutions. Prereq: Chem 365.

**761 Optical Spectroscopy 2**
Theory and practice of modern spectroscopic methods. Emphasis on visible and ultraviolet wavelength ranges. Half semester. Prereq: Chem 632.

**763 Kinetics 2**
Experimental methods to determine reaction rates, empirical rate laws, transition state theory. Half semester. Prereq: Chem 365.

**764 Dynamics 2**
Chemical physics of energy transfer and reactive collisions. Half semester. Prereq: Chem 763.

**766 Quantum Chemistry I 4**
Wave functions and their properties, quantum mechanical behavior of atoms and molecules. Prereq: Chem 365.

**767 Quantum Chemistry II 2**
Ab initio and semi-empirical methods for the calculation of energetic and structural properties of molecules; computational methods. Half semester. Prereq: Chem 766.

The following variable credit courses are also offered:

**790 Graduate Seminar 1-3**

**793 Individual Study/Tutorial 1-5**

**796 Special Topics 1-5**

**798 Master's Thesis 1-10**

**799 Doctoral Dissertation 1-15**



E-Mail: The Graduate School Prospective students may schedule a visit by calling 1-800-488-NDSU.

The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701-231-8268

**Karin Bartoszuk, Ph.D.**
Auburn University, 2002
Research Interests: Adolescent Identity Development; Abusive Families

**Marlys Bratteli, Ph.D.**
University of North Dakota, 2003
Research Interests: Family Caregiving; Elder Abuse/Neglect

**Sean Brotherson, Ph.D.**
Oregon State University, 2000
Research Interests: Parenting; Family Life Education

**Thomas Carlson, Ph.D.**
Iowa State University, 2000
Research Interests: Family Therapy Training & Supervision; Fathering

**James E. Deal, Ph.D.**
University of Georgia, 1987
Research Interests: Personality Development in Children; Research Methods

**Martin Erickson, Ph.D.**
Iowa State University, 2003
Research Interests: Survivors of Abuse; Therapy & Issues of Ethics; Spirituality; Gender; and Culture.

**Margaret Fitzgerald, Ph.D.**
Iowa State University, 1997
Research Interests: Birth-timing & Economic Outcomes; The Interface Between Family Business & The Family

# Child Development and Family Science

## Program Description

The Department offers graduate study leading to the Master of Science degree with four options: Child Development and Family Science, Marriage and Family Therapy, Family Financial Planning, and Gerontology.

**The Child Development and Family Science** option is a two-year program, designed to provide students with a research-based, comprehensive, and integrated study of child, adolescent, and family development and dynamics. Faculty emphasize development and interaction throughout the life span and in a broad environmental context, with a particular emphasis on the establishment and maintenance of healthy developmental trajectories.

**The Couple and Family Therapy (CFT)** option is a three-year program, accredited by the Commission on Accreditation in Marriage & Family Therapy Education, designed to train students interested in working in clinical settings as couple and family therapists. This option involves intensive course work and an on-campus practicum the first two years, with thesis work and an off-campus practicum the third year.

**The Family Financial Planning (FFP)** option is a collaborative, inter-institutional program offered through web-based distance education. The FFP option is a 42 credit program with a specific curriculum approved by the Certified Financial Planner (CFP) Board of Standards. The program requires one of the following: practicum, practicum and Master's paper, or a Master's thesis.

**The Gerontology** option is a collaborative, inter-institutional program offered through web-based distance education. The Gerontology option requires 30 to 33 credits of coursework and a thesis or masters paper for a total of 36 credits. The program can be completed in two to three years.

## Admissions Requirements

The Department of Child Development and Family Science graduate program is open to qualified graduates of universities and colleges of recognized standing. To be admitted to the program with full status, the applicant must:

1. Hold a baccalaureate degree from an educational institution of recognized standing.
2. Have adequate preparation in child or human development, family science, or personal finance, and show potential to undertake advanced study and research as evidenced by academic performance and experience.
3. At the baccalaureate level, have earned a cumulative grade point average in all courses of

**Wendy Troop-Gordon, Ph.D.**
(Adjunct)
University of Illinois, 2002
Research Interests:
Peer Relationships in Childhood; Social-cognitive Development; Psycho-social and School Adjustment

**Joel Hektner, Ph.D.**
University of Chicago, 1996
Research Interests:
Alcohol/Drug Abuse Prevention; Delinquency; Peer Affiliation Patterns/ Influences on Behavior

**Virginia L. Clark Johnson, Ph.D.**
Pennsylvania State University, 1984
Research Interests:
Work and Family

**Harriett Light, Ph.D.**
Michigan State University, 1976
Research Interests:
Adolescence; Resilience

**Christie McGeorge, Ph.D.**
University of Minnesota, 2005
Research Interests:
Family Caregiving; Family Wellness; Premarital Counseling

**Debra Pankow, Ph.D.**
South Dakota State University, 2002
Research Interests:
Financial Decision-Making; Women's Economic Issues; Youth Financial Literacy

**Brandy A. Randall, Ph.D.**
University of Nebraska-Lincoln, 2002
Research Interests:
Prosocial & Moral Development; Relationships; Positive/Problem Behaviors

**Gregory F. Sanders, Ph.D.**
University of Georgia, 1983
Research Interests:
Later Life Families; Family Strengths

at least 3.0 or equivalent. Students with a previous graduate degree with a GPA of 3.0 or equivalent may be admitted in full standing.

Applications for the CDFS, CFT and Gerontology options should be submitted directly to the Graduate School; NDSU applications are available on the graduate school website, with CDFS applications available on the departmental website. For fall consideration, completed applications must be received by **February 1st**. Applications received after this date will be considered on a space-available basis. Applications received **after May 1st** will be held for consideration for admission the following year. The Family Financial Planning (FFP) admits students throughout the year if space is available in the courses.

Official transcripts (transcripts having an appropriate seal or stamp) of all previous undergraduate and graduate records must be submitted with the application. When a transcript is submitted in advance of completion of undergraduate or graduate studies, an updated transcript showing all course credits and grades must be provided in advance of the initial registration at NDSU.

Three letters of recommendation must be provided. Personal reference report forms are available from the NDSU Graduate School.

In addition to these materials, students applying for the CFT option must complete the Marriage and Family Therapy application. An interview conducted by the CFT faculty to determine readiness for the program will also be required after initial application materials are received. The interview will address professional interests and goals, perceived ability to complete the program, emotional and personal stability, and self-evaluation of clinical skills. Near the end of the first semester after admission, a second interview which focuses on clinical readiness will be conducted prior to admission into the practicum.

## Financial Assistance

To be considered for a departmental assistantship, a student must first make application to the Graduate School and be accepted in full or conditional status. The student must then submit a letter to the CDFS department indicating interest and special skills/experiences that would qualify him/her for an assistantship. A limited number of assistantships are available to qualified students with priority given to first year students.

## Degree Requirements

The CDFS option requires 35-38 semester credit hours; the Couple and Family Therapy option requires 57-61 credits; the Family Financial Planning option requires 42 credits; and the Gerontology option requires 24 credits.

## CDFS Option Requirements

**CDFS 703 Research Methods 3**
**CDFS 790 Seminar: Special Topics in Research Methods 3**
**CDFS 781 Family Systems 3**
**CDFS 782 Advanced Human Development: Birth through Childhood 3**
**CDFS 783 Dynamics of Parent-Child Relations 3**
**CDFS 784 Advanced Human Development: Adolescence through Adulthood 3**
**CDFS 785 Family Theories 3**
**CDFS 701 Graduate Orientation 1**

**9 additional credits to be approved by advisor and committee.At least six of these are to be within CDFS and exclusive of practicum or field experience credits.**

**Thesis 6**

## CFT Option Requirements:

**CDFS 701 Graduate Orientation 1**
**CDFS 703 Research Methods 3**
**CDFS 773 Foundations of Marital & Family Therapy I 3**
**CDFS 774 Foundations of Marital & Family Therapy II 3**
**CDFS 775 Clinical Applications in Marital & Family Therapy I 3**
**CDFS 776 Clinical Applications in Marital & Family Therapy II 3**
**CDFS 777 Diagnosis & Assessment in Marital & Family Therapy 3**
**CDFS 778 Clinical Applications in Marital & Family Therapy III 3**
**CDFS 780 Ethics & Professional Issues in Marital & Family Therapy 3**
**CDFS 785 Family Theory 3**
**CDFS 790 Seminar: Special Topics in Research Methods 3**
**CDFS 794 Practicum 19**
**CDFS 798 Thesis 6**

Select 2 from:

**CDFS 782 Advanced Human Development - Birth through Childhood 3**
**CDFS 783 Parent-Child Relations 3**
**CDFS 784 Advanced Human Development - Adolescence through Adulthood 3**

## FFP Option Requirements:

**CDFS 781 Family Systems 3**
**CDFS 764 Family Economics 3**
**CDFS 677 Financial Counseling 3**
**CDFS 770 Fundamentals of Family Financial Planning 3**
**CDFS 771 Investing for the Family's Future 3**
**CDFS 765 Insurance Planning for Families 3**
**CDFS 766 Estate Planning for Families 3**
**CDFS 768 Housing/Real Estate 3**
**CDFS 762 Retirement Planning, Employee Benefits And the Family 3**
**CDFS 767 Professional Practices in Family Financial Planning 3**
**CDFS 763 Personal Income Taxation 3**
**CDFS 769 Financial Planning - Case Studies 3**

During the final year of study, students will have a choice of the following requirements:

- **Six credits of practicum at the degree granting institution. OR**
- **Three credits of practicum (CDFS 796) and three credits of Master'spaper (CDFS 797) OR**
- **Six credits of Master's thesis (CDFS 798).**

Note: The courses in Insurance, Investment, Personal Taxation, EstatePlanning, Retirement and Employee Benefits, and Real Estate and Housing will satisfy the education requirements for students who wish to sit for the Certified Financial Planner exam.

## Gerontology Option Requirements:

Core. Students are required to take each of the following eight courses (24credits). Although titles vary somewhat across participating campuses, we have current course numbers for all core courses. Bolded schools refer to those who are taking initial lead teaching these courses.

**1. Perspectives in Gerontology (Iowa State) 3 credits**
**2. Adult development and aging (Colorado State) 3 credits**

**3. Aging in the family context (Montana State) 3 credits**
**4. Environments and aging (Kansas State) 3 credits**
**5. Program evaluation and Research methods in aging (North Dakota State) 3 credits**
**6. Physical health and wellness, nutrition (Montana State) 3 credits**
**7. Economics, public policy and aging (North Dakota State) 3 credits**
**8. Professional Seminar in Gerontology (Iowa State) 3 credits**

During the final year of study, students will have a choice of the following requirements:

**A. Three credits of Master's paper.**
**B. Six credits of Master's thesis.**

Electives. Additional electives would be used to fulfill a 36-credit degree program.

POTENTIAL ELECTIVES TO BE DEVELOPED OR OFFERED ONLINE INCLUDE:

**Global aging (SDSU, ISU) 3 credits**
**Gender (KSU, NDSU) 3 credits**
**Grandparent-grandchild relations 3 credits (already available online from OSU and offered summers)**
**Adult learners (CSU, MSU) 3 credits**
**Study tour (all universities) 3 credits**
**Leadership in aging organizations (SDSU, KSU) 3 credits**
**Intergenerational issues and programs (MSU, CSU) 3 credits**
**Statistics 3 credits**
**Arts and humanities (KSU) 3 credits**
**Advanced theories on aging (OSU) 3 credits**
**Current topics (all universities) 3 credits**
**Community services and aging 3 credits**
**Mental health, cognition (CSU, KSU, NDSU) 3 credits**
**Ethics (OSU) 3 credits**
**Rural aging (ISU) 3 credits**
**Retirement planning (Nebraska) 3 credits**
**Estate planning (Montana State) 3 credits**
**Practicum (all universities) 3 credits maximum**

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## Courses Offered

**624 Observation and Assessment of Children 3**
This course is an introduction to the observation and assessment of children for both research and practice applications. Areas covered will include standardized testing; informal assessments; and observations of infants, toddlers, and preschoolers, focusing on progress toward developmental goals in cognitive, social-emotional, and physical domains.

**625 Children and Stress 3**
Survey of theory and research relating to children's reactions to stress and coping, infancy through adolescence. Examination of strategies for working with children, including topics on children's reactions to divorce, sibling death, and hospitalized children.

**648 Issues in Sexuality 3**
Study of personal, interpersonal, and societal meanings of human sexuality. Decision making relevant to sexual behavior.

**650 Adolescent Development 3**
Study of physical, social, cognitive, and emotional development of adolescents. Includes

examination of contemporary issues related to this age group.

**660 Adult Development and Aging 3**
Study of development during adulthood and later life. Emphasis on perceptual-motor and cognitive functioning, personality, adjustment, social, familial, and cultural aspects of adulthood.

**662 Family Crisis 3**
Effects of crisis-producing situations on adjustment within the family. Intervention strategies.

**668 Families and Work 3**
Issues, opportunities and problems related to the interface of work and family. Topics include household division of labor, trends in the labor market, and work-family policy.

**675 Children and Families Across Cultures 3**
Study of developmental and family issues as viewed from a cross-cultural diversity perspective. Prereq: 6 credits of social science.

**677 Financial Counseling 3**
Advanced analysis of family financial issues. Evaluation of alternative financial programs. Prereq: CDFS 357.

**678 Financial and Consumer Issues of Aging 3**
Integration of economic and consumer problems of the elderly including income trends in retirement and health care. Prereq: 6 credits of social science.

**681 Women and Aging 3**
Study of theory, research and application of issues related to women and the aging experience.

**682 Family Dynamics of Aging 3**
Examination of issues related to family life in the later years from the perspectives of the elderly and the family. Prereq: 6 credits of social science.

**683 Family Wellness 3**
Principles and theories of family wellness/enrichment. Includes study of preventive and enrichment programs for couples and families. Prereq: CDFS 135, 6 credits of social science.

**688 Exceptional Child and Family 3**
Study of children and their families who vary from the norm in development and functioning. Prereq: CDFS 230, 6 credits of social science.

**701 Graduate Orientation Seminar 3**
Introduction to graduate program, faculty, policies and procedures.

**703 Research Methods in Child Development and Family Science 3**
Introduction to research methods in child development and marital and family relationships. Includes instrument selection/construction, data collection, interpretation of results, and proposal writing. Emphasis on the unique methodological features associated with the field.

**722 Applied Research in Gerontology 3**
Study of research in applied Social Gerontology. The course will explore quantitative and qualitative approaches to studying older persons and related systems.

**760 Aging Policy 3**
Formation, implementation and impact of policies that affect the well-being of the elderly in the United States.

**761 Applications in Gerontology 3**
Study of application of gerontology research and theory. The course will provide an overview of programs, methods and evaluations of services for older adults.

**762 Retirement Planning, Employee Benefits and the Family 3**
Critical examination of micro and macro considerations in retirement planning for individuals and families.

**763 Personal Income Taxation 3**
Study of principles and concepts of personal income tax planning as they relate to families.

**764 Family Economics 3**
Overview of basic concepts and theories in family economics with emphasis on the economic situation of families in the United States.

**765 Insurance Planning for Families 3**
An in-depth study of risk management concepts, tools, and strategies for individuals and families.

**766 Estate Planning for Families 3**
Study of principles and concepts of estate planning as they relate to families.

**767 Professional Practices in Family Financial Planning 3**
Study of strategies and methods for managing private family financial planning practices including ethics, compensation, client-centered marketing and practice management.

**768 Housing/ Real Estate 3**
Overview of the role of housing and real estate in the family financial planning process including taxation, law, mortgages, ethics and financial calculations.

**769 Financial Planning Case Studies 3**
Examines professional issues in family financial planning including ethics, regulation an certification, communication, and professional responsibility. Emphasis on personal finance case studies and investment policy.

**770 Fundamentals of Financial Planning 3**
Survey of personal/family financial planning including process, time value of money, cash management, credit, taxation, insurance, housing, investments, retirement and estate planning.

**771 Investing for the Family's Future 3**
Study of concepts of time and risk value of money in evaluating investment markets.

**773 Foundations of Marital and Family Therapy I 3**
Introduction to theoretical foundations of marital and family therapy and the historical and contemporary development of the field.

**774 Foundations of Marital and Family Therapy II 3**
Study of critical epistemological issues in the field of marriage and family as they relate to contemporary models in the practice of therapy.

**775 Clinical Applications in Marital and Family Therapy I 3**
In-depth study of current approaches to family therapy. Emphasis on contextual, structural, and strategic approaches.

**776 Clinical Applications in Marital and Family Therapy II 3**
In-depth study of current approaches to family therapy. Emphasis on constructivist

approaches. Application in the clinical practice of marital and family therapy.

**777 Diagnosis and Assessment in Marital and Family Therapy 3**
Training in methods of diagnosis and assessment in mental health issues using DSM-IV criteria as applied to the discipline of marital and family therapy.

**778 Clinical Applications in Marital and Family Therapy III 3**
Exploration of emerging issues in marriage and family therapy as they relate to clinical practice, using a critical social justice lens.

**780 Ethics and Professional Issues in Marital and Family Therapy 3**
Study of legal responsibilities, ethical issues, and professional matters as they pertain to the practice of marital and family therapy.

**781 Family Systems 3**
Advanced study of contemporary family systems with emphasis in research, ethics, media, and current family issues. Prereq: Graduate standing.

**782 Advanced Human Development: Birth throughout Childhood 3**
Critical examination of current research and theories on child development. Emphasis on applying theoretical understanding and knowledge of the current empirical research base to current issues facing children and families.

**783 Dynamics of Parent-Child Relations 3**
Study of selected theories and research in parent-child relations. Emphasis on interaction between adults and children from infancy to youth. Prereq: CDFS 784 or 785 or departmental approval.

**784 Advanced Human Development: Adolescence through Adulthood 3**
Critical examination of current research and theories on adolescent and adult development. Emphasis on applying theoretical understanding and knowledge of the current empirical research base to current issues facing adolescents, adults, and families.

**785 Family Theory 3**
Identification and analysis of theoretical approaches to research on the family. Study of frameworks currently used.

The following variable credit courses are also offered.

**790 Graduate Seminar 1-3**

**792 Case Studies 1-3**

**793 Individual Study/Tutorial 1-5**

**794 Practicum 1-8**

**795 Field Experience 1-15**

**696/796 Special Topics 1-5**

**797 Master's Paper 1-3**

**798 Master's Thesis 1-10**

## Graduate Faculty

701-231-7244

**Magdy Abdelrahman, Ph.D.**
University of Illinois-Urbana , 1996
Research Interests: Characterization of Modified Asphalt Binders and Mixes, Pavement, Maintenance and Rehabilitation Techniques, Performance-Related, Specifications for Pavement Materials, Quality Control and Quality, Assurance in Pavement Construction.

**Donald A. Andersen, Eng.D.**
Texas A & M University, 1982
Research Interests: Transportation, Pavements, Traffic Engineering

**Achintya N. Bezbaruah , Ph.D.**
University of Nebraska-Lincoln (UNL), 2002
Research Interests: Environmental sensors, Recalcitrant and micro pollutants, Contaminant fate and transport, Small community water and wastewater treatment, Environmental management

**Chung-Souk Han , Ph.D.**
University of Hannover , Germany , 1999
Research Interests: Computational mechanics and simulation techniques, Crystal plasticity and composite materials, Micromechanical characterization/ modeling at the micron and nanometer scale, Mechanics of polymers, Macroscopic modeling of anisotropic materials

**Dinesh Katti, Ph.D.**
University of Arizona, 1991
Research Interests: Geotechnical Engineering,

# Civil Engineering

## Program Description

The Department of Civil Engineering and Construction offers the M.S. and Ph.D. degrees in civil engineering and the M.S. degree in environmental engineering. Also, the College of Engineering and Architecture offers a program leading to a Ph.D. degree in engineering in which civil engineering is a possible area of specialization. The M.S. in environmental engineering and the Ph.D. in engineering programs are described in their respective sections.

Specialty areas in the M.S. and Ph.D. degrees in civil engineering include construction, environmental, geotechnical, materials, structural, transportation, and water resources engineering. Other related areas are also accommodated. The academic and research foci are tailored to individual needs and interests. To complement the major area of study, additional courses are often selected from other disciplines. The programs are designed to advance the technical knowledge, competence, and interdisciplinary understanding of the students and to prepare them for entering or advancing within the civil engineering profession.

## Admissions Requirements

To be admitted to the M.S. or Ph.D. programs in civil engineering, the applicant must

### Master of Science

1. Hold a baccalaureate degree from an educational institution of recognized standing.
2. Have adequate preparation in civil engineering, and show potential to undertake advanced study and research as evidenced by academic performance and experience.
3. At the baccalaureate level, have earned a cumulative grade point average (GPA) of at least 3.0 or equivalent to attain full standing.
4. For international applicants, a minimum TOEFL score of 525 (paper test) or 193 (computer test) is required for admission. Graduate Record Examination (general test) is also required.

### Doctor of Philosophy

1. Hold a baccalaureate degree or preferably a master's degree in civil engineering with a cumulative grade point average of at least 3.0 or equivalent at both the baccalaureate and master's levels.
2. Have adequate preparation in civil engineering, and show potential to undertake advanced study and research as evidenced by academic performance and experience.

Constitutive Modeling of Geologic Materials, Expansive Soils, Multiscale Modeling, Steered Molecular Dynamics, Computational Mechanics, Nanocomposite, and Bio-nanocomposites. Computational Biophysics

**Kalpana Katti, Ph.D.**
University of Washington, 1996
Research Interests:
Advanced Composites, Nanomaterials, Biomaterials, Biomimetics, Materials Characterization and Modeling, Analytical Electron Microscopy, and Microspectroscopy, Bone Tissue engineering

**Eakalak Khan, Ph.D.**
University of California, Los Angeles, 1997
Research Interests:
Water and Wastewater Quality, Water and Wastewater Treatment, and Storm Water and Non-point Source Pollution

**Wei Lin, Ph.D.**
SUNY at Buffalo, 1992
Research Interests:
Water and Wastewater Treatment, Hazardous Waste Management

**Charles McIntyre, Ph.D.**
Pennsylvania State University, 1997
Research Interests:
Risk Analysis and Decision Support Systems in Construction, Land Development

**Tang-Hung Nguyen, Ph.D.**
Pennsylvania State University, 1999
Research Interests:
Computer-Aided Engineering Design, Integration of Building Systems and Construction, Construction Materials

**G. Padmanabhan, Ph.D.**
Purdue University, 1980
Research Interests:
Stochastic Hydrology, Water Resource Systems, and Hydrologic Modeling

**Gary R. Smith, Ph.D.**
Purdue University, 1986

3. For international students, a minimum TOEFL score of 525 (paper test) and 193 (computer test). Graduate Record Examination (GRE) is also required.

Preferably, applications should be submitted directly to The Graduate School before January 5th for fall semester and May 20th for spring semester.

Official transcripts of all previous undergraduate and graduate records must be received by The Graduate School before the application is complete. When a transcript is submitted in advance of completion of undergraduate or graduate studies, an updated transcript showing all course credits and grades must be provided prior to initial registration at North Dakota State University.

Three letters of recommendation are required before action is taken on any application. Personal reference report forms are available from The Graduate School.

## Financial Assistance

Research and/or teaching assistantships may be available. Applicants are considered on the basis of scholarship, potential to undertake advanced study and research, and financial need. To be considered for an assistantship, a completed Graduate School application, official transcripts, and three letters of reference (and TOEFL and GRE results for international applicants) must be submitted to The Graduate School.

For teaching assistantships, a minimum TOEFL score of 600 (paper test) or 247 (computer test) is required.

## Degree Requirements

The Master of Science degree is offered in two options: the thesis option and the comprehensive study option. The first option emphasizes research, and the ability to analyze data and to prepare a scholarly thesis while the second option emphasizes a broader understanding of a more general field. The student and adviser select the appropriate option and develop a program of study consisting of at least 30 credit hours of graduate level material to meet individual educational goals. An overall GPA of 3.0 or better must be maintained. An oral defense of the research-based thesis or comprehensive study option paper is required.

The Doctor of Philosophy degree requires a total of 90 credits beyond the baccalaureate degree in civil engineering with an overall GPA of 3.0 or higher (60 credits beyond an M.S. degree in Civil Engineering or a sub-area of Civil Engineering) for graduation. A dissertation advisory committee should be formed and a plan of study filed by the end of first year after admission. A minimum of 30 hours of additional course work chosen by the student and his/her advisory committee from appropriate existing Civil Engineering graduate courses, new courses, and courses outside the department must be completed.

An M.S. degree from another institution may substitute for up to 30 credits of the 90 credits required; however, suitability of transfer or use of courses and research credits in the plan of study would be decided by the adviser and advisory committee.

A comprehensive preliminary exam is administered after completion of the greater portion of the course work. The committee chair will coordinate the examination. The format and duration will be determined by the committee. The student will present a research proposal within one year after the preliminary examination. A minimum of 30 and a maximum of 40 credit hours can be earned for research, preparation, and defense of a dissertation in Civil Engineering. A minimum of 12 credit hours in a minor or cognate area as deemed appropriate by the student and the advisory committee may be completed by the student. The student will defend his/her dissertation in a final examination attended by the advisory committee members and other academics.

Research Interests:
Quality Control and Systems Applications, Decision Analysis and Modeling Techniques, Safety Performance Measurement and Improvements in Labor Productivity

**Amiy Varma, Ph.D.**
Purdue University, 1993
Research Interests:
Transportation Systems and Planning, Traffic Engineering, Airports, and Infrastructure Management

**Jialai Wang, Ph.D.**
University of Akron, 2003
Research Interests:
Analytical and Applied Mechanics, Advanced Polymer Composite Materials in Civil Infrastructure (Infrastructure Composites), Mechanics of Composite Materials and Structures, Fiber Reinforced Plastic (FRP) Structural Shapes, Smart Composites and Structures, Structural Health Monitoring, Fracture of Bonded Interfaces (FRP-Wood and FRP-Concrete), Advanced and High Performance Materials for Highway Bridge Applications, Homeland Security Technology

**Frank Yazdani, Ph.D.**
University of New Mexico, 1987
Research Interests:
Structures, Constitutive Modeling of Materials, and Continuum Mechanics

**Douglas Chrisey, Ph.D. (adjunct)**
The University of Virginia,1987
Research Interests:
Novel laser fabrication of thin films and coatings of advanced electronic, sensor, and biomaterials.

**Ayman Smadi, Ph.D. (adjunct)**
Iowa State University, 1994
Research Interests:
Transportation Systems, Intelligent Transportation Systems, Freight Planning

**Denver D. Tolliver, Ph.D. (adjunct)**
Virginia Polytechnic University,

# Courses Offered

## Civil Engineering

**604 Reinforced Concrete* 3**
Principles of design and analysis of reinforced concrete members, flexural and shear design of rectangular and tee beams, serviceability criteria, short and slender columns. 2 one-hour lectures and 1 two-hour session. Prereq: CE 343.

**605 Advanced Reinforced Concrete 2**
Development and anchorage of reinforcement, details of reinforcement in flexural members, continuous beams and one-way slabs, slender columns, two-way slabs. 1 one-hour lecture and 1 two-hour session. Prereq: CE 404.

**610 Water and Wastewater Engineering 3**
Water quality principles included in treatment, disposal, reuse, and recycling of municipal water supplies and wastewaters. Theories and design procedures of water and wastewater treatment unit processes. 3 one-hour lectures. Prereq: CE 309, 370, 371.

**611 Design of Prestressed Concrete 2**
Theory and design of prestressed concrete structures, pre- and post-tensioning, loss of prestress, proportioning of flexural members, deflections. 2 one-hour lectures. Prereq: CE 404.

**617 Slope Stability and Retaining Walls 2**
Performance and design of retaining walls, sheet pile walls, braced walls, and reinforced earth. Also evaluation and mitigation of unstable earth slopes. 2 one-hour lectures. Prereq: CE 316.

**618 Transportation Engineering* 4**
Location, analysis, modeling, and design of multi-modal facilities, including highways, railways, airports, terminals, harbors, ports, canals, waterways, pipelines, and conveyor systems. 3 one-hour lectures and 1 two-hour session. Prereq: CE 204.

**619 Pavement Design3**
Design of flexible and rigid pavements, including subgrade, base courses, and surface courses; evaluation criteria, including soil, climate, traffic, material, and drainage; initial and maintenance cost considerations; construction practices. 2 one-hour lectures and 1 two-hour session. Prereq: CE 316.

**621 Open Channel Flow3**
Geometric and hydraulic properties of open channels, momentum and energy principles, design of channels for uniform flow, gradually varied and rapidly varied flow. 3 one-hour lectures. Prereq: CE 309.

**630 Timber and Form Design3**
Analysis and design of wood structures and concrete form work. 2 one-hour lectures and 1 three-hour session. Prereq: ME 223.

**641 Finite Element Analysis2**
Weak and strong solutions to governing differential equations in bars, boundary conditions, Galerkin approximation, nodal basis functions, shape functions. Two-dimensional problems with triangular and quadrilateral elements. 2 two-hour lectures.

**642 Matrix Analysis of Structures2**
Review of matrix algebra, flexibility and stiffness methods, direct stiffness method, introduction to finite element analysis. 2 lectures. Prereq: CE 343.

**644 Structural Steel Design* 3**
Design of metal structures, including mechanical behavior of metals; behavior and proportioning of tension and compression members; beams, beam columns, and

1989
Research Interests: Transportation , Planning and Economics

**Robert Zimmerman, Ph.D. (adjunct)**
North Dakota State University, 1991
Research Interests: Water and Wastewater Treatment, Solid Waste

connections; selection of metal structural systems. 2 one-hour lectures and 1 two-hour session. Prereq: CE 343.

**645 Advanced Steel Design 2**
Analysis and design of metal structures including connections, selection of structural systems. 1 one-hour lecture and 1 two-hour session. Prereq: CE 444.

**646 Basic Dynamics of Structures3**
Analysis of single degree of freedom structural systems to harmonic and general dynamic loading, free vibration of multiple degree of freedom systems, modal superposition, earthquake engineering. 3 one-hour lectures. Prereq: CE 343.

**651 Advanced Surveying 2**
Property description and legal land surveys. Astronomical observations to establish position and direction. State plane coordinates. 2 one-hour lectures. Prereq: CE 204.

**654 Geometric Highway Design 3**
Location and design of highways and streets; design controls; elements of design; cross-section and alignment; design of intersections, interchanges, safety appurtenances, and noise barriers. 2 one-hour lectures and 1 two-hour session. Prereq: CE 418.

**655 Airport Planning and Design 2**
System planning and demand forecasting; siting and configuration of airports; aircraft characteristics; air traffic controls; standards for geometric design, pavement design, earthwork, drainage, lighting, and marking. 2 one-hour lectures. Prereq: CE 418.

**656 Railroad Planning and Design 2**
Rail planning and location analysis, track/rail structure, track layout and control system, locomotives and train resistance, track safety standards and geometrics, terminal design. 2 one-hour lectures. Prereq: CE 418.

**657 Pavement Management Systems 2**
Pavement design, maintenance, and rehabilitation strategies; planning, budgeting, and programming for pavement management at network and project levels; development, design, and maintenance of pavement management systems. 2 one-hour lectures. Prereq: CE 418, 419.

*Courses CE 604, 618, and 644 are not acceptable for credit in graduate programs in Civil Engineering (M.S. or Ph.D.).

**661 Foundation Engineering 2**
Performance and selection of the following foundations: shallow, mat, combined pile, and drilled piers. 2 one-hour lectures. Prereq: CE 316.

**662 Designing with Geosynthetics 2**
Theories, principles, and engineering design using geosynthetic materials for a variety of civil engineering applications. Applications to geotechnical, environmental, transportation, and water resources fields are emphasized. Includes construction issues. Prereq: CE 316.

**671 Water and Wastewater Laboratory 2**
Emphasis on recent developments in and standard methods of water and wastewater analysis. Studies of efficiency, operation, and evaluation of water and wastewater treatment.
1 one-hour lecture and 1 three-hour laboratory. Prereq: CE 408, 410.

**672 Solid Waste Management 3**
Basic study of solid waste materials, current collection methods, available disposal techniques, recycling and resource conservation, and economics of solid waste collection and disposal. 3 one-hour lectures. Prereq: CE 370, 408.

**673 Air Pollution 3**

Fundamentals of air pollution and its control technology. Types and sources of air pollutants; meteorology; effects on plants, animals, people, and property. Design of control equipment. 3 one-hour lectures and 1 three-hour laboratory. Prereq: CE 370.

**677 Applied Hydrology 3**

Scope of hydrology, probabilistic concepts in water resources, regional frequency analysis, application of risk concepts to hydrologic design, hydrologic data generation for ungaged watersheds, hydrologic modeling. 3 one-hour lectures. Prereq: CE 408.

**678 Water Quality Management 3**

Physical, chemical, biological, hydrological characteristics, and hydrodynamic elements of receiving waters. Characterizations, measurement, and modeling methods of river/ streams, lakes/reservoirs, wetlands, and groundwater systems. 3 one-hour lectures. Prereq: CE 370, 371, 408.

**679 Advanced Water and Wastewater Treatment 3**

Principles of treatment, application, and disposal of water and wastewater sludge; theory and design of biological and physico-chemical unit processes for advanced water and wastewater treatment. 2 one-and-a-half hour lectures. Prereq: CE 370, 371, 410.

**686 Fundamentals of Nanotechnology and Nanomaterials 3**

Principles of nanotechnology and nanomaterials, tools of nanotechnology, nanoscale materials characterization, nanoscale physics, processing, current trends in nanotechnology. Prereq: Graduate standing in science or engineering.

**701 Theory of Elasticity 2**

A theoretical study of linear elasticity, Saint Venant's problems, plain stress, plain strain, strain energy, and torsion. 2 one-hour lectures.

**702 Plates and Shells 2**

Theoretical and applied study of the classical theories of plates and shells as they pertain to engineering problems, including small displacement of rectangular and circular plates and thin shells. 2 one-hour lectures.

**706 Plastic Design in Structural Steel 2**

Inelastic bending of beams and frames; application of upper and lower bound theorems; calculation of deflection; effect of axial and shearing forces on flexural strength, connections, structural safety, and rules of plastic design. 2 one-hour lectures.

**707 Numerical Methods in Structural Engineering 3**

Methods of successive approximations in stress, vibrations, and stability analysis of structural members and frames; numerical methods for the calculation of beam deflections, buckling of nonuniform columns, diaphragms, and webs. 3 one-hour lectures.

**709 Dynamics of Structures and Foundations 2**

Advanced topics in structural dynamics, frequency domain response, generalized coordinates, nonlinear structural response, dynamic analysis of framed structures, structures with distributed properties, seismic design considerations. 2 one-hour lectures. Prereq: CE 446.

**712 Ductile Structures 2**

Ductile behavior of reinforced concrete structures, failure criteria, ductility of confined concrete, moment/rotation behavior of reinforced concrete members, collapse mechanism, and limit analysis. 2 one-hour lectures.

**713 Structural Mechanics 2**

Elements of classical mechanics: stress, strain, stress-strain relations, two-dimensional problems in elasticity, torsion, axisymetrically loaded elements. Introduction to plates and shells. 2 one-hour lectures.

**714 Theory of Elastic Stability 2**
Bending of beams under simultaneous action of axial and lateral loads, buckling of compressed bars in both the elastic and plastic ranges, design formulas, lateral buckling of beams. 2 one-hour lectures.

**720 Continuum Mechanics 3**
Tensor analysis in affined and metric spaces, kinematics of motion, general principles of continuum mechanics, thermodynamics of deformation, and postulates on constitutive laws. 3 one-hour lectures. Cross-listed with ME.

**722 Theory of Models 2**
Physical, analog, mathematical, and computer models; application of dimensional analysis to physical hydraulic model studies, scaling ratios, distorted models. 2 one-hour lectures. Prereq: CE 309.

**725 Introduction to Biomaterials; Materials in Biomedical Engineering 3**
Materials used for replacement of biological tissues, types of biomaterials, synthesis, properties and biocompatibility of metallic, ceramic, polymeric and composite biomaterials, includes current trends in use of biomaterials.

**762 Advanced Foundation Engineering 2**
Advanced topics in performance and design of foundations. Current topics include a two-dimensional finite element analysis of the foundation and its supporting soil. 2 one-hour lectures. Prereq: CE 461/661.

**768 Advanced Water and Wastewater Laboratory 3**
Studies on selected processes, efficiency and evaluation of water and wastewater treatment. Selected methods of water and wastewater analyses. 2 one-hour lectures and 1 three-hour laboratory. Prereq: CE 370, 371, or instructor's permission.

**770 Hazardous Waste Management 3**
Characterization of hazardous waste, legislation related to hazardous waste, brief toxicology, environmental audits, pollution prevention, hazardous water treatment/ remediation technologies and disposal. 3 one-hour lectures. Prereq: CE 370, 408

**771 Rural and Non-Metropolitan Transportation Systems 3**
See Agribusiness and Applied Economics for description.

**772 Rural Logistics and Distribution Management 3**
See Agribusiness and Applied Economics for description.

**774 Statewide Transportation Planning 3**
See Agribusiness and Applied Economics for description.

**776 Groundwater and Seepage 3**
Groundwater as a resource; relation to hydrologic cycle, well hydraulics, seepage, ground-water quality and contamination; groundwater flow models. 3 one-hour lectures. Prereq: CE 408.

**778 Transportation Administration 3**
See Agribusiness and Applied Economics for description.

**780 Transportation Planning 3**
Development and trends in travel demand forecasting; trip generation, trip distribution, mode choice, and traffic assignment; transportation plans for modal, multi-modal, and paratransit alternatives; policy formulation and analysis. 3 one-hour lectures. Prereq: CE 418.

**781 Traffic Engineering 3**
Traffic characteristics, studies, and control devices; operations analysis and design; aspects of signing, signalization, markings, and lighting; accident analysis; traffic laws and ordinances; work zone safety practices. 2 one-hour lectures and 1 two-hour

laboratory. Prereq: CE 418.

Variable credit courses are also offered:

**790 Graduate Seminar 1-3**

**793 Individual Study/Tutorial 1-5**

**796 Special Topics 1-5**

**798 Master's Thesis 1-10**

## Construction Management and Engineering

**603 Scheduling and Project Control 4**
Includes theories, principles, and techniques of construction planning and scheduling; emphasizes the management of time, costs, and other resources through the preparation and analysis of network schedules. Computer applications. 4 lectures. Prereq: CM&E 411.

**611 Construction Cost Estimating 2**
Topics include quantity takeoffs, labor, materials, equipment, overhead cost, profit, and bidding strategies. Computer applications. 2 lectures. Prereq: CM&E 370.

**612 Construction Management 3**
Concepts of development and organization of projects, project contract administration, and project delivery systems; management methods; management information systems, constructability review, and value engineering; construction productivity. 3 lectures. Prereq: CM&E 403.

**625 Decision Making and Risk Analysis 3**
Decision making and decision theory. Decision support systems, and applied risk identification and analysis in construction activities. Computer applications.

**630 Land Development 3**
Practical applications of the planning, design, and construction phases of the land development process. Computer applications. 3 lectures. Prereq: CE 204 or departmental approval.



E-Mail: The Graduate School
Prospective students may schedule a visit by calling 1-800-488-NDSU.
The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701-231-7633

## Current Faculty

**Gordon P. Bierwagen, Ph.D.**
Iowa State University, 1968
Research Interests:
Surface chemistry of coatings materials, corrosion, electrochemistry of coatings, coating lifetime prediction, concentrated random composites

**Bret Chisholm, Ph.D.**
University of Southern Mississippi, 1993
Research Interests:
Combinatorial chemistry methods for coatings, novel organic-inorganic coatings applications, new polyester nanocomposites

**Stuart G. Croll, Ph.D.**
University of Leeds, UK, 1974
Postdoctoral:
National Research Council, Canada
Research Interests:
Weathering durability of coatings, physical chemistry and suspension stability, pigment-polymer interactions, film formation processes, coating and polymer physics

**Dean Webster, Ph.D.**
Virginia Polytechnic Institute and State University 1984
Research Interests:
Synthesis of high performance polymers, polymerization reactions, crosslinking chemistry, and quantitative structure-property relationship

# Coatings and Polymeric Materials

## Program Description

The Department of Coatings and Polymeric Materials offers graduate studies leading to the M.S. and Ph.D. degrees in Polymers and Coatings Science. A mission of the departmental research is to bridge a gap between basic and applied research in the field of polymers and coatings. Such philosophy provides a unique atmosphere and opportunities for cross-disciplinary research experience, which is often accomplished by the multi-disciplinary research activities with other departments, for example, chemistry or engineering departments. Advanced research work involves specialized training in the following areas: colloidal and interfacial chemistry of polymers and coatings, polymer synthesis, adhesion, durability, spectroscopy of polymers and coatings, corrosion control by coatings, electrochemistry of coatings, nanomaterials design and synthesis, and rheology. The department has an industrial advisory board consisting of leading industrial scientists and/or former graduates who often help provide new directions to the program.

First-year students who enter the program take qualifying examinations, which are used by the graduate committee primarily for advisory purposes. During the fall semester, the faculty meet with the new students to acquaint them with the research programs in the department. Because students are required to select an advisor and examining committee by the end of the first year in residence, they are strongly urged to discuss research opportunities with faculty members.. Programs are individually tailored to the needs of each student.

## Admissions Requirements

The Department of Coatings and Polymeric Materials graduate program is open to all qualified graduates of universities and colleges of recognized standing. To be admitted with full status to the program, the applicant must:

1. Hold a baccalaureate degree from an educational institution of recognized standing.
2. Have adequate preparation in a science or engineering, field, and show potential to undertake advanced study and research as evidenced by academic performance and experience.
3. At the baccalaureate level, have earned a cumulative grade point average (GPA) in all courses of at least 3.0 or equivalent. Students with a previous graduate degree with a GPA of 3.0 or equivalent may be admitted in full standing.

Students who do not meet all requirements for admission or have deficiencies in prerequisite course work, but show potential for successful graduate study, may be admitted under a conditional status. Evidence must be provided showing that the applicant's record does not adequately reflect on his/her potential. The student may not earn more than 12-semester graduate credits in the conditional

## Research Faculty

**Victoria Johnston Gelling, Ph.D.**
North Dakota State University, 2001
Research Interests: Corrosion control of active metal substrates by environmentally friendly coating, electroactive conducting polymers (ECPs) as corrosion inhibitors, electrochemical experimental techniques for the examination of coated substrates

## Adjunct Faculty

**Matthew S. Gebhard**
(currently at Rohm and Haas Company)
Stanford University, 1990
Research Interests: Rheology in coatings processes, final film properties, architectural binder technology

**Loren W. Hill, Ph.D.**
(currently a consultant)
Pennsylvania State University, 1965
Research Interests: Structure-property relationships of thermoset coatings, dynamic mechanical analysis

**Theodore Provder, Ph.D.**
(currently director of Coatings Research Institute, Eastern Michigan University)
University of Wisconsin, 1965
Research Interests: Chromatographic and separation methods of polymers, particle size measurements

**Richard R. Roesler, Ph.D.**
(currently at Bayer Corporation)
University of Washington, 1969
Research Interests: Blocked polyisocyanates,

status. After meeting the specified standards of performance set by the department, the student, in consultation with the major adviser, may request a change to full graduate standing. The request for change must be submitted to the Dean of the Graduate School by the adviser and approved by the departmental graduate program director or chair.

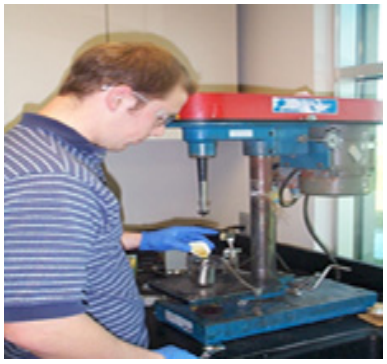
Although there is no application deadline, the applicants are encouraged to submit all application materials to the Graduate School before April 15th of the upcoming academic year.

Official transcripts (transcripts having an appropriate seal or stamp) of all previous undergraduate and graduate records must be received by the Graduate School before the application is complete. When a transcript is submitted in advance of completion of undergraduate or graduate studies, an updated transcript showing all course credits and grades must be provided prior to initial registration at North Dakota State University.

Three letters of recommendation are generally required before action is taken on any application. Personal reference report forms, as well as other application forms, can be obtained from the Graduate School or the Department of Coatings and Polymeric Materials.

The TOEFL examination is required of international applicants. A score of 550 or greater must be achieved. General Graduate Record Examinations (GRE) scores are also required of international students and domestic students. GRE subject scores are highly recommended, but not required for both international and domestic students.

### Financial Assistance



The student must first be accepted in full or conditional status before he/she is eligible for an assistantship in the Department of Coatings and Polymeric Materials. To be considered for an assistantship, a completed Graduate School application, official transcripts, and three letters of reference must be submitted no later than April 15. International students must also submit a TOEFL score. General and subject GRE scores are highly encouraged if they are available to the student.

Graduate students are supported during both the academic year and summer months by either teaching or research assistantships. The current monthly stipend is $1,300 - $1,700+ per month, for an annual stipend of $15,600 - $20,400+. University tuition is waived for all qualified TA's and RA's.

### Degree Requirements

The Master of Science programs require the completion of 16 credits of letter-graded course work with an overall GPA of 3.0 or better. The Ph.D. option requires the completion of 27 credits of letter-graded course work with an overall GPA of 3.0 or better.

Each student must choose a thesis adviser within three to six months of beginning graduate school. By the end of the first semester in residence, the student selects a research adviser and, by the end of the first year, an examining committee. This committee advises the student and administers oral examinations.

polyurethane pispersions, high solids amine functional coreactants for polyisocyanate

**Brian S. Skerry, Ph.D.**
(currently at Sherwin-Williams)
University of Manchester, UK, PhD 1980
Research Interests: Corrosion and coatings

## Emeritus Faculty

**Juergen H. Braun, Ph.D.**
(adjunct professor emeritus, retired from DuPont)
University of Texas, 1956

**Zeno W. Wicks, Jr., Ph.D.**
(professor emeritus)
University of Illinois, 1944

Candidates for the M.S. program normally satisfy course requirements within one year of study. Ph. D. candidates typically take about one and a half years to complete courses, leaving later years for full-time dissertation research.

Candidacy qualifying examinations are administered twice annually. All Ph.D. candidates are required to pass the qualifying exam and defend an original written research proposal at least eight months prior to the final dissertation examination. The proposal topic must be approved by the student's advisory committee, which administers the oral exam. Following completion of dissertation research and the presentation of an acceptable written dissertation, the candidate defends before the advisory committee.

### Research Facilities and Equipment

The Department of Coatings and Polymeric Materials is housed in a new building in the NDSU Research and Technology Park on the northwest corner of the campus. This new building, which will be part of a three-building complex when all are finished, consists of nearly 40,000 square feet of floor space for research and teaching. The holdings in the Klosterman Chemistry Library (second floor of Ladd Hall) include current subscriptions to more than 200 journals, monographs, and other reference materials. Graduate students and faculty have round-the-clock access seven days a week.

Modern equipment and instrumentation have profoundly influenced the development of instruction and are the cornerstones of research in the chemical sciences. The Department of Coatings and Polymeric Materials offers instrumentation ranging from the most modern spectrometers to coatings and paints making and testing equipment. While more expensive research facilities, for example, state-of-the-art electron and optical microscopy laboratories, are readily available to all researchers on the NDSU campus, great efforts have been made to assure that the research equipment is sufficient to meet the needs of modern research. Some noteworthy acquisitions of the past few years include 400 MHZ and 270 MHZ NMR spectrometers, a gas chromatrograph-mass spectrometer (GC-MS), Fourier transform-mass spectrometer, Fourier transform infrared spectrometers with all necessary surface accessories and step-scan capabilities, FT-IR and FT-Raman microscopies, color measuring apparatus, pulsed laser systems (several with tunable dye lasers) and other optical hardware, a tunable infrared diode laser, all with their own dedicated computers. Scanning probe microscopes (AFM, scanning thermal microscope, and a Kelvin Probe microscope), routine electrochemical testing equipment for EIS, ENM and other electrochemical measurements on coatings, a scanning vibrating electrode technique equipment are also available. Facilities for Langmuir monolayer thin film preparation and characterization, including three KSU trough systems capable of in-situ UV-Vis spectroscopic studies. Other facilities include differential scanning calorimetry, dynamic mechanical thermal analysis, mechanical testing, gel permeation chromatography, viscosity measurements, UV visible absorbance, fluorescence, atomic absorption, as well as cyclic salt fog chambers and UV exposure equipment for durability studies, etc. are also available. Other, more specialized instrumentation include static/dynamic surface tension and contact angle apparatus, viscometers, color and foam characterization devices.

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## Courses Offered

**673 Polymer Synthesis (3 Cr)**
Catalysts and mechanisms in the chain-growth and step-growth synthesis of macromolecules from polyesters of the 30s to engineering polymers of the 90s. Prereq. Chem 342.

**674 Coatings I (3 Cr)**
Principles of film formation, synthesis, structure-property relationships, coatings solvents; pigments and their dispersion. Prereq. Chem 342.

**675 Coatings II (3 Cr)**

Physical properties of coatings and their components; formulation, design, testing, and applications; color, adhesion, and rheology. Prereq. P&C 474/674.

**684 Coatings I--Laboratory (2 Cr)**
Polymer synthesis, coating characterization, and properties. Laboratory counterpart to P&C 474/674. Coreq. P&C 474/674.

**685 Coatings II--Laboratory (2 Cr)**
Coating formulation; testing, color measurements, synthesis, application methods. Laboratory counterpart to P&C 475/675. 1 six-hour laboratory. Hours flexible. Coreq. P&C 475/675.

**686 Corrosion and Its Control by Coatings (2 Cr)**
Corrosion science: electrochemistry of corrosion, corrosion effects, measurement of corrosion, corrosion control by coatings, characterization of coating protection, accelerated testing. Prereq. or Coreq. Chem 430; Coreq. P&C 474/674, 475/675. Cross-listed with Chem.

**771 Modern Methods of Polymer Characterization (3 Cr)**
Polymer physics and physical (dynamic mechanical analysis, chromatographic and thermal analysis) methods for characterization of polymers and coatings. Prereq. Chem 365 or departmental approval.

**773 Organic Chemistry of Coatings (3 Cr)**
Advanced topics in organic chemistry as used in coatings including polymer synthesis, crosslinking reactions, and molecular degradation reactions in coating films. Prereq. P&C 473 and 475, and Chem 741 or departmental approval.

**775 Color and Appearance (3 Cr)**
Topics in color and appearance in coatings and weathering of coatings, including numerical methods for opacity and color measurement, computer color matching methods, and color methods in coatings, inks and computers.. Prereq: P&C 475/675.

**778 Physical Chemistry of Polymers (4 Cr)**
Introduction to rheological concepts and the flow behavior of macromolecules. Transitions in polymers, molecular weight characterization, blend compatibility, composite behavior, and other topics, e.g., drug release and liquid crystals. Prereq: P&C 473/673.

**782 Physical Chemistry of Coatings (3 Cr)**
Surface chemistry diffusion in coatings, colloid stability, advanced CPVC concepts, film formation, particle size effects, and theories of coating application methods. Prereq: Chem 365; Prereq: P&C 474/674.

**796 Topics in Supramolecular Chemistry (3 Cr)**
Supramolecular chemistry as a non-covalent bond synthetic tool in material design and development. Prereq. P&C 473, 475 or departmental approval.

The following variable credit courses are also offered:

**690 Graduate Seminar (M.S) 1-3**

**790 Graduate Seminar (Ph.D.) 1-3**

**793 Individual Study/Tutorial 1-5**

**795 Field Experience 1-15**

**796 Special Topics 1-5**

**798 Master's Thesis 1-10**

**799 Doctoral Dissertation 1-15**

## Graduate Faculty

701- 231-8221

### Faculty Listing

**Edward Deckard, Ph.D.**
Professor of Plant Sciences
University of Illinois, 1970

**Charles McIntyre, Ph.D.**
Associate Professor and Chair of Construction Management and Engineering
Pennsylvania State University, 1996

**Donald Miller, Pharm.D.**
Professor of Pharmacy Practice
University of Michigan, 1978

**Lisa Montplaisir, Ph.D.**
Assistant Professor of Biological Sciences
University of Arizona, 2003

**Donald Schwert, Ph.D.**
Professor of Geosciences
University of Waterloo, 1978

**Deanna D. Sellnow, Ph.D.**
Director-Graduate Certificate in College Teaching
Professor of Communication
University of North Dakota, 1991

**Justin Wageman, Ph.D.**
Assistant Professor of Education
University of North Dakota, 1999

**Richard Warner, Ph.D.**
Assistant Professor of Education
University of Illinois at

# College Teaching Certificate

## Program Description

The Graduate Certificate Program in College Teaching provides a structured program in pedagogy for graduate students across campus who plan to teach in a college or university. Students study contemporary education research focused on higher education issues, as well as gain experience in the teaching and learning process through microteaching modules, field experience, peer observations, and a structured practicum.

## Admissions Requirements

To be admitted to the program, the applicant must:

1. Hold a baccalaureate degree from an educational institution of recognized standing.
2. At the baccalaureate level, have earned a cumulative grade point average (GPA) in all courses of at least 3.0 on a 4.0 scale.
   Applications should be submitted directly to the graduate school. Applications should specify the Graduate Certificate Program in College Teaching.

## Degree Requirements

Required Core (7 credits):

| Hours | Course Name | Semester |
|---|---|---|
| HUM/COMM 702 | Introduction to College Teaching (Didactic) | 3 (Fall) |
| EDUC 794 or COMM794* | Practicum | 1 (Every Semester) |
| EDUC 795 or COMM795* | Field Experience/Internship | 3 (Every Semester) |

Urbana-Champaign, 1975

Electives (at least 2 credits from among these didactic courses):

| | | | |
|---|---|---|---|
| EDUC | 722 | Instructional Systems, Media and Methods | 2 (Spring) |
| EDUC | 724 | Advanced Educational Psychology | 2 (Summer) |
| EDUC | 717 | Adult Learning | 2 (Fall & Summer) |
| EDUC | 780 | Instructional Models | 2 (Fall & Summer) |
| BIOL/EDUC | 705 | Teaching College Science | 3 (Spring) |

TOTAL: 9

*Refers to courses that have been cross-listed to be taken under a prefix in the student's major field.
**These courses are taught every other summer.

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## Courses Offered

The program consists of 9 credits. The core requirements are:

- COMM 702: Introduction to College Teaching (3 credits)
  - This course is designed to introduce students to pedagogical philosophy and practice in higher education. Ideally, students begin their certificate program with this course.
- EDUC/COMM/XXXX 794: Practicum (1 credit)
  - This practicum is taken in conjunction with 795 as a capstone for the certificate. Weekly meetings and observations provide guidance as students teach a course for their field experience.
- EDUC/COMM/XXXX 795: Field Experience (3 credits)
  - This field experience is an opportunity for students to teach a course at the college level with structured guidance by a team of seasoned professionals. It is taken in conjunction with 794 as a capstone for the certificate.

Electives (students earn at least 2 credits from among the following):

- EDUC 702: Instructional Systems, Media and Methods (2 credits)
- EDUC 724: Advanced Educational Psychology (2 credits)
- EDUC 717: Adult Learning (2 credits)
- EDUC 780: Instructional Models (2 credits)
- BIOL/EDUC/XXXX 705: Teaching College Science (3 credits)
- Others (must be approved by the Certificate Program Director)

## Graduate Faculty

701-231-7705

**Ann Burnett, Ph.D.**
University of Utah, 1986
Research Interests:
Legal Communication, Small Group Communication

**Ross F. Collins, Ph.D.**
University of Cambridge, 1992
Research Interests:
Media History, International Media

**Robert S. Littlefield, Ph.D.**
University of Minnesota, 1983
Research Interests:
Intercultural Communication, Rhetoric, Public Address, Forensic Pedagogy

**Mark Meister, Ph.D.**
University of Nebraska, 1997
Research Interests:
Rhetorical and Critical Theory, Environmental Communication

**Paul E. Nelson, Ph.D.**
University of Minnesota, 1968
Research Interests:
Educational Administration, Basic Course Pedagogy, Persuasion

**Amy O'Connor, Ph.D.**
Purdue University, 2003
Research Interests:
Organizational Communication, Health Communication, Advertising

**Charles Okigbo, Ph.D.**
Southern Illinois University, 1982
Research Interests:
Social and Behavioral Change Communication, Health Communication

**Judy C. Pearson, Ph.D.**
Indiana University, 1975
Research Interests:
Communication Education, Family Communication, Technology and Education, Research Methods

# Communication

## Program Description

The graduate program in communication offers graduate study leading to the M.A., M.S., and Ph.D. degrees. The program prepares students for advanced graduate work, management-level positions, teaching or advancement within their current careers.

The department tailors student research projects and academic programs to individual needs and interests. Students may take interdisciplinary graduate course work to enhance their program of study. For more information, please contact the director of graduate studies for the master's program (Mark.Meister@ndsu.edu), director of graduate studies for the Ph.D. program (Judy.Pearson@ndsu.edu), or department head at 701-231-7705. Information also is available on the department's Web site, www.ndsu.edu/communication.

## Admissions Requirements

### Master of Science or Arts

Programs are open to students holding baccalaureate degrees from accredited universities or colleges. To be admitted with full status to the program, the applicant must

1. Have adequate study in communication, journalism or a related area; and demonstrate potential for advanced study and research as evidenced by academic performance and experience.
2. Have earned at the baccalaureate level a cumulative grade point average (GPA) of at least 3.25 or equivalent.
3. Provide a score for the Graduate Record Examination (GRE).

### Doctor of Philosophy

### Direct-to-doctorate program

Direct-to-doctorate students are selected from among persons with an undergraduate degree, a GPA of 3.50 or higher, and a Graduate Record Examination (GRE) score of 1200 or higher in the combined score for verbal and quantitative areas.

### All other doctoral applicants must

1. Have an undergraduate GPA of 3.25 or higher in communication or a related area. If

**Deanna Sellnow, Ph.D.**
University of North Dakota, 1991
Research Interests: Communication Education, Popular Culture

**Timothy L. Sellnow, Ph.D.**
Wayne State University, 1987
Research Interests: Organizational Communication, Crisis Communication

the undergraduate record is more than 10 years old, the graduate committee may evaluate a candidate's employment in responsible management or professional positions as an alternative to the 3.25 GPA requirement. However, applicants must meet The Graduate School minimum GPA of 3.0 for full standing status.
2. Provide a score for the Graduate Record Examination (GRE).
3. Provide transcripts for undergraduate and master's degree in communication or a related area.
4. Include a writing sample (e.g., thesis, publication or term paper).
5. Include a current curriculum vita.
6. Include three letters of recommendation. (Personal reference reports are available from The Graduate School or Graduate Bulletin.)

Students who fail to meet these requirements for full status, or who have deficiencies in background preparation but demonstrate potential for successful graduate study, may be admitted under a conditional status. In general, evidence must be offered demonstrating that an applicant's potential is not reflected by the academic record. Students who do not show sufficient evidence of communication study at the undergraduate level may be asked to complete certain undergraduate course work in addition to graduate requirements. After meeting The Graduate School standards, the student may request a change to full graduate standing. The student may not earn more than 12 semester graduate credits in conditional status. The request for change of status must be submitted to the Dean of The Graduate School by the major adviser and approved by the department head.

The Department of Communication welcomes international students, but English language facility is a must. International students must have a minimum of 600 on the paper-based TOEFL, a 250 on the computer-based TOEFL, a 100 on the Internet-based TOEFL or a minimum 7 on the International English Language Testing System (IELTS).

## Financial Assistance

Students admitted at full or conditional status may apply for teaching assistantships at the master's degree level or at the doctoral level. Teaching assistants teach two speech fundamentals classes or media writing classes each semester. Doctoral-level teaching assistants teach two classes each semester. Depending on experience, a portion of the assistantship may be devoted to assisting with other communication courses. Teaching assistantship deadline is Feb. 15 for the following fall semester.

Graduate assistants receive a stipend and tuition waiver. Applications are available from the department office or online from the department's Web site (www.ndsu.edu/communication). Other assistantships requiring specialized media knowledge may be available through other university offices.

## Degree Requirements

### Master's program

The Master of Arts or Master of Science program requires completion of a minimum 30 credits of course work with an overall GPA of 3.0 or above. All students must elect to complete a research-based thesis for 6 credits or a paper/experiential project for 3 credits. The degree candidate defends the thesis or paper in an oral examination.

### Requirements for the M.A. Degree in Communication (30 credits minimum)

**Core Courses (6 credit hours)**

**Comm 700 Research Methods in Communication**
**Comm 711 Communication Theory**

**Research Tools**

Two of the following, one of which must be Comm 708 or Comm 767:

**Comm 767 Rhetorical Criticism**
**Comm 708 Advanced Qualitative Methods in Communication**
**Comm 710 Advanced Quantitative Methods**
**Stat 725 Applied Statistics**

**Elective Specialization**

12-15 credits of additional course work, depending on whether the thesis or paper/project option is selected.

**Thesis/Paper**

6 credits of thesis (798) or 3 credits of paper (797).

## Requirements for the M.S. Degree in Communication (30 credits minimum)

**Core Courses (6 credit hours)**

**Comm 700 Research Methods in Communication**
**Comm 711 Communication Theory**

**Research Tools**

Two of the following, one of which must be Comm 710 or Stat 725:

**Comm 767 Rhetorical Criticism**
**Comm 708 Advanced Qualitative Methods in Communication**
**Comm 710 Advanced Quantitative Methods**
**Stat 725 Applied Statistics**

**Elective Specialization**

12-15 credits of additional course work, depending on whether the thesis or paper/project option is selected.

**Thesis/Paper**

6 credits of thesis (798) or 3 credits of paper (797).

## Doctor of Philosophy

The Ph.D. requires 60 semester hours beyond the master's degree. The 60 or more hours must be in a planned course of study approved and overseen by the student's adviser and advisory committee. The student's program will often contain more than the minimum 60 hours. Students with a master's degree in another discipline may be required to complete additional graduate course work in specific areas of communication deemed necessary by the student's adviser and advisory committee. Graduate work taken beyond the master's degree may be judged applicable by the advisory committee, but post-master's graduate credits beyond 9 semester hours will not count toward the 60-hour minimum required for the Ph.D.

To complete the program, students must demonstrate a/an

1. thorough grasp of perspectives on the nature of communication as an applied science and the process of theory construction and testing.
2. broad knowledge of theories and research in various applied communication contexts.
3. in-depth knowledge of the communication context chosen as the student's area of specialization.
4. competence in a cognate field which supports the student's area of specialization.

5. broad knowledge of various communication research methods and statistical procedures, with expertise in either qualitative or quantitative methodologies.

## Requirements

**A. Minimum of 30 credit hours in didactic courses to include**

1. **Core Courses (12 credit hours)**
   Comm 700 Research Methods in Communication
   Comm 711 Communication Theory
   Comm 705 Advanced Communication Theory
   Comm 701 Action-Oriented Research for Communication Professionals
   (Note: Persons with a communication master's degree may be exempt from one, or more, of these core courses.)
2. **Major Concentration:** Minimum of 21 credit hours of courses including a major concentration. (Generally, the core courses will not comprise a portion of the concentration.)
   Minimum of 15 credit hours in the departmental 700-789 courses.
   Minimum of 6 credit hours at the 700-789 level in a cognate area outside the department that represents a coherent unit of study (such as education, sociology, psychology, or business).

**B. 30 credit hours in research and research courses to include**

1. **Research Courses**
   Minimum of 15 total credit hours of research courses. Of these, a minimum of 12 credit hours of didactic research courses (6 credit hours may be transferred from the master's degree).
   A maximum of 9 credit hours of independent study conducting research.
2. **Dissertation Credit Hours**
   Minimum of 15 credit hours of dissertation research. The department does not limit the number of dissertation credit hours.

## Comprehensive Synthesis

When course work is nearly completed, doctoral students will meet with their advisers to determine if they are prepared to write a synthesis of the student's course work, in consultation with the Director of Doctoral studies, presentations and publications, teaching or other applied work, and professional or other service.

When the adviser and Doctoral Director agree, the student will compose a scholarly comprehensive synthesis. After completion, the doctoral committee will evaluate the written work. If the committee deems the work to be generally acceptable, the adviser will schedule an oral examination, during which the student will defend his or her composition. If the work is unacceptable, the student may be offered a second chance to rewrite the composition. A student whose work is generally acceptable may or may not pass the oral portion of the preliminary examination. If the committee is willing, the student will be allowed a second opportunity to defend his or her answers orally. Students can be offered a maximum of two attempts to complete the written or oral portions of the comprehensives. (For a complete description of the comprehensive synthesis, please see the doctoral program description at www.ndsu.edu/communication/Phdstudy/html.)

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# Courses Offered

**602 Contemporary Rhetoric 3**

Examination of the use of public address in the contemporary culture to identify styles of usage and ethical practices employed by communicators.

**633 Legal Communication**
Examines communication in the legal process, including interviewing, negotiation, jury selection, opening statements, witness examination, closing arguments, and deliberation.

**634 Communication Law 3**
Exploration of speech and press protections of the First Amendment. Topics include libel, privacy, electronic media regulation, and speech regulation.

**635 Popular Culture and Mass Media 3**
Analysis of popular culture messages (programming, content, and advertising) presented by the media as an expression of social values. Mediums include television, cinema, music, and radio.

**636 Issues in Mass Communication 3**
Topical studies of media technologies and organizations in interaction with social, cultural, political, and economic realities. Media's impact on national life and thought. May be repeated.

**642 Information Technologies and Mass Media 3**
Study of mass media programming and management with an emphasis on the impact of new information technologies.

**643 Mass Media and Public Opinion 3**
Overview of theories and methodologies used in the study of the role of mass media in attitude formation, attitude change, and public opinion.

**650 Issues in Communication 3**
Theory and philosophy of research issues in the field of communication. May be repeated.

**672 Public Relations Campaigns 3**
Social science research as applied to public relations, case study analysis, construction, and implementation of public relations campaigns. Prereq: Comm 370 or departmental approval.

**680 Health Communication 3**
Designed to help individuals communicate in the health professions. Exploration of professional behavior as communication, staff-client communication, and team communication in the healthcare setting.

**700 Research Methods in Communication 3**
Introduction to research planning and design, methods of research, and presentation of research results.

**701 Action-Oriented Research for Communication Professionals 3**
Introduction to the doctoral program in communication. Will explore concepts including engaged learning, service learning, problem-based learning, collaborative learning, learner-centered education, the scholarship of teaching, and role of social justice in this emerging research genre.

**705 Advanced Communication Theory**
Provides doctoral students with a structured forum for discussion of communication theory and research. Prereq: Comm 611 or Comm 637.

**706 Advanced Interpersonal Communication 3**
Interpersonal communication theory and research methods are developed from the perspectives of uncertainty reduction, conflict management, relationship reciprocity, constructivism, compliance gaining, discourse dominance, and relational dynamics.

**708 Advanced Qualitative Methods in Communication 3**
In-depth application of one of the methods used in qualitative communication research. Prereq: Soc 700.

**710 Advanced Quantitative Methods 3**
Application of quantitative methods to communication research, with an emphasis on testing theoretically derived hypotheses, operationalizing variables, designing valid and reliable measures, implementing a research design, analyzing data, and reporting findings. Prereq: Soc 701 or Stat 725.

**711 Communication Theory 3**
Major theoretical approaches to the study of communication from a social scientific tradition.

**715 Theories of Small Group Communication 3**
Survey of theoretical constructs of communication in the small group setting. Examination of current methods of research.

**721 Intercultural Communication 3**
Advanced theories of verbal and nonverbal behavior, attitudes, and communication styles that affect interaction between cultural groups.

**725 Communication and Change 3**
Investigation of the methods by which innovations are communicated through the process of diffusion to members of social systems, and adopted or rejected by them.

**731 Communication Ethics Seminar 3**
Focuses on individual and institutional communication ethics, and considers ethical standards and responsibilities guiding individuals, organizations, and institutions. Specific attention to public, private, corporate, governmental, and professional settings.

**750 Issues in Communication 3**
Advanced theory and philosophy of research issues in the field of communication. Prereq: Ph.D. status, or departmental approval. May be repeated.

**752 Theory of Argument 3**
Philosophy and theory of argumentation. Exploration of analytical methods employed in argumentation.

**755 Rhetoric of Environmental Science 3**
Investigation of how science shapes human perceptions about nature and the environment.

**761 Survey of Rhetorical Theory 3**
Historical/descriptive examination of rhetorical theory from the classical through contemporary periods. Exploration of the foundations and evolution of modern rhetorical theory.

**767 Rhetorical Criticism 3**
Survey of critical methods of inquiry that may be applied to oral discourse and frameworks for critically evaluating communication processes and products.

**780 Health Communication 3**
Exploration of the theory and research in health-care and health-practices communication settings.

**782 Theories of Persuasion 3**
Survey of the theories related to persuasion, attitudes, and values of societal groups, and the assessment of attitudes and values held by the public.

**783 Advanced Organizational Communication I 3**
Exploration of the theory of management communication practices in organizations. Emphasis on the formal structure and interpersonal aspects of supervisor-subordinate relations. Cross-listed with Busn.

**784 Advanced Organizational Communication II 3**
Study of the structure and function of communication interaction in formal organizations and survey of methods of analysis including the communication audit.

**785 Advanced Crisis Communication 3**
Long-term and short-term issues for managing communication related to organizational crises are discussed in the states of pre-crisis, crisis, and post-crisis. Prereq: Comm 700.

**786 Risk Communication 3**
Investigates perception of risk and crisis and how communication function to shape these perceptions.

The following variable credit courses are also offered:

**790 Graduate Seminar 1-3**

**793 Individual Study/Tutorial 1-5**

**795 Field Experience 1-15**

**796 Special Topics 1-5**

**797 Master's Paper 1-3**

**798 Master's Thesis 1-6**

**799 Doctoral Dissertation 1-15**



E-Mail: The Graduate School
Prospective students may schedule a visit by calling 1-800-488-NDSU.
The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701-231-8562

**Noel Anderson, Ph.D. (adjunct)**
Iowa State University, 1998
Research Interests:
Embedded Computer Systems, Computer System Architecture

**Anne Denton, Ph.D.**
University of Mainz, Germany, 1996
Research Interests:
Data Mining, Bioinformatics, Scientific Informatics, Educational Technology, Model Building, Databases

**Xiaojiang Du, Ph.D.**
University of Maryland, 2003
Research Interests:
Wireless Sensor Networks, Mobile Ad Hoc Networks, Computer Networks, Network Security

**Bruce Erickson, Ph.D.**
Yale University, 1973
Research Interests:
Theoretical Computer Science, Graph Theory

**Paul Juell, Ph.D.**
The Ohio State University, 1981
Research Interests:
Computational Linguistics, Expert Systems, Operating Systems

**Sung Kim, Ph.D.**
University of Texas, 2004
Research Interests:
Software Engineering, Software Reliability, Distributed Systems, Web Services, Service-Oriented Technologies

**Jun Kong , Ph.D.**
University of Texas, Dallas, 2005
Research Interests:
Software Engineering; Human-

# Computer Science

## Program Description

The Department of Computer Science and Operations Research offers the M.S. and Ph.D. in Computer Science. Graduate course work in Operations Research is offered and may be used to provide an operations research concentration to either program. For additional information, please contact the department chair (701) 231-8203.

## Admissions Requirements

The following minimum qualifications are required of all students seeking an advanced degree:

### Master of Science

1. The applicant must have a baccalaureate degree from an educational institution of recognized standing.
2. The applicant must show, by a combination of educational background, academic performance, and work experience, the potential to succeed in advanced study and research in computer science. Minimum preparation usually includes the ability to program in one or more modern, commonly used high-level languages; at least one semester of calculus; and experience in using simple data structures such as linked lists and binary trees. Minimum preparation for unconditional admission to the master's program would normally include courses in computer science principles and theory equivalent to the NDSU courses CSci 160, 161, 222 or 235, 372, and 373.
3. The applicant for the M.S. must have a cumulative grade point average (GPA) in all previous courses of at least 3.0 (out of 4.0) or equivalent to attain full standing.

### Doctor of Philosophy

1. The applicant must have a bachelor's degree or a master's degree in computer science. In some cases, students with a degree in a closely related area may be considered.
2. Admission to the program is competitive, and requirements for admission to this program are more rigorous than for admission to the M.S. program. In order to be considered seriously, an applicant must normally have the equivalent of at least a 3.25 GPA (on a 4-point scale). The admissions committee will look at the applicant's overall academic record, as well as any relevant employment and professional experience. Of particular importance is evidence of the applicant's potential for scholarship and independent research at the Ph.D. level.

Computer Interaction; Model Management

**Honglin Li, Ph.D.**
Ohio State University, 2004
Research Interests:
Video Indexing, Annotation, Analysis, and Coding; Signal/ Image Processing; Data Mining; Pattern Recognition; Machine Learning; High-Performance Computing; Computer Networks and Communication

**Kenneth Magel, Ph.D.**
Brown University, 1977
Research Interests:
Software Engineering, Human-Computer Interfaces, Computer Networks, Subsymbolic Computation

**John Martin, Ph.D.**
Rice University, 1971
Research Interests:
Theoretical Computer Science, Theory of Computation

**Kendall Nygard, Ph.D.**
Virginia Polytechnic Institute and State University, 1978
Research Interests:
Software Agents, Operations Research, Algorithm Analysis, Artificial Intelligence

**Mark Pavicic, Ph.D. (adjunct)**
Columbia University, 1985
Research Interests:
Computer Architecture, Computer Graphics

**William Perrizo, Ph.D.**
University of Minnesota, 1972
Research Interests:
Distributed Database Systems, Centralized Database Systems

**Akram Salah, Ph.D.**
University of Alabama at Birmingham, 1986
Research Interests:
Software Engineering, Formal Methods, Knowledge Engineering, Database Engineering

**Brian Slator, Ph.D.**
New Mexico State University,

3. International students are welcome. They must submit a TOEFL score of at least 550 (paper test), 213 (computer test), or 79 (internet-based) to be considered. A score of at least 600 (paper test), 247 (computer test), or 100 (internet-based) is required for financial aid.

## Financial Assistance

Teaching assistantships, equivalent in total to about five full-time assistantships, are available to graduate students. A full-time teaching assistantship requires 20 hours of work per week, usually teaching two sections of a lower-level service course. A full-time teaching assistantship pays $920 per month and qualifies the student for a waiver of graduate tuition. Other assistantships offered by the department include research assistantships, which involve assisting faculty with their research, and graduate service assistantships, which might involve computer-related work with other faculty or organizations on campus. The stipends for full-time assistantships may vary slightly but are approximately the same as for teaching assistantships. In the case of a new international student, previous teaching experience will increase the likelihood of a teaching assistantship being awarded. For all assistantships, a student's chances may be greater after he/she has been at NDSU one or two semesters.

The department does not offer a waiver of tuition to students who are not awarded assistantships. However, there is a scholarship program, including a tuition waiver, administered by the Dean of The Graduate School. Students should contact The Graduate School office for application forms.

An application for financial aid requires a separate letter of application sent to the department. Decisions concerning financial aid are normally made by April 15 for the following academic year, and it is important that students applying for financial aid get their applications in well before that date.

In order for applicants who are not native speakers of English to receive an assistantship, they must have a personal interview, conducted by a committee containing both a member of the computer science department and a faculty member specializing in English as a second language. This interview includes the Test of Spoken English (TSE). There also is a writing requirement, which can be met by a score of 5.0 or higher on the Test of Written English or by a passing grade on a writing sample administered and graded at NDSU. In order to receive an assistantship, applicants whose TOEFL score is less than 247 (computer test) must also complete a summer course in English as a second language offered by NDSU.

## Degree Requirements

### Master of Science

**Semester core courses (required of all students):**

CSci 708 Foundations of Programming
CSci 713 Software Engineering I
CSci 724 Survey of Artificial Intelligence
CSci 765 Introduction to Database Systems

### Thesis Option:

1. Core plus three additional courses plus two credits of research seminar
2. Research adviser should be selected by the fourth semester of attendance at NDSU
3. Comprehensive Examination (on the core courses) completed by the end of the fourth semester
4. Research proposal presentation and defense

1988
Research Interests:
Artificial Intelligence, Educational Games

**Vasant Ubhaya, Ph.D.**
University of California-Berkeley, 1971
Research Interests:
Algorithm Analysis, Operations Research

**Greg Wettstein, Ph.D. (adjunct)**
North Dakota State University, 1988
Research Interests:
Computer Security and Authentication, Operating Systems

**Dianxiang Xu, Ph.D.**
Nanjing University, China, 1995
Research interests:
Software Engineering, Software Security, Applied Formal Methods, Testing, Software Agents

5. Thesis
6. Final defense

### Comprehensive Study Option:

1. Core plus five additional courses plus two credits of research seminar
2. Research adviser should be selected by the fourth semester of attendance at NDSU
3. Comprehensive Examination (on the core courses) completed by the end of the fourth semester
4. Research proposal presentation and defense
5. Research paper
6. Final defense

A maximum of 8 semester credits may be transferred into the program for the thesis option and a maximum of 9 semester credits for the comprehensive study option. Such courses have to be approved on the plan of study.
There may be a maximum of 6 credits of independent study.

All course work must be approved by the student's adviser, Supervisory Committee, department chair, and graduate dean through the plan of study.

### Doctor of Philosophy

1. 90 credits with up to 30 included from the M.S. degree
2. 30 credits of research credit
3. Research adviser should be selected by the fourth semester at NDSU
4. Qualifying examination (written based on the M.S. core courses)
5. Research proposal presentation and defense
6. Dissertation
7. Final defense

There are some additional requirements on the course work:

1. The 90 credits must include three sequences of two courses each at the graduate level in computer science.
2. Beyond the M.S. degree, a maximum of 9 credits of course work could be transferred. The remainder MUST be taken at NDSU.
3. The 90 credits (including any credits transferred as part of the M.S. degree) must be computing-related with at least 45 credits involving significant graduate level computer science material. Generally, these credits would have to be those offered by a computer science department.
4. The 90 credits may include a maximum of 15 credits of non-didactic courses (independent studies or seminar hours). Seminars are limited to four of those credits.
5. The student's advisory committee, the department chair, and the graduate dean all must approve the course work on the plan of study.

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## Courses Offered

**618 Simulation Models 3**
Fundamental techniques involved in using a computer to simulate business, social, and industrial systems. Includes principles of random variate generation, statistical sampling, and design of experiments. Prereq: Stat 367.

**626 Introduction to Artificial Intelligence 3**

Introduction to artificial intelligence. Basic AI languages, concepts, and techniques. Prereq: CSci 372.

**653 Linear Programming and Network Flows 3**
Linear programming models and applications; primal and dual formulations; computational procedures; introduction to networks, maximum flow, and shortest path problems. Prereq: Math 265.

**654 Operations Research 3**
Deterministic and probabilistic models of operations research: networks and project management, dynamic programming, nonlinear programming, inventory, queuing, reliability, stochastic processes, and simulation. Prereq: CSci 453/653, Stat 367.

**658 Microcomputer Graphics 3**
Information on the techniques by which computers generate images of 2D and 3D objects. Principles to guide the use of computer graphics to enhance human-computer interaction. Prereq: CSci 372, and Math 146 or 165.

**659 Local Area Networks 3**
LANs interconnect modern computer work groups. LAN architecture, applications, implementations, protocols, management, security, external connections, and future directions are examined. Prereq: CSci 214, 474.

**660 Dynamic Programming 3**
Basic principles and algorithms of dynamic programming as applied to sequential decision problems in CS and OR. Prereq: Math 166.

**667 Algorithm Analysis 3**
Design, correctness, and analysis of algorithms and data structures. Prereq: Math 166; and CSci 161, 222.

**668 Database Systems Design 3**
Overview of the maintenance and manipulation of databases. Includes a large project in C++. Prereq: CSci 366.

**669 Network Security 3**
This course introduces cryptography and its application to network and system security. Topics include symmetric encryption, public key cryptography, email security, IP security, web security, network management security, intrusion detection, firewalls, etc. Prereq: CSci 459 or equivalent, programming in C, C++, or Java.

**676 Computer Forensics 3**
This course is intended to acquaint the students with principles, tools, and practical skills necessary to perform investigations of incidents in which computers play a significant or interesting role. Prereq: CSci 474 or consent of the instructor.

**677 Object-Oriented Systems 3**
Introduction to the concepts and advantages of object-oriented computer systems. Introduces exercises with at least one such language. Prereq: CSci 372.

**679 Introduction to Data Mining 3**
Data mining versus query processing, data mining examples, introduction to the basic techniques in association rule mining, classification, clustering, data warehousing and online analytic processing. Application areas may include bioinformatics, homeland and network security, web searching, market basket research, and image and video analysis. Prereq: CSci 366.

**688 Human-Computer Interaction 3**
Survey of the methodologies and alternatives used in developing and evaluating human-computer interfaces. Prereq: CSci 372. Cross-listed with Psyc.

**689 Social Implications of Computers 3**

Presentation and discussion of several ethical and social issues that have arisen from the introduction of the computer, including copy-protected software and liability for computer software errors. Prereq: CSci 372.

**702 Performance Evaluation 3**

Examination of basic techniques used to evaluate multi-programming systems. Both queuing models and other analytical approaches are constructed with simulation and direct measurements of actual systems. Prereq: CSci 475.

**708 Foundations of Programming 3**

Introduction to formalisms, in which computer programs are considered as mathematical objects, including weakest precondition and predicate calculus. Prereq: CSci 236.

**713 Software Development Processes 3**

This course is designed as a breadth course on the software engineering process. Basic concepts are reviewed and reassured to create a basis for higher concepts and techniques. Prereq: graduate standing.

**714 Software Project Planning and Estimation 3**

This course is designed to introduce the student to the concepts and techniques of how to plan for a software project. This includes time and effort estimation, planning and teaming the project, and managing the development activities. Prereq: CSci 713.

**715 Software Requirements Definition and Analysis**

This course is designed to make the student able to identify and capture requirements for a software system and be able to document and assess the requirements. Prereq: CSci 713.

**716 Software Design 3**

This course covers both architectural design and module design. Students receive practice using a set of design patterns to produce software designs with several different types of architecture. Substantial presentation and practice with the UML modeling language is provided. Prereq: CSci 713.

**717 Software Construction 3**

This course covers the fundamentals of software construction including programming and evaluation of the source code. Students receive a good grounding in and extensive practice with the comprehensive libraries associated with a modern programming language. Prereq: CSci 713.

**718 Software Testing and Debugging 3**

This course covers the goals, practices, evaluation and limitations of software testing and software debugging. Students receive practice in developing and using test plans and various testing and debugging techniques. Prereq: CSci 713.

**722 Compiler Construction 3**

Design and structure of complex grammars, lexical analysis, parsers, semantic data structures, and code generating and optimization. Construction of a simple compiler. Prereq: CSci 372 or graduate standing.

**724 Survey of Artificial Intelligence 3**

Survey of major areas of AI, including theorem proving, heuristic search, problem solving, computer analysis of scenes, robotics, natural language understanding, and knowledge-based systems. Prereq: CSci 372 or graduate standing.

**728 Computer Graphics 3**

Principles and algorithms used in computer graphics packages. Emphasis on raster graphics, clipping, hidden-surface elimination, ray-tracing, and radiosity. Prereq: Graduate standing.

**730 Office Information Systems 3**
Exploration of the evolution of the office since the introduction of the computer. Examination of the introduction of computers, word processors, database management systems, networks, and AI into the office. Prereq: CSci 160 or graduate standing.

**732 Introduction to Bioinformatics 3**
An introduction to the principles of bioinformatics, including statistical techniques for the analysis of one or more gene sequences, and computational techniques for knowledge discovery from biological data. Prereq: Graduate standing.

**734 Expert Systems 3**
Examination of types of expert systems, their powers and limitations. Students write their own expert system. Prereq: CSci 724.

**735 Neural Networks 3**
Introduction to the parallel processing paradigms that have been developed recently, including neuronetworks and genetic algorithms. Students will work on projects using these tools. Prereq: CSci 724. Cross-listed with Psyc.

**737 System Simulation 3**
Systems, models, discrete event simulation models, queuing systems, fundamental statistics of simulation. Prereq: CSci 653, Math 166.

**741 Algorithm Analysis 3**
Algorithm design and analysis, asymptotic analysis, worst and average case, recurrences, generating functions, divide-and-conquer, the greedy method, search and traversal, backtracking, branch-and-bound. Prereq: CSci 161, Math 166.

**742 Algorithms and Complexity 3**
Linear and nonlinear recurrences, algebraic problems, fast Fourier transforms, lower bound theory, computational geometry, the classes P and NP, NP--completeness, Cook's theorem, NP-hard problems. Prereq: CSci 741.

**745 Formal Methods for Software Development 3**
This course is a high level course with the aim of formal representation to be able to formally assess characteristics of software. The formal representations are based on the theoretical foundations of computer sciences such as set theory, logic, and graph theory. Prereq: CSci 713.

**746 Development of Distributed Systems 3**
This course is an advanced course in software engineering aiming at strategies and solutions of distributed systems. It assumes the knowledge of software engineering and particularly the design and implementation of software systems, then builds on these concepts to discuss how distributed systems designed and implemented. Prereq: CSci 713.

**747 Software Complexity Metrics 3**
This course covers complexity metrics for the entire software lifecycle. Students gain experience in using requirements metrics, design metrics, program metrics, test metrics, and planning metrics. The effectiveness and limitations of metrics in all these areas is emphasized. Prereq: CSci 713 and CSci 718.

**751 Nonlinear Optimization I 3**
Convex sets, convex functions and extensions, one-dimensional optimization, theory and algorithms for constrained and unconstrained nonlinear programs, optimization without derivatives. Prereq: CSci 653.

**752 Nonlinear Optimization II 3**
Convergence, rates, primal and dual methods of constraining optimizations of large-scale programs, linear complementarity, quadratic programs, computational complexity,

minimax problems. Prereq: CSci 751.

**760 Dynamic Programming 3**
Dynamic programming as an algorithm design method, formulating and solving problems using dynamic programming, deterministic and stochastic problems in OR and CS. Prereq: Math 166.

**761 Integer Programming 3**
Integer linear programs and modeling, theory and algorithms, duality and relaxation, cutting plane and branch-and-bound methods, combinational problems, total unimodularity, matching and matroids. Prereq: CSci 653.

**762 Network Flows 3**
Theory and algorithms for network flow optimization including network representation data structures, basic change methods, maximum flow, shortest path, minimum cost problems, and generalized networks. Prereq: CSci 653.

**765 Introduction to Database Systems 3**
Basic database concepts, models, management facilities, data structures, storage structures, data definition languages, data manipulation languages, normalization, operator implementation algorithms, transactions, correctness, reliability, distribution, performance analysis. Prereq: CSci 366 or graduate standing.

**766 Database System Internals 3**
Transaction management, processing, correctness, recoverability, serializability (conflict and view), concurrency control (2PL, BTO, SGT, multiversion), recovery, distributed systems (correctness, recovery, replication), query processing and optimization. Prereq: CSci 765.

**778 Computer Networks 3**
Examination of computer networks using the ISO-OSI model as a framework. Practical and theoretical issues are explored in modems, codes, error, impairments, modulation, protocols, and interfaces. Prereq: CSci 474 or graduate standing.

**779 Advanced Data Mining 3**
Topics include association rule mining, classification and clustering. Applications to such areas as bioinformatics, homeland and network security, web searching, market basket research, and image and video analysis will be included. Prereq: CSci 765 or departmental approval.

**783 Topics in Software Systems 3**
Includes an area of computer science not otherwise treated in computer science courses. Varies each time offered. May be repeated. Prereq: Graduate standing or departmental approval.

**785 Topics in Computer Architecture 3**
Includes an area of computer architecture not considered in other courses. Varies each time offered. May be repeated. Prereq: Graduate standing or departmental approval.

**787 Topics in Operations Research 3**
Includes an area of operational research not considered in other courses. Varies each time offered. May be repeated. Prereq: Graduate standing or departmental approval.

**789 Topics in Theoretical Computer Science 3**
Includes an area of theoretical computer science not considered in other courses. Varies each time offered. May be repeated. Prereq: Graduate standing or departmental approval.

The following variable credit courses also are offered**:**

**790 Graduate Seminar 1-3**

**793 Individual Study/Tutorial 1-5**

**696/796 Special Topics 1-5**

**797 Master's Paper 1-3**

**798 Master's Thesis 1-10**

**799 Doctoral Dissertation 1-15**



E-Mail: The Graduate School Prospective students may schedule a visit by calling 1-800-488-NDSU.

The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701-231-8567

### Criminal Justice Faculty

**Carol Archbold, Ph.D.**
University of Nebraska-Omaha, 2002
Research Interests:
Police Studies, Race and the Criminal Justice System, Alternative Dispute Resolution and the Criminal Justice System, Qualitative Research Methods

**Thomas D. McDonald, Ph.D.**
Southern Illinois University, 1972
Research Interests:
Criminal Justice, Deviant Behavior, Social Disorganization, Evaluation Research

**Kevin M. Thompson, Ph.D.**
University of Arizona, 1986
Research Interests:
Delinquency, Quantitative Methods, Alcohol and Drugs, Juvenile Drug Courts

### Political Science faculty

**Nicholas Bauroth, Ph.D.**
Loyola University , Chicago , 2003
Research Interests:
State and Local Politics, Politics of Crime

**Robert Wood, Ph.D.**
University of Missouri, 1983
Research Interests:
Terrorism, Constitutional Law, Judicial Politics, Campus Crime

### Affiliated faculty

**Wendy Troop-Gordon, Ph.D.**
University of Illinois at Urbana-Champaign, 2002

# Criminal Justice

### Program Description

The Department of Criminal Justice offers graduate study leading to both a MS and a Ph.D. degree in Criminal Justice. The MS degree has two tracks; Applied Criminal Justice and Criminology. The program in Criminal Justice is designed to enhance student's skills in understanding, gathering, processing, and analyzing research in the areas of criminology and criminal justice. The topical curriculum is geared to understanding, critiquing, and analyzing the criminal justice system with an orientation toward urban issues as they impact crime and criminal justice. The curriculum consists of foundation courses in theory, policy, and research methods, plus three substantive areas: 1) criminology, 2) policing, and 3) corrections. Students have their choice of specializing in one of the three. Elective course work can include classes such as Violence, Gender and Justice, and crime commodities. Students also will be afforded course work in learning how to teach a college course.

Graduates will find an expanding and terrific academic job market available as well as professional employment in the criminal justice policy and research sector. There are currently only 23 Criminal Justice Ph.D. programs operating on a national level, so students graduating with a Criminal Justice Ph.D. will be competitive for the 350 positions available annually in academic units.

## Ph.D. in Criminal Justice

### Admissions Requirements

Students can enter the program with either a baccalaureate degree or with an approved master's degree. Students will be required to have had one course research methods, and one course in statistics. Plus, students should have adequate background preparation or demonstrated potential in the field of Criminology or Criminal Justice.

Students will be required to take the Graduate Record Examination (GRE) and submit their undergraduate and/or graduate transcripts. For admission to full standing, students are required to attain a combined minimum score on the GRE of 1,000 (verbal and quantitative) and achieve a minimum grade point average of 3.0 over their last 60 credit hours. Students not meeting these standards will be evaluated and possibly admitted on conditional status.

A student entering the program with a bachelor's degree would take a minimum of 90 credit hours. Students entering the program with a master's degree should submit their research thesis to the graduate committee for review. This committee would be charged with determining whether the research project is sufficient in scope and depth to warrant further supervised research. Students entering the program with a master's degree would be required to complete

Research Interests: Violence and Aggression, Adolescent Development, Victimization, Quantitative Methods

**Joel Hektner, Ph.D.**
University of Chicago, 1996
Research Interests: Aggression, Research Methods, Peer Influence on Delinquency

a minimum of 60 credits.

## Degree Requirements

The curricular structure of the program is listed below for students entering the program without a master's degree:

**Credits**

1. Theory/Policy courses --- 9
2. Research skills --- 12
3. Substantive Area --- 18
4. Electives --- 18
5. Individual Study/Dissertation --- 36

Total --- 90

**Theory/Policy Courses (9 credits)**

1. Advanced Criminology - CJ 703
2. Criminal Justice Policy - CJ 709
3. Introduction to College Teaching - Hum 702

**Research Skills (15 credits)**

1. Advanced Quantitative Methods - COMM 710
2. Applied Statistics - Stat 725
3. Applied Regression and Analysis of Variance - State 726 (Note: Stat 725 is a prerequisite for this course)
4. Program Evaluation - CJ 702

**Substantive Areas** - Students must complete four courses in substantive area of choice (12 credits) plus complete one course (6 credits) in each of their non-substantive areas (Total 18 cr.).

**Substantive Area A - Criminology**

1. Delinquency - CJ 606
2. Violence - CJ 750
3. Criminogenic Commodities - CJ 752
4. Individual Theories of Crime - CJ 721
5. Structural Theories of Crime - CJ 722

**Substantive Area B - Corrections**

1. Corrections - CJ 661
2. Crime Prevention - CJ 765
3. Community Corrections - CJ 762
4. Juvenile Corrections - CJ 707
5. Correctional Rehabilitation - CJ 763

**Substantive Area C - Policing**

1. Criminalization - CJ 660
2. Administrative Policing - CJ 755
3. Community Policing - CJ 757

4. Police and Race Issues - CJ 760
5. Police Effectiveness - CJ 761

**Electives (15 cr.)**

1. Deviant Behavior - CJ 607
2. Gender and Justice - CJ 768
3. Qualitative Methods - SOC 700
4. Adolescent Development - CDFS 650
5. Experimental Methods - PSY 640
6. Experimental Social Psychology - PSY 670
7. Applied Survey Sampling - STAT 660
8. Meta-Analysis Methods - STAT 665

**Dissertation (1-15 Credits)**

# MS Degree in Criminal Justice

## Admission Requirements

Students will need to enter the program with a baccalaureate degree. Students will be required to have had one course in research methods, one course in statistics, and should document adequate background preparation or demonstrated potential in the field of Criminology or Criminal Justice. For admission to full-standing, students are required to achieve a minimum grade point average of 3.0 over their last 60 credit hours.

Applicants will be required to submit all academic transcripts, three letters of recommendation (at least one must be from a person who can evaluate their academic work), and a letter of interest detailing their rationale for pursuing a master's degree and justifying their ability to succeed in the program. Students not meeting these standards will be evaluated and possibly placed on conditional status.

Interested students can apply online at http://www.ndsu.edu/gradschool/apply/index.shtml

## Degree Requirements

Students will need to declare their choice of a Track by the end of their first semester in the program. Both Tracks require the completion of the following 5 Foundation Courses (15 Credits total)

**Advanced Criminology**

**Criminal Justice Policy**

**Program Evaluation**

**Applied Statistics**

**Advanced Quantitative Methods**

In addition to the Foundation Courses, students enrolled in the **Applied Track** must complete 1 course from each of the following 3 areas (9 credits total).

**I. Corrections**

1. Corrections
2. Community Corrections
3. Crime Prevention
4. Correctional Rehabilitation
5. Juvenile Corrections

**II. Policing**

1. Criminalization
2. Administrative Policing
3. Community Policing
4. Police Effectiveness
5. Police and Race Issues

**III. Management-Related**

1. Organizational Psychology
2. Legal/Social Environment of Business
3. Organizational Communication I
4. Human Resource Management

In addition to the Foundation Courses, students enrolled in the **Criminology Track** must complete 1 course from the Theory area (3 credits total) and 2 courses from the Elective Area (6 credits total).

**I. Theory**

1. Individual Theories of Crime
2. Structural Theories of Crime

**II. Electives**

1. Crime and Delinquency
2. Violence
3. Criminogenic Commodities
4. Deviant Behavior
5. Advanced Psychopathology

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## Courses Offered

**CJ 606 Crime and Delinquency 3**
Study of the nature and extent of juvenile delinquency and adult crime. Analysis of causes of juvenile and adult offending, and an exploration of policies to combat crime and delinquency. Prereq: Soc 110.

**CJ 607 Deviant Behavior 3**
Analysis of the sociological aspects of the antecedents, the social/human relations processes, and the consequences of deviance in Western society, Prereq: Soc 110.

**CJ 660 Criminalization 3**
Analysis of historical and contemporary developments in the functions of police and courts. Focuses on societal and inter- and intra-organization contexts.

**CJ 661 Corrections 3**
Analysis of institutional- and community-centered corrections. Emphasis on historical, contemporary, and developing trends regarding structures, program content, and problems.

**CJ 702 Program Evaluation 3**
Methods and techniques of conducting applied research associated with the evaluation of criminal justice programs.

**CJ 703 Advanced Criminology 3**
Examination of measurement and correlates of crime as well as theoretical explanations of crime and criminal behavior.

**CJ 707 Juvenile Corrections 3**
Historical and contemporary examination of the role of juvenile facilities in punishment, treatment, and reform.

**CJ 709 Criminal Justice Policy 3**
Examination of the role of criminal justice agencies in developing and implementing policy. Focus on the interplay between criminal justice theory and practice.

**CJ 721 Individual Theories of Crime 3**
Review of historical and contemporary individual theories of crime. Discussion of the assumptions, causes, and policy implications of criminological theories.

**CJ 722 Structural Theories of Crime 3**
Review of historical and contemporary structural theories of crime. Assumptions, causes, and policy implications of criminological theories.

**CJ 750 Violence 3**
The course will examine violence in various social settings (e.g., community, domestic, and school) with attention to the causes, consequences, and moderating factors associated with violent criminal behavior.

**CJ 752 Criminogenic Commodities 3**
Examination of the role of drugs, firearms, and gangs in contributing to crime. Analysis of the laws pertaining to drugs, guns, and gangs and their impact on criminality.

**CJ 754 Criminal Investigations 3**
Researches the process of gathering information and evidence in the administration of justice. Focus on the role of evidence gathering and its importance to disseminating justice.

**CJ 755 Administrative Policing 3**
Organizational theory, leadership, communication, labor relations, and crisis management in police administration.

**CJ 757 Community Policing 3**
Examines the history, philosophy, theory, and implementation of community policing, compares community policing with other policing styles, and describes community-police collaborations to apprehend criminals, prevent crime, maintain order, and enhance community quality-of-life.

**CJ 759 Security Management 3**
Examination of public and private security concerns and methods for addressing them. Analysis of protection of money, materials, information, and secrets.

**CJ 762 Community Corrections 3**
Evaluation of practices, issues, and trends in community corrections. Focus on probation, parole, halfway houses, and other community alternatives to incarceration.

**CJ 760 Police and Race Issues 3**
Provides an in-depth historical and contemporary view of the police and race issues in

the United States. Discussions on diversity, use of force, racial profiling, and citizen complaints

**CJ 761 Police Effectiveness 3**
Examines effectiveness of police delivery services in the U.S. Examines theories and scrutinizes factors that are associated with police effectiveness.

**CJ 763 Correctional Rehabilitation 3**
Examines issues related to the implementation and effectiveness of various correctional treatment programs that utilize theories of behavior change.

**CJ 765 Crime Prevention 3**
This course will examine methods for responding to crime outside of the traditional criminal justice and correctional systems, as well as innovative crime reduction, control and prevention programs within these traditional institutions.

**CJ 768 Gender and Justice 3**
Critical analysis of the role of gender in the justice system. Focuses particularly on the role of women in justice circles and as employees, offenders, and victims.

For descriptions of Stat 725 and 726, HUM 702, and COMM 710 see appropriate section.

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201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

# Graduate Faculty

701-231-7202

## School of Education Graduate Faculty

**Mari Borr, Ph.D.**
University of North Dakota, 2005
Research interests:
Experiential Learning, Family and Consumer Sciences, Professional Development Evaluation

**Lisa Daniels, Ed.D.**
Texas A&M University, 2002
Research interests:
High Stakes Testing, Student Learning in Virtual Environments, Societal Issues in Education

**Stacy Duffield, Ph.D.**
University of North Dakota, 2003
Research interests:
Teacher Preparation, the Professional Development School Model, and Literacy Issues.

**Myron Eighmy, Ph.D.**
University of Minnesota, 1995
Research Interests:
Higher Education Policy, Training and Human Resources Development, State and Federal Policy for Workforce Education and Training.

**J. Wade Hannon, Ed.D.**
University of Arkansas, 1983
Research Interests:
Counselor Education; Community Counseling; Multicultural Counseling; Critical Theory, Feminism, Professional Ethics; Research; Public Policy; and the Person-Centered Approach.

# Education

## Program Description

The School of Education offers graduate study leading to the Master of Education (M.Ed.) and Master of Science (M.S.) degrees. Graduate majors in the areas of counseling (school and community), educational leadership (school administration and community education), teacher education (curriculum and instruction or discipline-specific programs), agricultural education, and family and consumer sciences are offered. The Master's and Specialist degrees in Educational Leadership (Ed.S.) involves course work through the Tri-College University . A doctoral program in Education (Ph.D. and Ed.D.) with options in Institutional Analysis and Occupational and Adult Education, and a Counselor Education and Supervision track in the Human Development and Education Ph.D. program are also offered.

The NDSU programs in education are accredited by National Council for Accreditation of Teacher Education and are approved by the ND Education Standards and Practices Board. Changes in national and state legislation, standards, or rules can affect academic program requirements.

## Doctoral Program in Education

The following doctoral degrees in Institutional Analysis and Occupational and Adult Education are offered. The Doctor of Education (Ed.D.), degree requires extensive field service involving qualitative and/or quantitative research, leading to a dissertation that will apply a theory at an institution. The Doctor of Philosophy (Ph.D.) degree requires extensive inquiry involving quantitative and/or qualitative research, culminating in a dissertation that will develop and/or test theory.

The Institutional Analysis option is unique and focuses on mid-management needs regarding assessment, evaluation, research, and institutional analysis. This program involves data-drive statistical knowledge, comprehensive research skills, and dispositions needed to work with both academia and other environments, such as business, military, and government.

The Occupational and Adult Education option uniquely addresses emerging needs in all aspects of adult education. This option specifically relates to entrepreneurial-alternative deliveries that enhance emerging professional development and advanced training for business, industry, government, and military enterprises. This program integrates assessment and evaluation techniques, statistical skill, and research knowledge with curriculum and instructional development for workplace needs.

## Counselor Education

**Carol B. Hoheisel, Ph.D.**
Kansas State University, 2005
Research interests: School Counseling; Career Education, Crisis Management Preparation, Trauma

**William O. Martin, Ph.D.**
University of Wisconsin, 1993
Research interests: Mathematics Education

**Jill Nelson , Ph.D.**
Kent State, 2005
Research interests: Community Counseling, Counselor Education Counselor Supervision, Brief and Solution-Focused Approaches

**Robert C. Nielsen, Ed.D.**
University of Northern Colorado, 1973
Research Interests:
School Counseling, Stress Management, Cognitive Counseling

**A. Carol Rusaw, Ed.D.**
Virginia Polytechnic Institute, 1989
Research Interests:
Adult Education, Human Resource Development, Management Education, Women in Management, Feminist Critical Theory, Qualitative Research, and Leadership Development

**Mark Schmidt, Ph.D.**
The Florida State University, 2000
Research Interests:
Institutional Analysis, Program Assessment, Interinstitutional Collaboration

**Carol A. Sommer, Ph.D.**
Southern Illinois University, 2003
Research Interests:
Clinical Supervision, Counseling Theory and Theory Development, Women's Issues in Research, and Narrative Applications in Counseling, Supervision and Research.

**Ronald M. Stammen, Ph.D.**
Ohio State University, 1990

The Counselor Educational program, accredited by the Council for Accreditation of Counseling and Related Programs (CACREP), within the School of Education prepares counselors to work professionally with persons from diverse cultural backgrounds and in a variety of settings. Program specializations are available in school counseling and in community counseling at the master's degree level, and in Counselor Education an d Supervision at the Ph.D. level. Review of application for degree programs is once each year beginning on February 1, with master's degree course work required to start the following summer.

## Educational Leadership

The principle purpose of the program is to provide professional/academic education for individuals preparing for mid-management administrative positions (i.e., elementary school principal, secondary school principal, or community education director), staff administrative positions (i.e., school district business managers, technology coordinators, or curriculum coordinators), and upper-level administrative positions (i.e., superintendent of schools). The Educational Leadership program prepares students for Master of Education(M.Ed), Master of Science (M.S.) and Education Specialist (Ed.S.) degrees in Educational Administration. Programs meet certification requirements in the various areas appropriate to K-12 administration.

## Teacher Education

The graduate program in Teacher Education is committed to the further development of educational leaders who are dedicated to educational equity for all persons. The Teacher Education graduate program is aligned with the National Board for Professional Teaching Standards (NBPTS) to reflect the importance of applied research and content development of educators.

Programs offered in Teacher Education focus on the development of educational leaders and are designed for the practitioner. Students will engage in action research as a component of the program. Due to the unique nature of the program, candidates must have access to a teaching setting.

Plans of study for either the M.Ed. or M.S. in Teacher Education may emphasize curriculum and instruction or specific education disciplines including: Agricultural Education, English, Modern Languages, Health, Family and Consumer Sciences, Mathematics, Music, Physical Education, Science, History, Social Studies and Speech. Students are encouraged to work closely with an academic adviser to ensure that personal and professional goals are clear and achievable. Some of the options with unique features are described in more detail below and on the next page.

## Curriculum and Instruction

The program focuses on further development of teacher leaders through study of instructional delivery and enhancement. The program curriculum includes areas of human development, learning, foundations of education, school curriculum, roles of schools and society, and further study in areas of interest. Candidates choosing this option for an M.S. degree must also complete a thesis.

## Music Education

The Master of Education (M.Ed.) degree with a Music Education option is a dual program offered collaboratively by the School of Education and the Department of Music. The program is designed to facilitate the needs of currently working music teachers as well as students who wish to continue their education to the master's level after having completed the baccalaureate degree. It is possible to complete the M.Ed. degree in Music Education by attending three consecutive summer sessions, two years in residence during the academic year, or a combination of both. Most courses in the degree program are offered in the late afternoon or evening.

Research Interests: Research Methods
Telecommunications, Computer Support to School Instruction/ Administration, Vocational Education

**Justin J. Wageman, Ph.D.**
University of North Dakota, 1999
Research Interests: Standards, Curriculum, Instruction, Assessment, Professional Development and Evaluation

**Richard Warner, Ed.D.**
University of Illinois at Urbana Champaign, 1975
Research Interests: Teaching and learning, Staff Supervision and Development, Leadership

## Health, Nutrition, and Exercise Science Graduate Faculty

**David Barney , Ph.D.**
Florida State University, 2002
Research Interests: Physical Education Pedagogy

**Thomas C. Barnhart, Ph.D.**
University of New Mexico, 1978
Research Interests: Recreation Management, Playground Safety

**Ardith Brunt, Ph.D.**
Iowa State University, 1999
Research Interests: Nutrition, Gerontology

**Bryan Christensen, Ph.D.**
University of Kansas, 2002
Research Interests: Biomechanics, Sport Psychology

**Pam Hansen, Ed.D.**
University of South Dakota, 2000
Research Interests: Athletic Training

**Arthur W. Maughan, M.S.**
North Dakota State University, 1966
Research Interests: Coaching

Applied study may be in the areas of vocal, instrumental, or conducting. Students electing the choral emphasis will take vocal pedagogy and survey of choral literature. Students electing the instrumental emphasis will take instrumental pedagogy (woodwind, brass, or percussion) and survey of band literature. No thesis is required; rather, students will complete 2 three-credit hour practicum experiences: one in education and one in music. The practica will be agreed upon and planned jointly by the student and his/her adviser(s).

## Science Education

The M.Ed. (Science Education) degree option provides secondary science teachers with an enriched foundation in pedagogy, the sciences, and scientific research. The degree consists of 16 semester hours of education courses, 15 semester hours of graduate-level science courses, a practicum (classroom teaching) project, and a science research experience. The final requirement of this M.Ed. degree is the oral defense of a portfolio of accomplishments completed during the program.

The science requirements may be fulfilled by completing a variety of graduate science courses, many of which are offered during the summer months. Teachers are encouraged to discuss this degree option with a Science Education adviser from the NDSU Center for Science and Mathematics Education.

## Agricultural Education

Agricultural Education offers graduate study leading to the M.Ed. and M.S. degrees. Advanced work may involve specialized training in vocational education, extension education, international extension, and agricultural education.

Degree programs are planned cooperatively to meet the needs of individual students. Candidates are encouraged to include supporting work relevant to subject matter areas of interest. Some courses focus on problems related to various phases of Agricultural Education, including secondary, post-secondary, adult, and extension programs. Others emphasize issues common to all service areas in agricultural and extension education. Provision may be made for candidates to include internships in agribusiness, natural resources education, or other aspects of agricultural and extension education in their programs. Candidates should work closely with an adviser.

## Family and Consumer Sciences Education

Students have the option of pursuing an M.Ed. or M.S. degree in Family and Consumer Sciences Education. Advanced work may be taken in FCSE, vocational education, extension, and curriculum design and development.

This program is designed to provide students with an expanded background in Family and Consumer Sciences Education as well as the broader field of education with a solid foundation in research methodology. Students are encouraged to complete additional course work in areas of interest. Internships can be incorporated into the program of study and provide an opportunity for students to examine current issues. Candidates should work closely with an adviser.

## Admissions Requirements

Qualified students may apply for admission to graduate programs in the School of Education leading to Doctor of Education (Ed.D.), Doctor of Philosophy (Ph.D.), Education Specialist, (Ed. S.), Master of Education (M.Ed.), or Master of Science (M.S.) degrees. In addition to requirements described under academic information elsewhere in this bulletin, criteria are stated below that will be considered at the time of application for admission into graduate study. Admission to a doctoral, master's or education specialist program is considered only after all required application materials have been received and reviewed. Where appropriate, all

**Frank Pleban, Ph.D.**
Southern Illinois University-Carbondale, 2002
Research Interests:
Adolescent health, juvenile delinquency, gangs, school bullying

**Yeong Rhee, Ph.D.**
Oklahoma State University
Research Interests:
Trace elements, chronic disease, immune function, functional foods

**Julie Garden Robinson, Ph.D.**
North Dakota State University, 1994
Research Interests:
Food Safety, Applied Nutrition

**Brandford N. Strand, Ph.D.**
University of New Mexico, 1988
Research Interests:
Physical Education Curriculum and Instruction

**Donna Terbizan, Ph.D.**
The Ohio State University, 1982
Research Interests:
Exercise Physiology, Fitness, Wellness, Human Performance

## Music Graduate Faculty

**Andrew Froelich, D.M.A.**
Michigan State University, 1969
Research Interests/Area of Expertise:
Piano Performance, Theory/ Composition

**Robert Groves, Ph.D.**
University of Iowa, 1981
Research Interests/Area of Expertise:
Piano Performance, Literature, Popular Music Literature

**Robert Jones, D.M.A.**
University of Oklahoma, 1991
Research Interests/Area of Expertise:
Vocal Performance and Pedagogy, Opera, World Music

international student requirements must be met. If a program has a cohort group with enrollment limitations, an entrance interview will be required.

For the doctoral programs in Education the required materials are:

1. A statement of career goals consistent with the goals of either the Ed.D. or Phd.D. program.,
2. Official transcripts of baccalaureate and master's (or equivalent) degrees from accredited institutions,
3. Three letters of recommendation attesting to demonstrated academic strength in undergraduate and/or master's (or equivalent) degrees, and
4. A master's degree GPA of 3.0 or equivalent.

For the Counselor Education and Supervision track in the Human Development Ph.D. program see Human Development and Education.

Required materials for the Education Specialist (Ed.S.) degree in Educational Leadership are:

1. A written statement of career goals;
2. Official transcripts of baccalaureate and master's (or equivalent) degrees form accredited institutions,
3. A master's degree GPA of 3.0 or equivalent, and
4. The letters of recommendation attesting to demonstrated academic strength in undergraduate and/or master's (or equivalent) degrees.

For either the Master of Education (M.Ed.) or the Master of Science (M.S.) programs the required materials are:

1. A completed, signed application form;
2. Official transcripts of all previous collegiate work, including one verifying graduation with a baccalaureate degree from an accredited institution;
3. Three references that evaluate the applicant's potential for success as a graduate student in the chosen master's degree program.
4. An exhibit of the applicant's written competency through an essay discussing professional philosophy and professional goals.
5. Applicant's baccalaureate degree cumulative GPA must be at least 3.0 on a 4.0 scale or equivalent.

The School of Education reserves the right to obtain additional information about the student's professional competence from qualified professionals.

Admission decisions are based upon the predicted success of the applicant as a student and professional in the chosen field and are made only after considering all available data. The criteria for admission are as follows:

**NOTE:** Earning an academic/professional degree does not necessarily lead to state credential or licensure. People seeking licensure must provide evidence of the required number of years of teaching or counseling, and, in the case of school administration, administrative experience. Potential and current students should consult with the appropriate academic program coordinator for advice about licensure, certification, or credentialing after communicating with the appropriate state official.

## Admission with Full Standing

A student must meet all requirements for full admission. The following criteria act as guidelines for full acceptance: A cumulative baccalaureate GPA of 3.0 or better on a 4.0 scale, a GPA of at least 3.25 during the final 30 semester credits of graded undergraduate course work, or a

**Kyle Mack, D.A.**
Ball State University, 1992
Research Interests/Area of Expertise: Conducting, Low Brass, Instrumental Jazz, Band

**E. John Miller, Ph.D.**
Northwestern University, 1991
Research Interests/Area of Expertise:
Music Theory, Technology

**Jo Ann Miller, D.M.A.**
University of Cincinnati-College Conservatory of Music, 1989
Research Interests/Area of Expertise:
Choral Conducting, Literature, Choirs

**Neil Mueller, D.M.A.**
Boston University School for the Arts, 1998
Research Interests/Area of Expertise:
Trumpet Performance

**Warren Olfert, Ph.D.**
Florida State University, 1992
Research Interests/Area of Expertise:
Music Education, Conducting, Instrumental Music

**Matthew Patnode, D.M.A.**
Arizona State University, 1999
Research Interests/Area of Expertise: Woodwinds, Jazz Studies

minimum GPA of 3.0 on 10 semester credits of graduate course work.

### Admission with Conditions

A student who does not meet all requirements for full admission may be admitted with conditions by showing evidence that the applicant's potential is not adequately reflected by her/his record. The following criteria act as guidelines for conditional acceptance: A minimum cumulative GPA of 2.80 or better on a 4.0 scale, and MAT (or GRE) scores that show prospects of satisfactory graduate school performance.

A student admitted to this status will be provided with a statement of the conditions necessary to be satisfied before advancement to full standing. A student must be advanced to full standing before a plan of study can be approved.

After being accepted for graduate study in the School of Education , the student should contact an adviser assigned to her/him for assistance in filing a plan of study for consideration by the School of Education .

All enrollments in Education courses before the student files a graduate plan of study must be approved by the adviser. The School of Education will evaluate graduate courses taken prior to filing the graduate plan of study when the student's plan of study is being considered. Only those courses approved by the School of Education may be included on the final plan of study leading to the degree.

### Financial Assistance

Graduate assistantships are available in the School of Education . Applications are considered on the basis of scholarship, potential to undertake advanced study and research, and financial need. Students must be accepted into The Graduate School before they are eligible for an assistantship.

### Degree Requirements

Doctoral degree programs within the School of Education require a minimum of 90 semester hours beyond the bachelor's degree (a minimum of 50 semester hours beyond the master's degree). For the Counselor Education and Supervision track in the Human Development doctoral program, see Human Development and Education.

Master's programs within the School of Education require a minimum of 30 semester credits (minimums vary by academic program). The Master of Science (M.S.) degree requires a disquisition. The Master of Education (M.Ed.) degree is a non-disquisition, practitioner-oriented degree. Programs vary on requiring a written comprehensive exam or a portfolio/oral.

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## Courses Offered

### Counselor Education (CNED)

**710 Counseling Techniques 3**
Basic principles and techniques in the counseling process. Emphasis given to counseling techniques from several counseling orientations. Prereq: Admission to program.

**711 Counseling Theory 3**
Study of various theories and philosophies of counseling and therapy. Prereq: Admission

to program.

**712 Dynamics of Self 3**
Application of personality theory and the life stages to human behavior and the counseling process. Prereq: Admission to program or instructor's permission.

**713 Assessment Techniques 3**
Techniques and procedures of studying the individual and diagnostic process in identifying client issues. Prereq: Educ 710, 711, admission to program.

**714 Career Counseling and Testing 3**
Study of theories of career development and the use of career information and testing in career counseling. Prereq: Admission to program or instructor's permission.

**715 Professional Orientation and Ethics 3**
Introduction to dealing with professional and ethical responsibilities and multicultural issues in the counseling field. Prereq: Admission to the program.

**716 Social and Cultural Foundations in Counseling 3**
Issues and trends in counseling with multicultural and diverse populations within our society. Prereq: Educ 710, 711, Admission to program.

**720 Group Counseling 3**
Study of group counseling principles appropriate to various counseling settings, including schools, treatment centers, and agencies. Includes a group experience. Prereq: Admission to program.

**723 Advanced Assessment in Counseling 3**
Assessment and diagnostic procedures: how to use appropriate tools for accurate diagnosis and assessment, how to interpret assessment and diagnostic instruments, and how to make effective use of assessment results in counseling with clients. Prereq: Admission to program or instructor's permission.

**725 Elementary School Counseling 2**
Exploration of models of elementary counseling and examination of counseling materials in implementing a counseling program. Prereq: Admission to program.

**726 Middle School Counseling 2**
Exploration of models for middle school counseling and examination of counseling materials for middle school counseling programs. Prereq: Admission to program.

**727 Secondary School Counseling 2**
Overview of principles and functions of a secondary school counseling program and examination of secondary school counseling materials. Prereq: Admission to program.

**728 Guidance Administration and Consulting 2**
Role of administrators, counseling personnel and teachers in the management of and consulting in K-12 counseling programs. Prereq: Admission to program or instructor's permission.

**730 Sexual Functioning and Abuse Issues in Counseling 3**
Study of sexual dysfunction, incest and abuse and strategies of intervention and counseling and victims and perpetrators. Prereq: 710, 711, admission to program.

**731 Counseling Children and Adolescents 3**
Counseling with children and adolescents, including specific counseling strategies; mental, physical, and emotional development issues related to counseling. Prereq: 710, 711, admission to program.

**732 Family Counseling 3**
Principles and techniques of family counseling, study of family dynamics, family systems, and theories of family counseling. Prereq: 710, 711, admission to program.

**733 Marital Counseling 3**

Survey of marital counseling theories and techniques; analyses of dysfunctional communications. Prereq: 710, 711, admission to program.

**734 Dynamics of Addiction 3**
Study of the theories and scope of addiction from both the personal and social viewpoints with consideration given to the impact on the family. Prereq: 710, 711, admission to program.

**763 Advanced Testing and Appraisal 3**
Theory, methods and techniques of assessment of client strength(s) and deficit(s) will be examined. Common instruments used in counseling will be studied, as well as their administration and interpretation. Prereq: admission to doctoral program.

**767 Advanced Group Counseling 3**
Theory and practice of group facilitation will be covered, building on the student's current expertise. Supervision of group facilitators is included. Prereq: admission to doctoral program.

**769 Theory and Practice for Counselor Educators 3**
Instructional models, educational techniques and the unique relationship between Counselor Educator and counseling student will be featured. Supervised experience in facilitating student learning will be included as well as feedback from the professor and fellow classmates. Prereq: admission to doctoral program.

**770 Counselor Supervision 3**
Theory and practice of counselor supervision. Major schools of thought in counselor supervision will be examined, as well as the process of supervision and relationship between supervisor and supervisee. Prereq: admission to doctoral program.

**771 Counselor Education and Supervision in a Multicultural Society 3**
An overview of becoming a professor in Counselor Education. The nature, scope and vista of being a scho9lor, educator, supervisor and practitioner in a multicultural context will be explored. Prereq: Admission to program.

**772 Advanced Counseling Theories 3**
An exploration of what constitutes the human condition. Appropriate components of good theory will be addressed and the major schools of thought within counseling theory will be surveyed. Prereq: Admission to program.

**776 Qualitative Research and Program Evaluation 3**
Major approaches in qualitative research in counseling and counselor education will be examined. Theory and practice issues will be included as well as data analysis. Positivistic and non-positivistic approaches will be explored. Prereq: Admission to doctoral program.

**779 Quantitative and Survey Research 3**
In-depth analysis of theory, method and technique for conceptualizing and conducting quantitative research in counseling and counselor education will be examined. Survey design and methodology will be included. Specific emphasis will be on issues related to qualitative and survey theory, research and practice related to counseling and counselor education. Prereq: Admission to doctoral program.

**780 Ethical and Legal Issues in Counselor Education 3**
Current challenges in Counselor Education regarding ethical and legal issues in the practice of counselor education and supervision. Prereq: Admission to doctoral program.

**787 Professional Issues: Professional Development, Consultation, and Publishing 3**
A seminar that addresses the following needs of practitioners for professional development, both as consumers and providers; theory and practice of consultation; and, the process of developing, writing and submitting manuscripts for publication. Prereq: Admission to program.

The following require admission to the program or instructor's permission

**790 Graduate Seminar 1-4**

**793 Individual Study/Tutorial 1-5**

**794 Practicum/Internship 1-9**

**795 Field Experience 1-15**

**796 Special Topics 1-5**

**797 Master's Paper 1-3**

**799 Dissertation 1-15**

## Education (Educ)

**671 Middle School Philosophy and Curriculum 2**
Educational foundations for middle schools, essential to meeting young adolescent needs and improving their learning. Identifies and expands central ideas in philosophy, historical background, curriculum, facilitating learning, organizational structures and practices, assessment, and planning. Prereq: Educ 451 or graduate standing.

**672 Middle Level Teaching Methods 3**
Instruction and guidance in the design, implementation, and assessment of teaching strategies adapted to young adolescents. Prereq: Educ 451 or graduate standing.

**702 Statistics in Educational Research 2**
Basic theory, techniques for using descriptive and inferential statistics, application in educational research designs.

**703 Research, Measurement, and Program Evaluation 3**
Methodology and design of research studies; organization, reporting analysis, and interpretation of research.

**710 Philosophy of Education 2**
Major philosophical concepts and principles of education from Plato to the present.

**712 Social, Cultural, and Political Dimensions of Schools 4**
Social processes and interaction among diverse populations in educational settings. Relationship of schools to society.

**714 History of American Education 2**
Historical and intellectual development of education in the United States from the colonial period to the present.

**715 The Superintendecy 2**
This course deals with examining the role and functions of the public school district administrator.

**716 Comparative Education 2**
Analysis of educational systems of selected nations, including emerging and economically developed countries.

**717 Adult Learning 2**
Includes recent research concerning adult learning in the context of planning and operating effective adult education programs.

**718 Community Education 2**
Study of the theory base on which community education is founded. Consideration is given to implementing the concept in the community with available resources.

**719 Planning and Conducting Needs and Assessment 3**

A three-phase model will be compared and contrasted to provide the skill and knowledge necessary for conduction needs assessments for educational schools and institutions.

**720 Supervision of Student Teachers 2**
See Human and Community Education for description.

**721 Assessment Techniques for Educational Institutions 3**
The purposes of this course is to introduce educators about all aspects of assessments in order to select the assessment technique that meets specific accountability mandates in the field of education.

**722 Instructional Systems, Media, Materials 2**
Preparation of instructional systems in support of a variety of teaching techniques and alternative media approaches.

**723 Diversity and Educational Policy 3**
The purpose of this course is to help educators understand ethinic and racial identity formations among high school and college students of racially mixed heritage.

**724 Advanced Educational Psychology 2**
Principles of effective human learning. Discussion of learning theories, the teacher as a director of learning experiences, and factors in students representing a variety of cultures and abilities in the educational setting.

**725 Institutional Analysis Techniques 3**
Surveys, focus groups, longitudinal studies, national data sets, correct statistical design and analyses, and effective reporting techniques will be reviewed and utilized in depth to address questions of institutional performance in academic and student affairs.

**726 Diagnosis of Learning Disabilities 2**
Identification of different types of learning disabilities with an overview of diagnostic techniques and remediation procedures.

**727 Higher Education Law 3**
To develop expertise in legal issues for students whose current positions or future career goals include administrative and management positions in higher education where they will work on legal issues with attorneys.

**728 Instructional Technology for Teaching and Learning 3**
This course provides and advanced understanding of technology concepts and contemporary computer-based programs for contemporary computer-based programs for the teaching and learning processes.

**729 Organization and Administration of Telecommunication Technologies**
This course provides the procedures for developing videoconferencing training materials to prepare faculty, students, and staff to effectively use the video-conferencing equipment both for meetings and instruction.

**730 Leadership, Planning, and Organizational Behavior 3**
Introduction to models of educational leadership including organizational structure, theory, and leadership styles. Consideration of concepts, problems, and issues in administration.

**731 Educational Law and Organizational Structure of Schools 3**
Examination of the legislative and judicial actions affecting the public schools. Consideration is given to contemporary legal issues for teachers, administrators, and boards.

**732 Curriculum, Instruction, and Learning Theory 4**
Investigation of curricular decision-making and program evaluation strategies as they affect the educational program. Problem-solving skills are presented through theory and simulation. Prereq: Educ 730.

**733 Technology and Information Systems 2**

Provides an understanding of selected computer applications for educational administrators at the building and district office levels.

**734 Personal Communications and Ethics 3**
Prepares aspiring school leaders to plan for their personal and professional development and to understand and use the principles of communication, ethics, and values.

**735 Personnel, Supervision, and Staff Development 4**
Specific techniques and systems to supervise instruction. Review of interpersonal communication and group process skills as applied to administrative supervision. Prereq: Educ 730.

**736 Policy and Educational Finance 2**
Provides school leaders with an understanding of managing and allocating resources in a political climate in which policy decisions are based on historical resource allocations.

**737 The Helping Relationship and the Elderly 3**
The theoretical foundations and the techniques of the helping relationship between the helper and people of advanced age will be studied and applied.

**738 Administration of Elementary Schools 2**
Common elements of leadership as they apply to the principalship. Consideration of practical applications in an elementary school setting. Prereq: Educ 730.

**739 Administration of Secondary Schools 2**
Common elements of leadership as they apply to the principalship. Consideration of practical applications in a secondary school setting. Prereq: Educ 730.

**740 Financing Higher Education 3**
This course provides funding theories and procedures necessary to develop and maintain to finance higher education.

**741 Higher Education Student Affairs and Enrollment Management 3**
The purpose of this course is to teach about the roles of student affairs professional in schools, colleges, and other educational organizations, including recruitment, selection, orientation, development, compensation, and evaluations.

**742 Elementary School Curriculum 2**
History, development, evaluation, and revision of the curriculum. Review of recent research in elementary school curriculum.

**743 Secondary School Curriculum 2**
Study of contemporary curriculum patterns with emphasis on curricular construction and evaluation.

**744 Administration of the Middle School 2**
Organization and administration of educational programs for early adolescents with special consideration given to block scheduling, interdisciplinary teams, and adviser-advisee problems. Prereq: Educ 730.

**745 Program Evaluation Research 3**
Major theoretical approaches to the evaluation of educational programs are reviewed, analyzed, and critiqued. Pragmatic implications for educational and social policy are addressed, as well as constructive impact on program decision-making

**746 Institutional Quality Control 3**
History and effecting of quality control will be briefly reviewed. Global, U.S. societal, state government, accreditation, and student accountability forces will be elucidated. Successful, failed, and future institutional responses to these forces will be discussed.

**747 Analysis of Elementary Reading Instruction 2**
Reading process; psychological and linguistic foundations; program assessments; and diagnostic approaches, skills, and individualization.

**748 Collective Bargaining and Negotiation in Education 2**
Study of the principles and processes of collective bargaining in public educational institutions. Development of negotiation skills through participation in simulations.

**749 Case-based Educational Research and Statistics 3**
The purpose of this course is have graduate students understand statistical meanings and concepts which will provide the professional expertise needed to serve schools and institutions with their contemporary research and accountability needs.

**750 Reflective Practice and Research in Education 3**
An examination of teaching and professional practice based on reflective practice. Analyze educational research as relates to and informs practice.

**751 Students and Their Learning 3**
Exploration of student differences and ways of adjusting teaching practice to meet individual needs. Application of learning theories to educate the whole child (cognitive, affective, social). Equitable treatment of students.

**752 Curriculum Design and Delivery 3**
An inquiry-based course for the reflective practicioner to develop deep understandings of curriculum content emphasized by state and national standards documents and acquire an effective repertoire of instructional skills.

**753 Managing and Monitoring Learning 3**
This course is based on the concepts that assessment drives instruction. A working definition of student learning will be defined. Multiple measures of assessment will be investigated and impacts in student learning will be explored.

**763 Education and Training for Business and Industry 3**
The purpose of this course is to teach the fundamentals necessary to educate and train people for the workforce according to evolving training needs of businesses, industry, military, and government.

**767 Organization and Administration of Higher Education 3**
This course deals with the organization and administration of higher education and the current and evolving problems and possibilities for higher education.

**769 Politics and Policy Analysis in Education 2**
The purpose of this course to examine political and policy development in American public education in order to understand current local, state, and national issues.

**770 Empowerment and Advocacy in Human Development and Education 3**
An examination of theory, research and practice in individual and group empowerment and advocacy in the multicultural and diverse contexts that contemporary human beings find themselves.

**771 Structural and Equation Modeling Fundamentals 3**
This course is designed for faculty and doctoral-level students who need a significant familiarity with those statistical techniques known collectively as "structural equation modeling".

**772 Curriculum and Instructional Development 3**
A five-phase model will be compared and contrasted to provide the skill and knowledge necessary to establish a systematic curriculum and instructional development.

**775 Content Area Reading 2**
Examination of content, instructional methodologies, and evaluation techniques for reading in content classes.

**776 Qualitative Research 3**

The purpose of this course is to address theory and practice approaches in qualitative research for education settings that include data analysis, content analysis, interpretive analysis, positivistic, and non-positivistic.

**777 Tort Liability 2**

Examination of the legal liability of teachers, administrators, and public school boards for injurious intentional or unintentional acts. Prereq: Educ 731.

**778 School Fund Management 3**

Proper recording and reporting of financial accounts for elementary and secondary schools. Use of procedures and concepts for governmental fund accounting and financial management. Prereq: M.S. or equivalent in educational administration.

**779 Quantitative and Survey Research 3**

The purpose of this course is to have an in-depth analysis of theory, method, and technique for conceptualizing and conducting quantitative research, survey design and methodology in educational leadership.

**780 Instructional Models 2**

Investigation of current practices and trends in instructional models. Emphasis is on the relationship of current research to contemporary practice.

**781 Science Teaching and Curriculum 3**

Overview of recent research on science teaching, learning, and curriculum. Special attention given to contemporary theories on science teaching models that enhance student understanding.

**782 Supervisory and Administrative Theories 4**

Study of management models and techniques, needs assessment, goal setting, planning and evaluation systems, and decision-making problems as they relate to the school improvement process. Prereq: Educ 732.

**783 Computer Data Management and Decision Making 2**

Interpretation of effective computer applications for computer use as a decision-making and planning tool for school finance and managerial functions relating to the field of school business administration and school district superintendency. Prereq: Educ 730 and 10 credits in educational administration.

**784 School Personnel Administration 2**

Study of personnel administration in public school systems. Includes an examination of the purposes, policies, plans, procedures, and personnel administration. Prereq: Educ 782.

**785 Organization and Administration of Vocational/Technical Education 2**

Overview of the vocational education services of local educational agencies and their relation to post-secondary education. Emphasis on planning, organizing, administering, and managing resources.

**786 School Facility Planning 2**

Overview of the principles in planning, construction, and maintenance of school buildings. Visits to educational facilities and the assessment of school buildings. Prereq: M.S. or equivalent.

**787 Issues in Education 2**

This course delves into the issues of why a person would pursue a doctoral degree in light of the current issues facing educators. Helps define a professional course of study available in respect to educational issues. Leads to studying creators and leaders in different realms by people who have special interest in creativity and ethical pursuits.

**788 School Finance and Business Management 4**

Overview of school fund revenues and expenditures pertaining to local, state, and federal funding. Includes in-depth study of the practices of school business administration pertaining to all fund activities in instruction and ancillary operations.

**789 School Community Relations 2**
Purposes, organization, agencies, and criteria of good school-community relationships; knowledge and techniques for effective public relations. Prereq: Educ 739, M.S. or equivalent in educational administration.

**790 Graduate Seminar 1-3**

**793 Individual Study/Tutorial 1-5**

**794 Practicum/Internship 1-8**

**795 Field Experience 1-15**

**796 Special Topics 1-5**

**797 Master's Paper 1-3**

**798 Master's Theses 1-10**

**798s Specialist's Field Study (TCU) 1-6**

## Human and Community Education (H&CE)

**702 Introduction to College Teaching in the Humanities and Social Sciences 3**
Techniques for effective teaching and assessing learning at the college level. Includes special issues and responsibilities related to college-level teaching.

**724 Program Development in Vocational Education 2**
Methods and curricula development in vocational family and consumer sciences education in accordance with state and federal guidelines. Includes long-range and strategic planning competencies.

**740 Vocational Philosophy and Policy 3**
Philosophy in developing, planning, and conducting vocational education programs at federal, state, and local levels. Importance of legislation on state and local policymaking.

**743 SAE/Adult Programs 3**
Principles of leadership, design, analysis, record keeping, student organizations, and activities in adult/youth programs. Community-based programs in adult farm business management education. Prereq: Teaching experience.

**746 International Extension 3**
The ideological and theoretical basis of world agricultural assistance programs and their effects on different sectors and classes. Prereq: H&CE 345.

**751 Rural Survey in Agricultural Education 3**
Research-type survey of the agricultural education resources unique to the local area/ community, research data implications, and current technology implementation. Prereq: Teaching experience, Educ 702.

**756 Program Development and Evaluation 3**
Methods and procedures of long-range planning, strategic planning techniques, integrating new/emerging biotechnology, guidance and counseling, and evaluating program effectiveness.

**772 Curriculum Development in Family and Consumer Sciences 2**
Examination of the major concepts, philosophies, and strategies that influence curriculum
decisions in family and consumer sciences programs at all educational levels. Includes assessment of curriculum goals and materials.

**775 Internship 1-3**

Supervised experience in a formal or informal environment relevant to the application of educational principles. Setting may include middle, secondary, post-secondary, and adult programs. Prereq: Admission to Graduate School.

**777 Evaluation in Family and Consumer Sciences 2**
Examination of the role of course assessment, teacher effectiveness, facilities, equipment, and staffing patterns in program evaluation. Review of research on evaluation and exploration of alternative evaluation models.

**781 Professional Development in Agricultural Education 1-3**
Continued professional development in technical and pedagogical subjects of current importance for professionals in agricultural education.

**787 Issues in Education 1-3**
Exploration and assessment of a current issue associated with middle and secondary applied academic programs. Prereq: Current employment or experience as middle/ secondary teacher.

The following variable credit courses are also offered:

**790 Graduate Seminar 1-3**

**793 Individual Study/Tutorial 1-5**

**794 Practicum/Internship 1-8**

**795 Field Experience 1-15**

**796 Special Topics 1-5**

**797 Master's Paper 1-3**

**798 Master's Theses 1-10**

## Health, Nutrition, and Exercise Science (HNES)

**701 Administrative Leadership in HNES 3**
This course provides an introduction to administrative leadership in health, physical education, recreation and sports. The course is designed to provide students with skills, techniques and practices for successful leadership.

**702 Sport Marketing and Public Relations in HNES 3**
Understanding the issues and areas involved in marketing and public relations in the area of HNES. Discussed are both fund raising strategies and the development of communication skills needed for success in this field.

**703 Organization and Administration of Sport and Physical Education 2**
Comprehensive study, including current research in physical education, recreation, and sports organization and administrative techniques.

**710 Recent Literature and Research 3**
Directed readings and class discussions of recent literature, steps involved in problem solving, and critical analysis of research in the field.

**711 The Physical Education Curriculum 2**
Instruction on the role and importance of physical education in today's society, steps involved in curriculum planning, trends and issues in curriculum, various approaches to curriculum design.

**712 Supervision and Analysis in HNES 3**
To study the scope of supervision, techniques for improvement of various phases of the

learning process of teaching or coaching, and means of evaluating the effectiveness of supervision in the filed. Also, to provide practicing physical education teachers with practical field-based observational experiences via the viewing of teaching situations. Students will learn and use a number of observational techniques as they evaluate teacher behaviors, student behaviors, and teacher-student interaction.

**713 Applied Sports Physiology 2-3**
Comprehensive state-of-the-art review of the current knowledge of the physiological responses to exercise.

**714 Legal Liability in HPER 2**
Focused on risk management and legal liability in health, physical education, and recreation. Overview of civil and criminal law related to sport and recreation. Offered alternate years.

**715 Teaching Concepts-Based Fitness 2**
Theoretical and practical aspects of the role of fitness education in contemporary physical education in a public school setting. Offered alternate years.

**716 Analysis of Teaching Physical Education 2**
Theoretical and practical aspects of the role of the physical education teacher in educational settings in contemporary society. Offered alternate years.

**717 Recreation and Sport Complex Management 2**
Current practices in management, planning and design of facilities in sport, physical education, and recreation.

**718 Community Relations and Communication Strategies 2**
Development of communication skills necessary for the professional success of prospective and current athletic coaches and administrators. Offered alternate years.

**719 Wellness and Leisure for Adults 2-3**
Leisure services and their effect on the adult population.

**720 Fitness/Wellness Management 2-3**
Management principles and operational guidelines in fitness/wellness programs/settings.

**721 Health Promotion Programs 2-3**
Development of health promotion programs in wellness settings.

**722 Epidemiology of Physical Activity2-3**
Association between sedentary habits, risk for chronic disease, and physical activity recommendations.

The following variable credit courses are also offered:

**790 Seminar 1-3**

**793 Individual Study 1-5**

**794 Practicum/Internship 1-6**

**795 Field Experience 1-15**

**797 Master's Paper 1-3**

**798 Master's Thesis 1-15**

## Music

**701 Psychology of Music 2**

Study of acoustics, the anatomy and physiology of hearing, and how music and sound are perceived by the listener.

**711 Form and Analysis 2**
Study of the types of tonal relationships which create musical works of art. Examination of small forms such as motive and phrase, and progressing to large forms such as fugue, variation, and sonata.

**712 Survey of Choral Literature 2**
Study of the major genres, forms, and style periods of choral music, including major composers and their output. Concert programming included.

**713 Band Literature, History, and Development 2**
In-depth study of band literature including history, trends, significant works, and related resources.

**721 Advanced Vocal Pedagogy and Repertoire 2**
In-depth study of the physical and physiological considerations of vocal technique with application to specific voices and suitable repertoire.

**722 Advanced Instrumental Music Pedagogy and Literature 2**
Advanced study in the pedagogy and literature of wind instruments. Emphasis on techniques of teaching winds in grades 5 through 12. Section 1: Brass pedagogy. Section 2: Woodwind pedagogy.

**731 Applied Study 1**
Private study in voice, woodwinds, brass, or conducting designed to refine performance skills, and technical and musical proficiency.

**790 Seminar in Music History 2**
In-depth study of a specific period in music history. Involves specialized readings, score study, and listening. A research paper on some aspect of the period is required.

**794 Practicum 3**
Independent study in the music field which will relate to the student's chosen teaching situation.



E-Mail: The Graduate School
Prospective students may schedule a visit by calling 1-800-488-NDSU.
The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701-231-7019

**Fei Dai, Ph.D.**
Florida Atlantic University, 2005
Research Interests:
Sensor Networks

**Daniel L. Ewert, Ph.D.**
University of North Dakota, 1989
Research Interests:
Biomedical Engineering

**David C. Farden, Ph.D.**
Colorado State University, 1975
Research Interests:
Communications, Systems, Signal Processing

**Jacob Glower, Ph.D.**
The Ohio State University, 1988
Research Interests:
Control Systems, Digital Systems

**Roger Green, Ph.D.**
University of Wyoming, 1998
Research Interests:
Signal Processing, Array Processing, Time-frequency Analysis

**Joel A. Jorgenson, Ph.D.**
Iowa State University, 1998
Research Interests:
VLSI Design, Signal Integrity, Electronics

**Rajendra Katti, Ph.D.**
Washington State University, 1991
Research Interests:
Computer Architecture, Parallel Processing

**Rajesh G. Kavasseri, Ph.D.**
Washington State University, 2002
Research Interests:
Power Systems, Nonlinear Dynamics, Renewable Energy resources

**Ivan T. Lima Jr., Ph.D.**
University of Maryland, Baltimore County, 2003

# Electrical and Computer Engineering

## Program Description

The Department of Electrical and Computer Engineering offers graduate programs in selected specialty areas leading to the M.S. and Ph.D. in Electrical and Computer Engineering. Current departmental research expertise falls into one of the following areas: Signal Processing Group, Biomedical Engineering, Power/Power Electronics, Integrated Circuit, Electromagnetics, and Computer Engineering. The ECE Department is also a key contributor to NDSU's Research and Technology Park.

## Admissions Requirements

Admissions to the ECE program is on a competitive basis based upon the student's GRE scores, grade point average, and area of interest. Students who have graduated from an accredited electrical and computer engineering program in the United States with a B or better are encouraged to apply. Students with less than a B average may, under certain circumstances, be admitted on a conditional basis. Graduates from programs other than electrical and computer engineering--such as mathematics, physics, and other engineering areas--may be admitted if their average is B or better. However, they must satisfy or prove proficiency in the electrical and computer engineering undergraduate curriculum in effect at the time of matriculation. Normally, this means completing some undergraduate courses before pursuing graduate study. Some students may be able to take graduate and undergraduate courses at the same time. Students in this category should contact the department's graduate coordinator for specific details concerning their individual cases.

Applications should be sent to The Graduate School by February 1st for fall semester enrollment. Normally, students are only admitted for fall semester.

Students are required to take the general test of the Graduate Record Examination (GRE) before their application will be considered. The TOEFL exam is required for applicants whose first language is not English. A minimum score of 525 (paper test) or 193 (computer test) is required for admission. A minimum score of 600 (paper test) or 247 (computer test) is required for teaching assistantships.

## Academic Good Standing

All graduate students must maintain a 3.00 GPA or better and make significant progress towards their degree to remain in good standing. Failing to do either may hinder the student's financial assistance and/or ability to register for courses in the ECE graduate program.

Research Interests:
Photonics

**Robert M. Nelson, Ph.D.**
North Dakota State University, 1987
Research Interests:
Electromagnetics, Electromagnetic Compatibility

**Floyd M. Patterson, M.S.**
North Dakota State University, 1963
Research Interests:
Computer Vision, Signal and Image Processing

**V.V.B. Rao, Ph.D.**
I.I.T., Madras, 1970
Research Interests:
Circuits, Digital Systems

**David A. Rogers, Ph.D.**
University of Washington, 1971
Research Interests:
Microwave Engineering, Electromagnetics, Fiber Optics

**Val G. Tareski, M.S.**
North Dakota State University, 1969
Research Interests:
Computer Systems

**Chao You, Ph.D.**
Rensselaer Polytechnic Institute, 2005
Research Interests:
VLSI

**Subbaraya Yuvarajan, Ph.D.**
I.I.T., Madras, 1981
Research Interests:
Power Electronics

## Financial Assistance

The department has a limited number of both teaching and research assistantships available. These assistantships provide a monthly salary during the academic year, a waiver of graduate tuition during the academic year and summer, but do not cover the minimal activity fee. In addition, there are opportunities, both in the department and on the campus, to perform part-time work as graders, teachers, tutors, and consultants. These assistanceships are awarded on a competitive basis -- typically at the time of admission for fall semester.

## Degree Requirements

The Master of Science degree requires a minimum of 30 semester credits beyond the B.S. degree. For the paper or thesis options, 6 hours of the 30 must be assigned to the thesis while a maximum of 3 credits are assigned to the paper. All students must pass a final oral examination covering both course work, and the thesis or paper.

The Doctor of Philosophy degree requires a minimum of 90 credits beyond the baccalaureate with an overall GPA of 3.0 or higher. Of these 90 credits, 30-40 credits may be assigned to the student's dissertation. The remainder must comprise of at least 36 credits in course work as chosen by the student and his/her supervisory committee. These must include two required courses: (ECE 702: Advanced Research Topics, 3 credits; ECE 703: Advanced Teaching and Classroom Topics, 3 credits).

## Research Facilities and Equipment

The department is housed in a modern, well-equipped building. Graduate students have access to laboratories, instrument rooms, and computer services ranging from the university computer system to departmental computers. Research facilities include cardiovascular engineering lab, computer architecture lab, digital systems lab, EMI shield room, power and power electronics lab, signal processing and systems lab, and printed circuit lab.

## Ph.D. in Engineering Requirements

In addition to the Ph.D. in Electrical and Computer Engineering, NDSU offers a Ph.D. in Engineering. This Ph.D. program is characterized as an interdisciplinary approach to engineering. A doctoral program for all engineering disciplines provides electrical and computer engineering students with general engineering knowledge and with in-depth understanding of one major specialty area, electrical engineering. The Ph.D. degree requires a minimum of 90 semester credits beyond the B.S. degree. Of these, 24 to 54 credits are to be in an area of concentration, 12 to 30 credits are from cognate and minor areas, and 30 to 40 credits comprise the doctoral dissertation. Students are required to pass a written qualifying examination on course work and a preliminary oral examination to qualify for Ph.D. candidacy. A final oral examination, primarily concerned with research work, is taken after the candidate has completed all course work and the dissertation.

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# Courses Offered

**611 Optics for Scientists and Engineers 3**
Introduction to modern optics. Geometric optics, electromagnetic nature of light, polarization, interference, diffraction, fiber optics. Corequisite laboratory with major related optics project. Prereq: Phys 252. Coreq: ECE 611L.

**611L Optics for Scientists/Engrs. Lab. 1**
Required laboratory for ECE 611. Ten optics experiments plus a major related project.

Prereq: Phys 252. Coreq: ECE 611.

**617 Optical Signal Transmission 3**
Optical signal transmission including geometric optics and modal analysis for homogeneous
and inhomogeneous light guides. System studies including coupling, inter-symbol interference, sources, photo detectors, and modulation. 3 lectures. Prereq: ECE 351.

**621 Communication Circuits 3**
Resonant circuits and tuned amplifiers, oscillators, modulators and demodulators, phase-locked loops, and power amplifiers. Analysis, design, and applications in communication systems. 3 lectures. Prereq: ECE 323.

**623 Digital Electronics 3**
Analysis and design of digital integrated circuits. Characteristics and applications of logic gates and regenerative logic circuits. 3 lectures. Prereq: ECE 323.

**625 Introduction to Semi-Conductor Devices 3**
Properties and applications of semi-conductors and solid state electronic devices. Semi-conductors, junctions, and transistors. 3 lectures. Prereq: ECE 321, 351.

**631 Power Systems 3**
Electrical characteristics of high voltage lines. Symmetrical components, per unit system, and transformers. Matrix methods, load flow, and fault analysis. 3 lectures. Prereq: ECE 311.

**633 Power Systems Design 3**
Unbalanced power systems, economic dispatch, transients in power systems, power system stability, power system protection. 3 lectures. Prereq: ECE 311.

**637 Power Electronics 3**
Characteristics and modeling of power electronic devices. Rectifiers, choppers, and inverters; and their applications in power supplies and motor drives. 3 lectures. Prereq: ECE 321.

**643 Communications I 3**
Communication theory and design with an emphasis on spectral techniques. Modulation and noise effects. 3 lectures. Prereq: ECE 343; Coreq: ECE 441.

**645 Communications II 3**
Continuation of ECE 643. Digital communication systems. Optimum receivers. Information theory and coding. 3 lectures. Prereq: ECE 443.

**653 Signal Integrity 3**
Design of high-frequency circuits.

**655 Designing for Electromagnetic Compatibility 3**
Principles and methods concerning electronic system designs that are not sources of or susceptible to electromagnetic interference. 3 lectures. Laboratory. Prereq: ECE 343, 351.

**663 Digital Control 3**
Analysis and design of sampled-data control systems including z-transforms, sampling theory, design to specifications, controllability, observability, stability, and optimization. 3 lectures. Prereq: ECE 461.

**683 Instrumentation for Engineers 3**
Study of instrumentation including design, fabrication, and application.

**685 Biomedical Engineering 3**
Unified study of engineering techniques and basic principles in physiological systems. Focus on membrane biophysics, biological modeling, compartmental analysis, and systems control theory.

**701 Advanced Engineering Problem Solving (required) 3**
Application of advanced mathematical and computational methods to engineering problems. 3 lectures.

**702 Advanced Research Topics 3**
Application of the scientific method to develop research programs in the electrical and computer engineering discipline.

**703 Advanced Teaching and Classroom Topics 1**
Techniques and methods for presenting technical material to an audience.

**721 Integrated Circuits 3**
Introduction to CMOS circuits. Circuit characterization and performance estimation. CMOS circuit and logic design, CMOS testing. CMOS subsystem design. 3 lectures. Prereq: ECE 423/623.

**723 Advanced Electronics 3**
Characteristics and detailed modeling of operational amplifiers. Applications to waveform generation, analog multiplication, modulation, and data conversion. IC and special amplifiers. Prereq: ECE 421/621.

**731 Power System Protection 3**
Power system protective relaying. Generator, transformer, line, bus, motor protection. 3 lectures. Coreq: ECE 433/633.

**733 Power Distribution 3**
Power distribution systems. Lines and transformers, characteristics of loads, voltage drops and corrective measures, lightning protection. Fault analysis, fuses, reclosers, sectionalizers. Power system harmonics and power quality. 3 lectures. Coreq: ECE 431/631.

**741 Signal Processing I (required) 3**
Analysis and design of discrete- and continuous-time signals and systems. Advanced treatment of transform techniques and Fourier analysis. Classical filter design techniques. Fast Fourier transform algorithms and applications. 3 lectures. Prereq: ECE 443/643.

**743 Signal Processing II 3**
Discrete-time Wiener and Kalman filtering. Least squares signal processing and filter design. Spectral analysis. Adaptive signal processing. 3 lectures. Prereq: ECE 741.

**745 Statistical Communications 3**
Advanced topics in communication theory, including detection theory, estimation theory, and information theory. 3 lectures. Prereq: ECE 443/643.

**751 Electromagnetic Theory and Applications 3**
Theory of radiation, antenna characteristics, complex waves, potential functions, and spectral domain methods for waveguides, cavities, and dispersive media. 3 lectures.

**755 Advanced Topics in Electromagnetics 3**
Topics of current interest in electromagnetics, microwaves, and optics. 3 lectures. Prereq: ECE 751 or departmental approval.

**761, 763 Advanced Control Theory I, II 3 each**
State variable formulation of the control problem, system identification. Introduction to adaptive, distributed, multivariable, nonlinear, optimal, and stochastic control. Prereq for 761: ECE 461/661.

**774 Computer Architecture 3**
Processor operations, computer arithmetic, control mechanism, instruction sets, classification schemes, pipelining, parallel processing, hierarchical memory and memory management, I/O methods and interrupts, and interconnection buses. 3 lectures. Prereq: ECE 374.

**778 Computer Networks 3**
Examination of computer networks using the ISO-OSI model as a framework. Exploration of practical and theoretical issues in modems, codes, error, impairments, modulation, protocols, and interfaces. 3 lectures. Alternate years. Prereq: CSci 474.

The following variable credit courses are also offered:

**790 Graduate Seminar 1-3**

**793 Individual Study/Tutorial 1-5**

**696/796 Special Topics 1-5**

**797 Master's Paper 1-3**

**798 Master's Thesis 1-10**

**799 Doctorial Dissertation 1-10**



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The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701-231-8657

**Gary A. Goreham, Ph.D.**
South Dakota State University, 1985
Research Interests:
Rural Sociology, Community, Family, Research Methods, Sociology of Religion

**Daniel J. Klenow, Ph.D.**
University of Notre Dame, 1977
Research Interests:
Medical Sociology, Gerontology, Research Methods, Sociology of Disaster, Emergency Management

**Timothy J. Kloberdanz, Ph.D.**
Indiana University, 1986
Research Interests:
Expressive Culture and Folklore, Anthropological Theory, Indians of the Plains, Peoples of Europe, Ethnicity

**H. Elaine Lindgren, Ph.D.**
**Professor Emeritus**
University of Missouri, 1970
Research Interests:
Social Change, Gender, Citizen Participation

**Richard W. Rathge, Ph.D.**
Michigan State University, 1981
Research Interests:
Demography, Applied Sociology, Rural Sociology, Research Methods

**Kathleen Slobin, Ph.D.**
University of California-San Francisco, 1991
Research Interests:
Medical Sociology, Sociological Theory, African Studies, Women's Health and Illness

# Emergency Management

## Program Description

The Emergency Management program is multidisciplinary and is geared both to the academic disaster research curricula and the applied aspects of emergency management. The program is built on a core of social science courses to help students approach the study of disasters and emergency management from a sociological perspective. Additionally, the program draws from other disciplines that enhance the development of processes and techniques to prevent disasters and to manage emergencies. The program strongly emphasizes the applied and technological aspects for managing emergencies and disasters. Thus, NDSU offers a wide variety of applied courses to ensure that graduates of the emergency management program gain technical knowledge, expertise, and the theoretical framework to join the workforce with a competitive edge. The master's and doctoral degree programs in emergency management are organized around the three following areas: core courses, disaster stage courses, and disaster area studies. Core courses include methods, statistics, and theory. Disaster stage courses cover preparedness, mitigation, response, and recovery. Disaster area studies include the following subtopics: social and behavioral sciences, disaster types, the emergency manager, and the public and private sector responses to emergencies.

## Admissions Requirements

Students can be admitted to our graduate program with either a baccalaureate degree (for admission to the master's or doctoral degree programs) or with an approved master's degree (for admission to the doctoral program). For admission in full standing to the master's program, students will be required to have completed one course in undergraduate social theory (or related topic), one course in research methods, and one course in statistics, have a GPA of 3.2 or greater, attain a combined minimum score on the GRE of 1,000 (verbal and quantitative). Applicants must submit their undergraduate and/or graduate transcripts. Plus, students should have adequate background preparation or demonstrated potential in the field of emergency management.

For admission to the doctoral program in full standing, students must satisfy the admission requirements for the master's degree and have a masters degree in emergency management or related field. Students not meeting the above admission standards may be required to enroll in 6-10 graduate credit hours and achieve a cumulative GPA in these classes of 3.0 for full-standing admission into the program. Students not meeting these standards will be evaluated and possibly placed on conditional status. Students entering the program with a master's degree will be required to complete a minimum of 60 credits.

## Financial Assistance

**Jennifer Wilson, Ph.D.**
Florida International University, 2000
Research Interests: Sociology of Disasters, Emergency Management, Professionalization, Gender.

Both teaching and research assistantships are available contingent on departmental and faculty research funds. Applicants will be considered based on scholarship and potential to undertake advanced study. Requests for assistantship require a completed Graduate School application, official transcripts, and three letters of reference. Applications for the doctoral program must be complete no later than April 1.

## Degree Requirements for M.S. Degree

Successful completion of a master's degree in emergency management will involve completion of all of the required course work plus a research-based master's thesis. The total required credits is 36.

The requirements for the master's degree in emergency management are as follows:

All students must

1. **Core:** Complete all courses (12 credits)
   SOC 723: Social Theory
   SOC 700: Qualitative Methods *or* SOC 701: Quantitative Methods
   EMGT 720: Emergency Management Theory
   EMGT 653: Emergency Management Law and Regulation

2. **Disaster Phases:** Complete at least one course from each of the following four Disaster Stages (12 credits). Courses should be taken in the order listed. Courses taken at the undergraduate level (400) cannot be retaken at the graduate level (600).

    1. **Preparedness**
       EMGT 611: Community Disaster Preparedness
       EMGT 712: Hazards Risk Assessment Theory and Practice

    2. **Mitigation**
       EMGT 613: Building Disaster Resilient Communities
       EMGT 721: Hazard Mitigation Theory and Practice

    3. **Response**
       EMGT 631: Disaster Response Operations and Leadership
       EMGT 732: Disaster Response Theory and Practice

    4. **Recovery**
       EMGT 683: Holistic Disaster Recovery
       EMGT 782: Damage Recovery Theory and Practice

3. **Disaster Area Studies - Social and Behavioral Sciences:** Select one course from each area (6 credits). Courses taken at the undergraduate level (400) cannot be retaken at the graduate level (600).

    1. **Social Structure, Social Institutions, and Social Processes**
       EMGT 681: Disaster Analysis
       SOC 605: Community Development
       SOC 626: Sociology of Medicine
       SOC 641: Sociology of Death
       SOC 631: Environmental Sociology

    2. **Social and Cultural Context of Disasters**
       SOC 610: Social Inequality
       SOC 643: International Disasters
       SOC 645: Special Populations & Disasters
       ANTH 658: Indians of the Great Plains
       ANTH 661: Germans from Russia
       ANTH 662: Cultural Ecology

4. **Disaster Area Studies - The Public and Private Sector:** Select one course (3 credits)
   EMGT 661: Business Continuity & Crisis Management
   EMGT 663: Voluntary Agency Disaster Services
   COMM 683: Organizational Communication I
   BUSN 630: Legal and Social Environment of Business

5. **Practicum:** (6 credits)
   EMGT 795: Emergency Management Practicum

6. **Thesis** (6 credits)

TOTAL = 45 credits

## Degree Requirements for Doctor of Philosophy Degree

The Ph.D. is awarded in recognition of significant depth of understanding and scholarly achievement in emergency management. The recipient must complete all of the required course work (see Ph.D. requirements below), pass both written and oral comprehensive exams, complete significant research project for the dissertation, and successfully defend this research in an oral examination. The student's progress will be reviewed by a supervisory committee that is responsible for reviewing the student's plan of study, written comprehensive examinations, dissertation proposal, and dissertation defense. The composition of the supervisory committee will meet the requirements established by The Graduate School. The program will require a minimum of 90 credits or 60 credits beyond the master's degree. The master's degree must be completed before pursuing the doctoral degree.

The structure of the doctoral program follows the same logic as that used for the master's degree. The courses are organized around the four disaster stages and the various disaster studies subfields. As part of disaster area studies, students will be required to complete two cognates, one in sociology and one in a second field approved by the student's supervisory committee. These cognates require a minimum of 12 credits each. The dissertation will be worth 15 credits.

All students must

1. **Core:** Complete all courses (18 credits)
   SOC 723: Social Theory
   SOC 700: Qualitative Methods
   SOC 701: Quantitative Methods
   EMGT 720: Emergency Management Theory
   EMGT 730: Advanced Research Methods
   EMGT 653: Emergency Management Law and Regulations

2. **Disaster Phases:** Complete at least two courses from two of the following four Disaster Stages and one course from each of the remaining two Disaster Stages (18 credits). Courses should be taken in the order listed. Courses taken at the undergraduate level (400) cannot be retaken at the graduate level (600).

   1. **Preparedness**
      EMGT 611: Community Disaster Preparedness
      EMGT 712: Hazards Risk Assessment Theory and Practice
      GEOG 656: Geographic Information Systems

   2. **Mitigation**
      EMGT 613: Building Disaster Resilient Communities
      EMGT 721: Hazard Mitigation Theory and Practice
      POLS 696: Environmental Policy and Politics

   3. **Response**
      EMGT 631: Disaster Response Operations and Leadership
      EMGT 732: Disaster Response Theory and Practice
      COMM 785: Advanced Crisis Communication

4. **Recovery**
   EMGT 683: Holistic Disaster Recovery
   EMGT 782: Damage Recovery Theory and Practice
   ECS 760: Environmental Impact Assessment

3. **Disaster Area Studies - Social and Behavioral Sciences:** Select three courses from each area (18 credits). Courses taken at the undergraduate level (400) cannot be retaken at the graduate level (600).

   1. **Social Structure, Social Institutions, and Social Processes**
      EMGT 681: Disaster Analysis
      SOC 605: Community Development
      SOC 626: Sociology of Medicine
      SOC 641: Sociology of Death
      SOC 631: Environmental Sociology

   2. **Social and Cultural Context of Disasters**
      SOC 610: Social Inequality
      SOC 643: International Disasters
      SOC 645: Special Populations & Disasters
      ANTH 658: Indians of the Great Plains
      ANTH 661: Germans from Russia
      ANTH 662: Cultural Ecology

4. **Disaster Area Studies - The Public and Private Sector:** Select one course (3 credits)
   EMGT 661: Business Continuity & Crisis Management
   EMGT 663: Voluntary Agency Disaster Services
   COMM 683: Organizational Communication I
   BUSN 630: Legal and Social Environment of Business

5. **Practicum:** (9 credits)
   EMGT 795: Emergency Management Practicum

6. **Electives:** (9 credits)
   Courses may include didactic courses, seminars, independent study and/or field research.

7. **Thesis** (6 credits)

8. **Dissertation** (15 credits)

TOTAL = 96 credits

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## Courses Offered

**Anthropology**

**658 Indians of the Plains 3**
An ethnographic/ethnohistorical survey of major Indian tribes in the Great American Plains region from ancient times to the present.

**661 Germans from Russia 3**
This course traces the cultural and historical background of an important ethnic group in the Great American Plains region: German-speaking immigrants from Russia.

**662 Cultural Ecology**
Analysis of the systematic relationship between human populations and their ecological surroundings. Prereq: Any Anth course.

**Business**

**630 Legal and Social Environment of Business 3**
Study of legal and regulatory environment in which business firms operate as well as the social environment. Includes business ethics and social responsibility issues.

**Communication**

**683 Organizational Communication I 3**
Exploration of the theory of management communication practices in organizations. Emphasis on the formal structure and interpersonal aspects of supervisor-subordinate relations. Cross-listed with Busn.

**785 Advanced Crisis Communication 3**
Long-term and short-term issues for managing communication related to organizational crises are discussed in the states of pre-crisis, crisis, and post-crisis Prereq: Comm 700.

**Emergency Management (EMGT)**

**611 Community Disaster Preparation 3**
Nature and rationale for public awareness of potential hazards that communities face, preparedness for these hazards, and potential strategies to mitigate adverse consequences.

**613 Building Disaster Resilient Communities 3**
Role of emergency management programs in community resilience and sustainability; incorporation of preparedness, mitigation, response, and recovery in community comprehensive and strategic planning.

**615 Rural Society and Emergency Management 3**
Application of emergency management principles and procedures of disaster preparedness, mitigation, response, and recovery in the rural context.

**631 Disaster Response Operations and Leadership 3**
Principles and procedures related to emergency operations plans, warning, evacuation, search rescue, mass casualty care, sheltering, donations management, disaster declaration, and incident debriefing.

**651 Floods, Blizzards, and Tornadoes 3**
Role of emergency management in floods, blizzards, and tornadoes; response of local, state, and federal governments and agencies to these conditions.

**653 Emergency Management Law and Regulation 3**
Legal principles and ethical issues that impact emergency management services.

**661 Business Continuity and Crisis Management 3**
This course provides an overview of planning and management principles applicable to business or operational resumption following an emergency. The emphasis will be on minimizing the impact of a disaster on business operations.

**663 Voluntary Agency Disaster Services 3**
Examination of the roles played by local, state, national, and international voluntary agencies in emergency preparedness, mitigation, response, and recovery.

**683 Holistic Disaster Recovery 3**
Examination of post-disaster policies and programs that protect the natural environment, improve disaster resistance, support diverse populations, improve economic conditions, and preserve community resources.

**712 Hazards Risk Assessment Theory and Practice 3**
Examination of natural and human-made disasters from a risk assessment perspective,

and preparedness and control procedures for each of these types of disaster.

**714 Hazardous Materials Regulation 3**
Hazardous materials contingency planning and environmental regulations at the community, state, and federal levels.

**721 Hazard Mitigation Theory and Practice 3**
Examination of disaster mitigation theory and the rationale and context of mitigation procedures, programs, and planning.

**732 Disaster Response Theory and Practice 3**
Examination of theory and practice in the relationships between incident command systems and emergency operating centers.

**782 Damage Recovery Theory and Practice 3**
Theory, principles, and procedures used in disaster damage assessment and in emergency supply and service dissemination.

**Geography**

**656 Geographic Information Systems 3**
Introduction to basic concepts of geographic information systems and their applications to various special problems. Lectures and laboratories.

**Political Science**

**696 Environmental Policy and Politics 3**

**Sociology**

**605 Community Development 3**
Study of communities viewed as social systems. Includes political, economic, social, and economic factors affecting community growth and decline. Community development methods are addressed.

**610 Social Inequality 3**
Historical and contemporary theories of stratification, the effects of stratification on social institutions and individuals.

**626 Sociology of Medicine 3**
Analysis of the social aspects of illness, the profession of medicine, organization of medical care, health occupations, and related issues

**639 Social Change 3**
An investigation of the nature of social change and its effects on society.

**641 Sociology of Death 3**
Examination of research on social psychological and social organizational dimensions of death and dying. Additional topics include hospice movement, grief and bereavement, and communicating death news.

**643 International Disasters 3**
Impacts of natural and human-made disasters on industrialized and developing societies, relief and reconstruction post-disaster programs.

**645 Special Populations in Disasters 3**
Identification of special populations and their needs that arise in emergency or disaster situations both in industrialized and developing countries.

**700 Qualitative Methods 3**
Advanced analysis of the methods used in qualitative research projects, such as intensive

interviewing, focus groups, and participant observation. Prereq: Soc 301.

**701 Quantitative Methods 3**
Advanced analysis of the methods used in quantitative research projects, such as survey design, experimental design, and evaluation research. Prereq: Stat 330 or 725, Soc 301.

**723 Social Theory 3**
Examines contemporary social theories and theory construction. Prereq: Soc 422/622.

The following variable credit courses are also offered:

**790 Graduate Seminar 1-3**

**793 Individual Study/Tutorial 1-3**

**795 Field Experience 1-15**

**696/796 Special Topics 1-5**

**797 Master's Paper 1-3**

**798 Master's Thesis 1-15**

**799 Doctoral Dissertation 1-15**

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APPLY ONLINE

E-Mail: The Graduate School
Prospective students may schedule a visit by calling 1-800-488-NDSU.
The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701-231-7994

**Iskander Akhatov, Ph.D.**
Lomonosov University of Moscow, USSR, 1983
Research Interests:
Dynamics of bubbles, bubble clouds and bubbly liquids

**Donald A. Andersen, Eng.D.**
Texas A & M University, 1982
Research Interests:
Transportation

**John R. Cook, Ph.D.**
Purdue University, 1991
Research Interests:
Human Factors, Design of Man-Machine Systems, Management of Technology

**Daniel L. Ewert, Ph.D.**
University of North Dakota, 1989
Research Interests:
Cardiovascular Engineering, Bioinstrumentation

**Kambiz Farahmand, Ph.D.**
University of Texas at Arlington, 1992
Research Interests:
Adverse environment protecting garment, thermal physiology, cooling systems, hypothermia, and respiratory heat and mass transfer

**David C. Farden, Ph.D.**
Colorado State University, 1975
Research Interests:
Signal Processing

**Dinesh Katti, Ph.D.**
University of Arizona, 1991
Research Interests:
Geotechnical

**Kalpana Katti, Ph.D.**

# Engineering Ph.D.

## Program Description

The Doctor of Philosophy in Engineering program is designed to provide the engineering student with a unique opportunity to contribute to the advancement of the engineering profession.

The program addresses the engineering profession's need for mature minds that can translate basic knowledge into practical solutions to the engineering problems associated with our rapidly changing environment. This is accomplished through a unique integration of engineering science within a basic area of concentration.

The Ph.D. program is characterized by an interdisciplinary approach to engineering. A single doctoral program for agricultural and biosystems engineering, civil engineering, electrical and computer engineering, industrial and manufacturing engineering, and mechanical engineering provides students with both general knowledge and in-depth understanding of one major area of concentration. Students are able to develop individualized programs of study that emphasize different areas of interest.

Each individualized program consists of three functional areas. The first, the cognate and minor area, includes course work considered to be of special importance to the student's future progression in any of the other areas. Second is the concentration area, including courses contributing to a specialization area. The student's dissertation makes up the third segment of the Ph.D. program.

## Admissions Requirements

The Ph.D. program in Engineering is open to qualified graduates of universities and colleges of recognized standing. To be admitted with full status to the program, the applicant must

1. Hold a baccalaureate degree and preferably a master's degree from an educational institution of recognized standing.
2. Have adequate preparation in engineering, and show potential to undertake advanced study and research as evidenced by academic performance and experience.
3. Have earned a cumulative grade point average (GPA) in all courses of at least 3.0 or equivalent at both the baccalaureate level and the graduate level.

Applications should be submitted directly to The Graduate School before March 15 of the upcoming academic year. However, applications will be considered at any time they are submitted.

University of Washington, Seattle, 1996
Research Interests: Biomedical engineering, polymer materials

**Eakalak Khan, Ph.D.**
University of California at Los Angeles, 1997
Research Interests: Biodegradable Solid Wastes, Industrial Wastes

**Charles McIntyre, Ph.D.**
Pennsylvania State University, 1996
Research Interests: Construction, CAD

**Sudhir I. Mehta, Ph.D.**
I.I.T., Bombay, 1982
Research Interests: Mechanical, Instrumentation, Controls, Data Acquisition, Robotics

**Robert M. Nelson, Ph.D.**
North Dakota State University, 1987
Research Interests: Electromagnetics

**Tang-Hung Nguyen, Ph.D.**
Pennsylvania State University, 1999
Research Interests: Computer Aided Engineering Design, Building Materials

**G. Padmanabhan, Ph.D.**
Purdue University, 1980
Research Interests: Civil Engineering, Water Resources

**Suranjan Panigrahi, Ph.D.**
Iowa State University, 1992
Research Interests: Machine Systems, Machine Vision, Artificial Intelligence

**David A. Rogers, Ph.D.**
University of Washington, 1971
Research Interests: Microwave Engineering, Electromagnetics, Fiber Optics

**Gary Smith, Ph.D.**

Official transcripts (transcripts having an appropriate seal or stamp) of all previous undergraduate and graduate records must be received by The Graduate School before the application is complete. When a transcript is submitted in advance of completion of undergraduate or graduate studies, an updated transcript showing all course credits and grades must be provided prior to the initial registration at NDSU.

Three letters of recommendation are required before action is taken on any application. Personal reference report forms are available from The Graduate School.

The TOEFL examination is required of foreign applicants. A minimum score of 550 (paper test) or 213 (computer test) must be achieved. The Graduate Record Examination (general test) is also required of international students.

## Financial Assistance

Applicants must first be admitted to The Graduate School to become eligible for consideration for an assistantship. Both research and teaching assistantships are available to qualified students. Applicants are considered on the basis of scholarship and potential to undertake advanced study and research.

To be considered for an assistantship, a completed Graduate School application, official transcripts, and three letters of reference must be submitted to The Graduate School no later than March 15. International students must also submit a TOEFL score as well as GRE general test scores. The GRE scores are preferred but not required for domestic students.

## Degree Requirements

The Doctor of Philosophy in Engineering program requires the completion of 90 credit hours of graduate study beyond the baccalaureate degree with an overall GPA of 3.0 or higher. The total credit hours are made up of 12 to 30 credit hours in the cognate and minor area, 24 to 54 credit hours in the area of concentration, and 30 to 40 credit hours of a research-based dissertation.

A preliminary comprehensive written examination and oral examination are required of the student after completion of the greater portion of the course work phase of the Ph.D. program. The comprehensive written portion is based on course work questions submitted by appropriate faculty. During the oral examination, the student presents a research proposal for dissertation research. After passing this exam, the student is formally admitted as a candidate for the Ph.D. degree.

The final examination, primarily concerned with research work, is taken after the candidate has completed all course work and the dissertation. The dissertation must show originality and demonstrate the student's capacity for independent research. It must embody results of research constituting a definitive contribution to knowledge.

## Research Facilities

The PhD program in Engineering utilizes facilities and laboratories in agricultural and biosystems engineering, civil engineering, electrical and computer engineering, industrial and manufacturing engineering, and mechanical engineering. Laboratory facilities include a bio-medical engineering laboratory, an internal combustion laboratory, a hydraulics laboratory, an automatic manufacturing laboratory, the Center for Nanoscale Science and Engineering, and others.

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# Courses Offered

**715 Engineering Systems 3**

Purdue University, 1986
Research Interests:
Quality Control, Decision Analysis and Modeling Techniques, Digital Imaging in Construction

**Dean D. Steele, Ph.D.**
University of Minnesota, 1991
Research Interests:
Irrigation, Environmental Engineering

**Amiy Varma, Ph.D.**
Purdue University, 1993
Research Interests:
Transportation Systems, Traffic Engineering Airports, Infrastructure Management

**David L. Wells, Ph.D.**
University of Missouri-Rolla, 1996
Research Interests:
Materials and Process Engineering, Manufacturing Operations

**Dennis D. Wiesenborn, Ph.D.**
Rice University, 1989
Research Interests:
Food and Value Added Process Engineering

**Frank Yazdani, Ph.D.**
University of New Mexico, 1987
Research Interests:
Civil Engineering, Structures

**Subbarayo Yuvarajan, Ph.D.**
I.I.T., Madras, 1981
Research Interests:
Power Electronics

**Weihong (Katie) Zhong, Ph.D.**
Beijing University, 1994
Research Interests:
Composite materials, processing technologies

For additional graduate faculty, see Agricultural and Biosystems Engineering, Civil Engineering, Electrical and Computer Engineering, Industrial and Manufacturing Engineering, and Mechanical Engineering.

Interdisciplinary systems analysis approach to engineering problems. Mathematical and physical stochastic process and control systems.

**721 Mechanics of Fluid States 3**
Basic laws of fluid motion in differential and integral forms, Navier-Stokes equations, potential flow, boundary layer theory, dimensional analysis, and similitude. Computational fluid mechanics.

**741 Systems--Linear and Nonlinear Concepts 3**
Nonlinear and linear programming methods for engineering design optimization. Formulation and optimization of design problems from all areas of engineering.

**742 Optimal Control Theory 3**
Formulation of general control problems, controllability and observability in discrete and continuous systems, performance functionals, applications.

**744 Modern Material Science 3**
Internal structure of materials, diffusion, phase transformation, and structure control. Mechanical, electrical, magnetic, and optical properties of materials; engineering applications.

**760 Thermodynamics 3**
General foundations of thermodynamics valid for small and large systems, and equilibrium and nonequilibrium states. Emphasis on the concepts of availability and its engineering applications.

**762 Heat and Mass Transfer 3**
Theory and application of transport of heat and mass. Heat diffusion equation in several coordinate systems. Fourier series and transforms, and Laplace transform techniques. Mass transfer examples. Introduction to simulations.

**770 Quantitative Modeling 3**
Applications modeling and optimization methods. Domains: transportation, logistics, manufacturing, service systems scheduling, and supply-chain management. Decision models: linear programming and sensitivity and analysis, transportation and assignment, network models and algorithms, and integer, dynamic and nonlinear programming.

**771 Probabilistic and Deterministic Methods 3**
Applications modeling. Domains include transportation, logistics, manufacturing, service systems scheduling, and supply-chain management. Quantitative models and tools include Markov chains, stochastic processes, queuing, deterministic and stochastic decision analysis, time series, forecasting, and regression modeling.

**780 Electromagnetic Theory 3**
Physical concepts and mathematical solutions of Maxwell equations; boundary conditions, force, and energy equations; potential equations; Green's functions; wave equations, radiation, and propagation of electromagnetic waves.

**789 Advanced Research Methods in Engineering 3**
Advanced study of the philosophy, reasoning, design, methods, and procedures employed in conducting and disseminating scientific research. Includes a survey of current and original research with interpretation and assessment.

* See individual deparment listings for discipline-specific graduate courses.

## Graduate Faculty

**M.G. Aune, Ph.D.**
Wayne State University, 2002
Field: Renaissance Studies, Travel Writing, Pedagogy, Material Bibliography.

**Elizabeth Birmingham, Ph.D.**
Iowa State University , 2000
Field: Rhetoric and Professional Communication, Gender Studies, Architectural History, Theory, and Critism

**Kevin Brooks, Ph.D.**
Iowa State University, 1997
Field: Rhetoric and Professional Communication, American Literature, Canadian Literature

**Muriel Brown, Ph.D.**
University of Nebraska, 1971
Field: Medieval Literature, Modern Drama, Women's Studies

**Linda L. Helstern, Ph.D.**
Southern Illinois University-Carbondale, 2001
Field: Native American literature, Modernism, contemporary poetry, literature and the environment

**R.S. Krishnan, Ph.D.**
University of Nebraska, 1981
Field: Restoration and 18th-century British Literature, Postmodern Theories, British Novel, Postcolonial Literature

**Andrew Flood Mara, Ph.D.**
University of New Mexico, 2003
Field: Technical and Professional Communication

**Miriam O'Kane Mara, Ph.D.**
University of New Mexico, 2003
Field: Postcolonial and Irish Literature

# English

## Master Arts

The Department of English, through its master's program, offers students the opportunity for intellectual growth and personal development; careers in diverse fields such as education, government, law, public relations, theology, business; and studies leading to advanced degrees in such fields as English, law, creative writing, religious studies, and education.

Students may choose from two options within the masters in English: literature or composition. These options require Engl 760, Graduate Scholarship, normally taken during the student's first or second semester in residence. In providing an opportunity for wide-ranging career choices through the two options, the department emphasizes critical thinking as an essential approach to the writing of papers, the making of oral reports, and the study of language and literature.

## Admissions Requirements

The Department of English graduate program is open to all qualified graduates of universities and colleges of recognized standing. To be admitted with full status to the program, the applicant must

1. hold a baccalaureate degree from an educational institution of recognized standing;
2. have completed a major in English at the undergraduate level;
3. have a cumulative grade point average (GPA) of 3.0.

Students who do not meet all requirements for admission or have deficiencies in prerequisite course work, but demonstrate potential for graduate study, may be given conditional admission.

Applications should be submitted directly to The Graduate School before April 1 of the upcoming academic year; however, applications will be considered at other times as well. Official transcripts (transcripts having an appropriate seal or stamp) of all previous undergraduate and graduate records must be received by The Graduate School before the application is complete. When a transcript is submitted in advance of completion of undergraduate or graduate studies, an updated transcript showing all course credits and grades must be provided prior to the initial registration at North Dakota State University. At least three letters of recommendation and a writing sample are required before action is taken on any application. Personal reference report forms are available from The Graduate School.

**Robert O'Connor, Ph.D.**
Bowling Green State University, 1979
Field: Romantic Literature, Science Fiction and Fantasy

**Debra Peterson, MFA**
Western Michigan University, 1996
Field: American Studies, Cultural Studies, Animation, American Literature

**Richard Shaw, Ph.D.**
Ball State University, 1985
Field: Composition Theory and Research, English Education

**Dale Sullivan, Ph.D.**
Rensslelaer Polytechnic Institute, 1988
Field: Rhetoric Theory and History, Rhetoric of Science, Rhetoric of Religion, Technical Communication

**Amy Rupiper Taggart, Ph.D.**
Texas Christian University, 2002
Field: Composition and Rhetoric, Pedagogy, English Education, Multi-ethnic Literature

**Gary Totten, Ph.D.**
Ball State University, 1998
Field: American Literature and Culture 1865-1950, Travel Writing, Multi-Ethnic American Literature

Applications must include

- at least 3 letters of recommendation;
- a writing sample;
- official transcripts from all previous undergraduate and graduate records.

The TOEFL examination is required of all international applicants. A minimum score of 100 (internet test) 600 (paper test) or 243 (computer test) or a minimum of 7 on the IELTS is required of international students seeking admission with full standing.

## Financial Assistance

Teaching assistantships are available and are based on the applicant's scholastic record and letters of recommendation. However, the student must first make application to The Graduate School and be accepted for admission before she/he is eligible for an assistantship in the Department of English. Letters of application for teaching assistantships should be submitted directly to the chair of the English department at the same time as the application to the program is submitted to the graduate school and should specify experience and qualifications.

Graduate students are awarded teaching assistantships for the academic year only. As of the 2005-2006 academic year, the annual stipend is $8,100. University graduate tuition charges (not fees) are waived for all TAs. Teaching Fellowships are available to selected TAs after completing course work. Moreover, the Department of English annually awards the Rooney Scholarship (2005: $1,000) and the Madeline S. Gittings Scholarship (2005: $1,000) to deserving graduate students.

## Degree Requirements

The Master of Arts program offers the option of completing 27 credit hours of letter-graded course work with an overall GPA of 3.0 or better, and a 3-credit master's paper. A thesis-oriented plan of study is also available with variable credit hours of letter-graded course work. Completion of intermediate competency in one foreign language is required. A thesis-oriented plan of study is also available with variable credit hours of letter-graded course work.

Within the first semester of graduate work, each student is assigned an academic adviser who helps in overseeing the student's course work and paper committee. Students who plan to pursue a Ph.D. after completing their M.A. degrees are encouraged to work closely with their respective advisers in choosing the courses which best prepare them for doctoral work.

A graduate student in English should enroll in no more than 3 credits of Engl 793, Individual Study/Tutorial, during his/her master's career. Exceptions are provided for through a graduate form signed by the chair of the department and the adviser.

### Literature Option

#### *Students must*

1. Complete Engl 760 Graduate Scholarship and Engl 762 Critical Theory.*
2. Complete 6 credits in British and 6 credits in American literature. At least three credits must be in a pre-1900 American or pre-1660 British and at least three credits must be in post-1900 American or post-1660 British. Three credits in multicultural or post colonial literature is recommended.
3. Complete one course (3 credits) in Composition** or Linguistics.
4. Complete two elective courses (6 credits), literature recommended.
5. Complete Engl 797, Masters Paper, or 798, Master's Thesis.

### Composition Option

***Students must***

1. Complete Engl 760 Graduate Scholarship.*
2. Complete two required courses: Engl 755 Composition Theory,* Engl 756 Composition Research.
3. Complete three electives in Composition.**
4. Complete one course each in Literature and Linguistics.
5. Complete one elective.
6. Complete Engl 797 or 798 (Master's Paper or Master's Thesis).

*Graduate students in any of the options are strongly advised to take Graduate Scholarship (Engl 760) and, as appropriate, Critical Theory (Engl 762) in their first year in the program. Students in the Composition Track planning to complete their course work in two years must take Composition Theory and Composition Research when they are offered, as those two core courses alternate.

**Engl 764 Classroom Strategies for TAs may be used to satisfy one Composition requirement.

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## Courses Offered

**652 History of the English Language 3**
Development of the English language from its Germanic origins to the modern period. (offered on alternate years)

**653 Social and Regional Varieties of English 3**
Regional and social variables affecting language uses; attitudinal considerations with emphasis on the educational and sociopolitical ramifications of standardization policies. Focus on American English with reference to British and other English dialects. (offered on alternate years)

**654 Language Bias 3**
Examination of how social asymmetries of race, gender, and ethnicity are reflected and sustained in discourse practices. Use of current critical linguistics theories to examine how gender, racial, and ethnic abilities/disabilities are manifested through language. (offered on alternate years)

**656 Literacy Studies 3**
Reading, writing, research, and discussion of diverse types of literacy from functional to cultural to technological and their roles in culture and identity formation. Completion of related community projects. (offered on alternate years)

**659 Research and Writing Grants and Proposals 3**
A rhetorical approach to writing academic and business grants, proposals, and related professional documents. Development of a portfolio of professionally designed and edited documents as well as the vocabulary of grants writing and research.(offered on alternate years)

**670 Topics in American Literature 3**
Intensive study of a special theme, form, period, or group of writers central to the formation and development of American literature. (offered on alternate years)

**671 American Realistic Literature 3**
Principles of American literary realism as exhibited in the major works of Howells, James, Twain, Crane, Chopin, Gilman, Norris, Wharton, Dreiser, and others. Combination varies. (offered on alternate years)

**672 20th-century American Writers 3**
Intensive study of major American writers from 1900 to 1950. (offered on alternate years)

**674 Native American Literature 3**
The development of literature by and about Native Americans is traced from 1850 to the present. Focus on Native American identity and contributions to the American culture. (offered on alternate years)

**680 Medieval Literature 3**
British poetry and prose from the beginning of the Middle Ages to 1500, excluding Chaucer. (offered on alternate years)

**682 Renaissance Literature 3**
Study of British writers of the 16th and 17th centuries. Past classes have covered non-Shakespearean drama, Renaissance poetry, and Shakespeare on film. (offered on alternate years)

**683 Topics in British Literature 3**
Intensive study of a special theme, form, period, or group of writers central to the formation of British literature. (offered on alternate years)

**685 18th-century Literature 3**
Study of major writers, Dryden, Pope, Swift, and Johnson, with occasional excursions into the fictional territory of Richardson , Fielding, Sterne, and Smollett. (offered on alternate years)

**686 19th-Century Literature 3**
Study of major British writers from the French Revolution to the coronation of Queen Victoria.(offered on alternate years)

**753 Rhetorics and Poetics of New Media 3**
This web-based class will explore issues related to the rhetoric and poetics of new media through selected reading, projects that allow students to develop skills and insight through experiential learning, and through reflection on the dynamics of online education itself. (offered on alternate years)

**754 Rhetorics of Science and Technology 3**
The study and critique of the rhetorics of science and technology, informed by rhetorical theory and by the philosophy of and the social studies of science and technology. (offered on alternate years)

**755 Composition Theory 3**
Study of contemporary theories of teaching writing with frequent summary/ response papers on assigned readings and a research paper on composition

theory. (offered on alternate years)

**756 Composition Research 3**

Study of designs and basic statistics for writing research, analysis of current research, and a research project in composition. (offered on alternate years)

**758 Topics in Rhetoric and Writing 3**

Intensive study of a theory, theorist, or issue in rhetoric or writing with regard to relevance for critical and production practices in English Studies. (offered on alternate years)

**759 History of Writing Instruction 3**

The study of the history of writing instruction from antiquity to the present, with emphasis on relevance to modern writing instruction. (offered on alternate years)

**760 Graduate Scholarship 3**

Introduction to scholarship in English studies and to the nature and state of the discipline. (typically offered every autumn term)

**762 Critical Theory 3**

Study of contemporary literary theory and criticism. (typically offered every spring term)

**764 Classroom Strategies for TAs 3**

Introduction to current issues in composition pedagogy, research, and theory, focusing on how they inform teaching practices. Instruction on developing philosophy of and strategies for teaching through short position papers, literacy autobiography, and a sequence of assignments for English 120. (typically offered every autumn term)

**770 Studies in American Literature 3**

Intensive study of a special period, theme, technique, or group of writers central to the formation, development, or flowering of American literature. (offered once a year)

**780 Renaissance Literary Studies 3**

Intensive study of a special theme, form, or group of writers central to the formation and development of British literature in the Renaissance period. (offered once a year)

**790 Graduate Seminar 1-3**

**793 Individual Study/Tutorial 1-5**

**696/796 Special Topics 3**

**797 Master's Paper 1-3**

**798 Master's Thesis 1-10**

## Graduate Faculty

701-231-7582

**Mark A. Boetel, Ph.D.**
South Dakota State University, 1996
Research Interests:
Integrated Pest Management of Sugarbeet and Corn Insects, Microbial Control

**Laurence D. Charlet, Ph.D.**
University of California-Riverside, 1975
Research Interests:
Sunflower Integrated Pest Management, Biological Control

**Stephen P. Foster, Ph.D.**
University of Waikato, 1983
Research Interests:
Insect Chemical Ecology, Pheromone Biochemistry, Reproductive Behavior

**Marion O. Harris, Ph.D.**
Michigan State University, 1986
Research Interests:
Insect Behavior, Insect-Plant Interactions, Resistance of Plants to Insects

**Stefan T. Jaronski, Ph.D.**
Cornell University, 1978
Research Interests:
Insect Pathology

**Janet J. Knodel, Ph.D.**
North Dakota State University , 2005
Research Interests:
Integrated Pest Management

**Roger Leopold, Ph.D.**
Montana State University, 1967
Research Interests:
Insect Cryobiology

**Ian V. MacRae, Ph.D.**

# Entomology

## Program Description

The Department of Entomology offers graduate study leading to the M.S. and Ph.D. degrees. Advanced work involves specialized training in the following areas: behavior, biochemistry, biodiversity, biological control, chemical ecology, ecology, host plant resistance, insect pathology, pest management, molecular genetics, physiology, and systematics. The department also participates in interdisciplinary programs in Environmental and Conservation Sciences and Natural Resources Management.

The close working relationship between the Department and the USDA Red River Valley Agricultural Research Center, located on campus, provides students many opportunities for research and consultation. Students may conduct their research program under the direction of USDA scientists holding adjunct appointments in the Department of Entomology.

Student research and academic programs are tailored to individual needs and interests. Interdisciplinary approaches to entomological programs are fostered. Prospective students are encouraged to check the Department of Entomology web site (http://www.ndsu.edu/entomology/graduate.htm) for the latest descriptions of the graduate program.

## Admissions Requirements

The Department of Entomology graduate program is open to all qualified graduates of universities and colleges of recognized standing. To be admitted with full status to the program, the applicant must

1. Hold a baccalaureate degree from an educational institution of recognized standing.
2. Have adequate preparation in entomology, and show potential to undertake advanced study and research as evidenced by academic performance and experience.
3. At the baccalaureate level or last graduate degree completed, have earned a cumulative grade point average (GPA) in all courses of at least 3.0 or equivalent.
4. Submit three letters of recommendation which attest to the applicant's skills and motivation for graduate study (Personal reference report forms are available from The Graduate School).
5. Provide a letter stating reasons for pursuing an advanced degree in entomology and expressing the applicant's research interests.
6. If an international applicant, submit a TOEFL examination score. A minimum score of 550 (paper test), 213 (computer test), or 79 (internet - based) must be achieved.

Official transcripts (transcripts having an appropriate seal or stamp) or all previous undergraduate

Colorado State University, 1996
Research Interests:
Computer Applications in Entomology, Landscape Ecology, Insect Behavior

**Paul J. Ode, Ph.D.**
University of Wisconsin-Madison, 1994
Research Interests:
Insect Evolutionary and Behavior Ecology, Tritrophic Interactions

**Denise L. Olson, Ph.D.**
Kansas State University, 1994
Research Interests:
Biological Control, Integrated Pest Management

**David A. Rider, Ph.D.**
Louisiana State University, 1988
Research Interests:
Insect Systematics, Biodiversity

**Richard Roehrdanz, Ph.D.**
University of Wisconsin, 1974
Research Interests:
Insect Genetics

**George Yocum, Ph.D.**
Ohio State University, 1992
Research Interests:
Insect Diapause Regulation

and graduate records must be received by The Graduate School before the application is complete. When a transcript is submitted in advance of completion of undergraduate or graduate studies, an updated transcript showing all course credits and grades must be provided prior to initial registration at North Dakota State University .

Applications should be submitted directly to The Graduate School.

## Conditional Admission

A student not meeting all admission requirements or having deficiencies in prerequisite course work who shows potential for graduate study may be admitted conditionally. A student admitted conditionally will be provided a statement of the conditions to be satisfied before advancement to full standing. The student may not earn more than 12 semester credit hours and must acheive a minimum grade of 3.0 per course as a conditional student. The request for change to full standing must be submitted to the Dean of The Graduate School by the major adviser and approved by the department chair.

## Financial Assistance

All specified application materials must be submitted to The Graduate School, and the student must be admitted in full or conditional standing to be considered for financial assistance. Graduate research assistantships are awarded on the basis of scholarship, potential for advanced study and research, and availability. Graduate research assistantships provide a monthly stipend and a waiver of graduate tuition.

## Degree Requirements

The program requires a minimum of 24 months of full-time study, during which an overall GPA of 3.0 or better must be maintained. For M.S. candidates, a minimum of 30 semester credits beyond the B.S. and an oral defense of a research-based thesis and academic subject matter is required. The Ph.D. requires a minimum of 90 semester credits beyond the B.S., (or 60 beyond the MS degree), preliminary written and oral examinations directed toward academic subject matter, and a final oral defense of a research-based dissertation. Depending on their area of specialization, Ph.D. candidates may be required to demonstrate reading proficiency in a foreign language relevant to the field of study. Plans of study are developed to meet both disciplinary requirements and special interests of the student.

### Core Courses

**Ent 750 Systematic Entomology**

**Ent 760 Insect Structure**

**Ent 761 Insect Physiology**

**Ent 770 Insect Ecology**

M.S. students are responsible for mastering the subject matter in at least two of the core course areas and an additional emphasis area relevant to their research topic. Ph.D. students are

responsible for all core courses and two additional emphasis areas. All students are expected to gain presentation and teaching experience.

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## Courses Offered

**610 Integrated Management of Pests 3**
How pest management practice is influenced by the environment, society, and pest biology across taxonomic groups is investigated. Focus is on integrated pest management concepts not management tactics.

**731 Principles of Integrated Pest Management 3**
Principles embodied in the implementation of multifaceted tactics designed to manage pest populations successfully. Offered even years; spring. Prereq: Ent 350.

**732 Plant Resistance to Insects 2**
Plant/insect interactions and their applications to plant breeding to increase resistance to pests. Offered even years; fall. Prereq: Ent 350.

**742 Quantitative Biology 3**
Introduction to statistical techniques used to analyze ecological data sets in applied and basic research settings. Offered odd years; spring. Prereq: Stat 330. Cross-listed with BIOL.

**750 Systematic Entomology 5**
Introduction to systematic methods and principles, identification of common families of insects. Offered even years; fall. Prereq: Ent 350.

**751 Immature Insects 3**
Characteristics of the immature forms of the orders and principal families of insects. Offered odd years; fall. Prereq: Ent 750.

**760 Insect Structure 4**
Structure and function of insect anatomy. The development of adult form from embryonic and larval precursors during growth and metamorphosis, evolutionary development of insect structures. Offered odd years; fall. Prereq: Ent 350.

**761 Insect Physiology 4**
Function of major insect organ systems and metabolism, growth, and molting of insects. Offered odd years; spring. Prereq: Ent 350, Chem 260.

**765 Biological Control of Insects and Weeds 3**
The natural or applied regulation of pests by predaceous and parasitic insects and pathogens. Offered odd years; fall. Prereq: Ent 350.

**770 Insect Ecology 3**
Principles of population dynamics, reproduction, competitive and trophic interactions using insects as examples. Emphasis is placed on using models to understand ecological theory and application. Offered even years; spring. Prereq: Ent 350, Stat 330.

The following variable credit courses are also offered:

**790 Graduate Seminar 1-3**

**793 Individual Study/Tutorial 1-5**

**795 Field Experience 1-15**

**696/796 Special Topics 1-5**

**798 Master's Thesis 1-10**

**799 Doctoral Dissertation 1-15**



E-Mail: The Graduate School Prospective students may schedule a visit by calling 1-800-488-NDSU.

The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

University of Nevada, 1995
Research Interests: Conservation Biology, Evolutionary Ecology of Native Fishes, Human-Wildlife Interactions

**George Youngs, Ph.D.**
University of Iowa, 1981
Research Interests: Perceived Ethics of Genetically Modified Organisms, Sustainable Agriculture



E-Mail: The Graduate School

Prospective students may schedule a visit by calling 1-800-488-NDSU.

The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701 231-7033

**Alan C. Ashworth, Ph.D.**
University of Birmingham, 1969
Research Interests: Quaternary Paleoecology, Paleoclimatology

**William Barker, Ph.D.**
University of Kansas, 1968
Research Interests: Plant Systematics, Floristics of the Northern Great Plains, Range Ecological Studies

**Mario E. Biondini, Ph.D.**
Colorado State University, 1984
Research Interests: Study and Analysis of Ecosystems, Use of Multivariate Statistical Techniques in the Study of Ecosystems, Modeling of Ecological Systems, Landscape Ecology, Plant-Soil Relationships

**William J. Bleier, Ph.D.**
Texas Tech University, 1975
Research Interests: Vertebrate Pest Management, Habitat Management, Geographic Information Systems

**Gary J. Brewer, Ph.D.**
Kansas State University, 1984
Research Interests: Insect-Plant Interactions, Resistance of Plants to Insects, Integrated Pest Management

# Environmental and Conservation Sciences

## Program Description

The graduate program leading to an M.S. in Environmental Science or a Ph.D. in Environmental and Conservation Sciences rests on an integrative curriculum and a multidisciplinary team approach. The program emphasizes the common ground shared by all sciences, and seeks to bridge methodological and philosophical boundaries that might hinder interdisciplinary communication and cooperation. The program offers two tracks: Environmental Science and Conservation Biology. The Environmental Science track focuses on abiotic environmental issues, such as water, air, and land pollution, while the Conservation Biology track focuses on biotic issues, such as the preservation of biodiversity and ecosystem function. The interdisciplinary nature of this program is reflected by the participation of faculty from across the campus, including the Colleges of Agriculture, Food Systems, and Natural Resources; Arts, Humanities, and Social Sciences; Engineering and Architecture; and Science and Mathematics.

## Environmental Science

Areas of environmental studies, such as climate change, groundwater, hazardous waste, and water chemistry, require broad training across discipline lines for successful application. To better predict anthropogenic environmental impacts, the engineering, earth material, chemical, and biological data must be considered in an integrated manner.

## Conservation Biology

Conservation Biology offers a new philosophy of looking at complex problems. This discipline focuses on the loss of regional and global biodiversity, but considers the human element as well in its approach to resource issues. As an example, landscape ecology, sustainable development, and conflict resolution are themes promoted by the field of Conservation Biology.

## Admissions Requirements

To be admitted to the Environmental and Conservation Sciences Program (ECSP), the applicant must

1. Hold a baccalaureate degree from an educational institution of recognized standing.
2. Have adequate preparation in the desired area of advanced study and the potential to undertake advanced study and research as evidenced by academic performance and experience.
3. At the baccalaureate level, have earned a cumulative grade point average of at least 3.0 or equivalent.

**Deborah P. Buitron, Ph. D.**
University of Minnesota, 1982
Research Interests: Behavioral Ecology of Aquatic Birds

**Malcolm G. Butler, Ph.D.**
University of Michigan, 1980
Research Interests: Aquatic Invertebrate Biology, Limnology, Wetland Ecology

**Patrick M. Carr**
Montana State University, 1989
Research Interests: Sustainable Agriculture, Cropping Systems

**Frank X.M. Casey, Ph.D.**
Iowa State University, 2000
Research Interests: Field and Laboratory Studies of Water Flow and Chemical Transport Processes

**Larry Cihacek, Ph.D.**
Iowa State University, 1979
Research Interests: Carbon Sequestration in Soils, Soil Physical Properties, Soil Management for Waste Disposal

**Gary K. Clambey, Ph.D.**
Iowa State University, 1975
Research Interests: Ecology and Biogeography, Environmental Analysis and Planning, Structure Function Relations in the Midwestern Ecosystems

**Mark E. Clark, Ph.D.**
University of Tennessee, 1996
Research Interests: Population Ecology,

The Graduate School will evaluate official transcripts of all previous undergraduate and graduate records before the application is complete. At the time of application, students should identify at least one ECSP faculty member with whom they wish to study.
Three letters of recommendation are required before action is taken on any application. Personal reference report forms are available from The Graduate School.

The TOEFL examination is required of international applicants whose primary language is not English. A score of 550 or greater is required for admission.

Students who do not meet all requirements for admission, but who show potential for successful graduate study, may be admitted under a conditional status. Evidence must be provided showing that their record does not adequately reflect the applicant's potential.

## Financial Assistance

The applicant should contact their prospective mentor to identify sources of financial aid. Teaching and research assistantships may be available through funded research or participating departments. Applicants are considered on the basis of scholarship and potential to undertake advanced study and research. Contact the University's Financial Aid Office for information and applications regarding scholarships.

## Degree Requirements

By the end of the first academic year, the student will select an academic adviser from among the ECSP graduate faculty and arrange for the appointment of a Graduate Advisory Committee. A Graduate Advisory Committee will consist of at least four members of the NDSU graduate faculty. The committee must include the student's adviser, two additional ECSP faculty members, and an appointee of The Graduate School. One committee member must be from outside the student's academic college. The plan of study will be prepared by the student, in consultation with the major adviser, by the end of the first year in residence. The plan shall be approved by the student's Graduate Advisory Committee, the Environmental Science Steering Committee, the department chair, the academic dean, and The Graduate School dean according to the regulations outlined in the NDSU Graduate Bulletin.

## Master of Science in Environmental and Conservation Sciences

The total credits will be not less than 30 graduate credits, with at least 16 credits of courses numbered from 601-689 or 700-789, and research credits (798) not fewer than 6 nor more than 10 thesis credits. All M.S. students must complete a thesis and pass a final examination as described in The Graduate School Policies section of the Graduate Bulletin.

## Doctor of Philosophy in Environmental and Conservation Sciences

The plan of study must be filed in The Graduate School prior to scheduling the comprehensive/ preliminary oral examination. The total credits will be not less than 90 semester graduate credits. Of this total, not less than 30 credits must be courses other than seminar or research credits. Of the 30 course credits, 15 must be at the 700-789 level.

ECSP requires Ph.D. students to complete a series of 4 core courses (12 credits) plus 18 track credits. The track courses will be distributed among four areas. A minimum of 3 credits in each track area is required. An overall GPA of 3.0 or better must be maintained.

### Core Courses

History of Environmental Science (Hist 634) 3
Rhetoric of Environmental Science (Comm 755) 3
Environmental Law and Policy (ECS 770) 3

Landscape Ecology, Fish and Wildlife Ecology, Ecological Modeling, Spatial Modeling, Species Interactions

**Davis Cope, Ph.D.**
Vanderbilt University, 1980
Research Interests: Partial Differential Equations, Numerical Methods, Applied Mathematics

**David B. Danbom, Ph.D.**
Stanford University, 1974
Research Interests: Agriculture and Rural Life, Recent U.S., Progressive Period

**Theodore L. Esslinger, Ph.D.**
Duke University, 1974
Research Interests: Lichenology, Taxonomy, Chemosystematics, Floristics of Lichens, Emphasis on the Alectoriacea, Parmeliaceae and Physciacae

**Karen P. Fawley, Ph.D.**
North Dakota State University, 1998
Research Interests: Phycology and Aquatic Community Ecology, Molecular Identification of Algae

**Marvin W. Fawley, Ph.D.**
Miami University, 1985
Research Interests: Phycology and Evolution, Biochemistry, Molecular Biology and Evolution of Light-Harvesting Complexes, rDNA Sequence Analysis

**Gary A. Goreham, Ph.D.**
South Dakota State University, 1985
Research Interests: Rural Sociology, Community, Family

Advanced Ecology (Biol 750) 3
Core Courses Total 12

### Conservation Biology Track

Biodiversity 3-9
ARSc 716; Bot 671, 672, 714, 717; Ent 750; Zoo 650, 652, 654, 658, 665

Ecology and Evolution 3-9
ARSc 765; Biol 631, 640, 659 750; Bot 660, 762, 764; Ent 765, 770; Geol 640; PlSc 631, 737, 781; Soil 610, 640, 647; Zoo 662, 670, 750, 760, 770, 776, 784

Human Dimensions and Management 3-9
Anth 650, 662; ARSc 656; CE 678; AgEc 680; Comm 755, 783; CS 750, 760; PolS 642, 650; Zoo 672, 674, 675, 676, 677, 750

Research Tools 3-9
ARSc 650, 740; CE 677; Geol 655, 656, 660, 760; PlSc 724; Psyc 640; Soc 701; Soil 784; Stat 661, 662, 663, 665, 670, 730, 761, 770

Conservation Biology Track Total 18

### Environmental Sciences Track

Water Sciences 3-9
ABEn 664, 765; CE 610, 677, 678, 697, 776, 796; Geol 640; Zoo 670

Soil and Solid Waste 3-9
ABEn 696; CE 672, 770; Soil 610, 633, 733, 783

Environmental Management 3-9
ARSc 656; CE 672, 678; Comm 783; ECS 750, 760; Zoo 674, 675, 676, 677

Research Tools 3-9
ABEn 682, 696; ARSc 650, 740; CE 677; Geol 655, 656, 660, 760; IME 660; Stat 662, 725, 761

Environmental Sciences Track Total 18

## Examinations

1. The written Preliminary Examination will cover the core areas for ECSP and each of the core topic areas for the appropriate track. The preliminary examination will typically be taken in the middle of the third year. The written exam must be passed before the comprehensive oral examination can be scheduled.
2. The comprehensive oral examination will be taken no later than the end of the third year in residence. The examination will cover the topic areas for the appropriate track.

## Dissertation Research

A proposal describing research suitable for preparation of a dissertation in Environmental and Conservation Sciences will be prepared in the format of a NSF Dissertation Improvement Grant. Alternative formats must be agreed to by the Graduate Advisory Committee. The proposal will be submitted to the student's Graduate Advisory Committee for review and approval. The dissertation must show originality and demonstrate the student's capacity for independent research.

## Program Administration

Research Methods, Sociology of Religion, Sociology of Agriculture

**James W. Grier, Ph.D.**
Cornell University, 1975
Research Interests: Animal Behavior and Ecology, Animal Population Dynamics, Applied Biostatistics, Philosophy of Research

**Marion O. Harris, Ph.D.**
Michigan State University, 1986
Research Interests: Insect-Pest Management, Host-Plant Relationships

**Mark Harvey, Ph.D.**
University of Wyoming, 1986
Research Interests: American West, Environmental History, Public History

**Ron Hutchison, Ph.D.**
University of Illinois, 1994
Research Interests: Bioremediation, Phytoremediation

**Tom Isern, Ph.D.**
Oklahoma State University, 1977
Research Interests: History of Agriculture, History of Great Plains

**Don Kirby, Ph.D.**
Texas A&M, 1980
Research Interests: Grazing Ecology, Restoration Ecology

**David Lambert, Ph.D.**
Oregon State University, 1985
Research Interests: Natural Resources Economics

**F. Larry Leistritz, Ph.D.**
University of Nebraska, 1970
Research Interests:

The graduate program will be administered by the ECSP Steering Committee. The committee will be composed of four ECSP graduate faculty members representing four different colleges: Agriculture, Food Systems, and Natural Resources; Arts, Humanities, and Social Sciences; Engineering and Architecture; and Science and Mathematics. Four alternate members will also be selected to substitute on the committee when necessary. Steering Committee members, who serve overlapping three-year terms, will be elected at a yearly meeting of the ECS faculty. The ECS Program Director will preside over ECS Steering Committee meetings. The duties of the ECS Steering Committee will include 1) review of requests to join the ECS faculty and 2) program review and administration.

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## Courses Offered

**Biol 640 Microbial Ecology 3**
Basic, applied, and current concepts in microbiology and the environment are covered. Also covered are the roles of microorganisms in maintaining environmental quality and the role of environment in determining microbial diversity.

**Biol 750 Advanced Ecology 3**
This course covers classical ecological literature and current literature focusing on ecological research philosophy and techniques. An overview/introduction of a variety of statistical methods for analyzing ecological data is covered.

**CE 796 Industrial Waste Management 3**
Regulations and standards on industrial pollution control, industrial waste characteristics, industrial waste management strategies, and waste treatment methods.

**Comm 755 Rhetoric of Environmental Science 3**
This course focuses on the communication (rhetoric) of science and how disciplinary conventions and ideological commitments shape the language of environmental science in understanding "external realities".

**ECS 750 Environmental Decision Analysis 3**
Quantitative methods for analyzing problems involving uncertainty and multiple, conflicting objectives. Topics include probability, utility, value of information, and multiple attribute methods. Students apply these tools to current environmental problems.

**ECS 760 Environmental Impact Statement 3**
An analysis of environmental protection, legislation, biological, physical, and socioeconomic impacts. National Environmental Policy Act (NEPA) and related regulations.

**ECS 770 Environmental Policy and Law 3**
Introduction to major federal and state statutes and regulatory programs that govern environmental quality, pollution control, and wildlife management, including legislative enactment, regulatory development, enforcement, federal/state relationship, and judicial interpretation.

**Geol 660 Biogeochemistry 3**
An overview of how life affects the Earth's chemistry, examining interactions among the atmosphere, the land surface, and the oceans. Biotic mechanisms will be followed via the global cycles of biologically relevant elements stressing human impacts.

**Geol 760 Advanced Biogeochemistry 3**
Examines the nature of the interaction between Earth's biogeochemical cycles and climate, and how this interaction has evolved over time and will change in the future.

**Hist 634 History of Environmental Science 3**
This class is designed to acquaint students with seminal events in the history of environmental science that have influenced the course of environmental ideas, politics, and policy.

**Zoo 750 Advanced Conservation Biology 3**

Economic Development, Resource Economics

**Kenneth E. Lepper, Ph. D.**
Oklahoma State University, 2001
Research Interests: Quaternary Geology and Age Dating

**Wei Lin, Ph.D.**
SUNY at Buffalo, 1992
Research Interests: Water and Wastewater Treatment, Hazardous Waste Management

**George M. Linz, Ph.D. (adjunct)**
North Dakota State University, 1982
Research Interests: Avian Ecology

**Mark Meister, Ph.D.**
University of Nebraska, 1997
Research Interests: Rhetorical and Critical Theory, Environmental Communication

**Gary L. Nuechterlein, Ph.D.**
University of Minnesota, 1980
Research Interests: Breeding Biology and Behavioral Ecology of Birds, Wildlife Ecology, Particularly of Nongame Species

**Paul J. Ode, Ph.D.**
University of Wisconsin-Madison, 1994
Research Interests: Parasitoid Behavior Ecology, Tritrophic Interactions

**Denise Olson, Ph.D.**
Kansas State University, 1994
Research Interests: Biological Control, Integrated Pest

This class will cover recent developments in the field of conservation biology, with a specific focus on recent literature. Areas of focus will include Evolutionary Conservation and Conservation Genetics.

Management

**G. Padmanabhan, Ph.D.**
Purdue University, 1980
Research Interests: Hydrology, Water Resources, Hydraulic Engineering

**Wendy L. Reed, Ph.D.**
Iowa State University, 2000
Research Interests: Physiological Ecology, Wetland and Bird Ecology, Environmental Endocrinology

**David A. Rider, Ph.D.**
Louisiana State University, 1988
Research Interests: Insect Systematics, Biodiversity

**Michael Robinson, Ph.D.**
University of Nottingham, 1985
Research Interests: Parasite Immunology

**Bernhardt Saini-Eidukat, Ph.D.**
University of Minnesota, 1991
Research Interests: Environmental Geochemistry, Igneous Petrology, Economic Geology

**Donald P. Schwert, Ph. D.**
University of Waterloo, 1978
Research Interests: Quaternary Paleoecology, Analysis of Fossil Insects

**Dean D. Steele, Ph.D.**
University of Minnesota, 1991
Research Interests: Irrigation and Environmental Engineering

**Craig A. Stockwell, Ph.D.**

## Graduate Faculty

701-231-7244

**Achintya N. Bezbaruah , Ph.D.**
University of Nebraska-Lincoln (UNL), 2002
Research Interests:
Environmental sensors, Recalcitrant and micro pollutants, Contaminant fate and transport, Small community water and wastewater treatment, Environmental management

**Eakalak Khan, Ph.D.**
University of California, Los Angeles, 1997
Research Interests:
Water and Wastewater Quality, Water and Wastewater Treatment, and Storm Water and Non-point Source Pollution

**Wei Lin, Ph.D.**
SUNY at Buffalo, 1992
Research Interests:
Water and Wastewater Treatment, Hazardous Waste Management

**G. Padmanabhan, Ph.D.**
Purdue University, 1980
Research Interests:
Stochastic Hydrology, Water Resource Systems, and Hydrologic Modeling

**Robert Zimmerman, Ph.D. (adjunct)**
North Dakota State University, 1991
Research Interests: Water and Wastewater Treatment, Solid Waste

# Environmental Engineering

## Program Description

The Department of Civil Engineering and Construction offers a graduate program leading to a Master of Science degree in environmental engineering. The M.S. degree in environmental engineering is offered through a program designed to advance the technical knowledge, competence, and interdisciplinary understanding of the students and to prepare them for entering or advancing within the environmental engineering profession.

The graduate curriculum in environmental engineering offers courses designed to prepare the student with engineering fundamentals as applied to the environment. To complement the major area of study, additional courses are often selected from other disciplines. Students without a B. S. degree in civil engineering will take remedial undergraduate courses to gain an appropriate background in civil engineering.

## Admissions Requirements

To be admitted to the graduate Master of Science program in environmental engineering, the applicant must

1. Hold a baccalaureate degree from an educational institution of recognized standing.
2. Have adequate preparation in engineering or a basic science area, and show potential to undertake advanced study and research as evidenced by academic performance and experience.
3. At the baccalaureate level, have earned a cumulative grade point average (GPA) of at least 3.0 or equivalent.

Preferably, applications should be submitted directly to The Graduate School before January 5th for fall semester and May 20th for spring semester..

Official transcripts of all previous undergraduate and graduate records must be received by The Graduate School before the application is complete. When a transcript is submitted in advance of completion of undergraduate or graduate studies, an updated transcript showing all course credits and grades must be provided prior to initial registration at North Dakota State University.

Three letters of recommendation are required before action is taken on any application. Personal reference report forms are available from The Graduate School.

The TOEFL and Graduate Record Examination (GRE) scores are required of international applicants. A minimum TOEFL score of 525 (paper test) or 193 (computer test) is required for admission, and 600 (paper test) or 247 (computer test) is required for teaching assistantships.

## Financial Assistance

Research and/or teaching assistantships may be available. Applicants are considered on the basis of scholarship, potential to undertake advanced study and research, and financial need. To be considered for an assistantship, a completed Graduate School application, official transcripts, and three letters of reference (and TOEFL and GRE results for international applicants) must be submitted to The Graduate School.

## Degree Requirements

The Master of Science degree thesis a scholarly document prepared by the student which is based on research performed. The research topic is chosen by the student in consultation with his or her adviser. The student and adviser together prepare a plan of study to meet the needs of the individual student. The program contains a minimum of 30 credits of graduate-level material, of which the thesis can count 6 to 10 credits. An overall GPA of 3.0 or better must be maintained. An oral defense of the research-based thesis and comprehensive academic subject matter is required.

A student entering the environmental engineering Master of Science degree program without an undergraduate engineering degree will be required to satisfy the undergraduate requirements for mathematics, basic science, and engineering sciences in addition to the Master of Science requirements.

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# Courses Offered

**610 Water and Wastewater Engineering 3**
Water quality principles included in treatment, disposal, reuse, and recycling of municipal water supplies and waste waters. Theories and design procedures of water and wastewater treatment unit processes. 3 one-hour lectures. Prereq: CE 309, 370, 371.

**621 Open Channel Flow 3**
Geometric and hydraulic properties of open channels, and momentum and energy principles; design of channels for uniform flow, gradually varied and rapidly varied flow. 3 one-hour lectures. Prereq. CE 309

**671 Water and Wastewater Laboratory 2**
Emphasis on recent developments in and standard methods of water and wastewater analysis. Studies of efficiency, operation, and evaluation of water and wastewater treatment. 1 one-hour lecture and 2 three-hour laboratory. Prereq. CE 370, 408.

**672 Solid Waste Management 3**
Basic study of solid waste materials, current collection methods, available disposal techniques, recycling and resource conservation, and economics of solid waste collection and disposal. 3 one-hour lectures. Prereq. CE 370, 408.

**673 Air Pollution 3**
Fundamentals of air pollution and its control technology. Types and sources of air pollutants; meteorology; effects on plants, animals, people, and property. Design of control equipment. 3 one-hour lectures and 1 three-hour laboratory. Prereq. CE 370.

**677 Applied Hydrology 3**
Scope of hydrology, probabilistic concepts in water resources, regional frequency analysis, application of risk concepts to hydrologic design, hydrologic data generation for ungauged watersheds, hydrologic modeling. 3 one-hour lectures. Prereq. CE 408.

**678 Water Quality Management 3**
Physical, chemical, biological, hydrological characteristics and hydrodynamic elements of receiving waters. Characterizations, measurement, and modeling methods of rivers/ streams, lakes/reservoirs, wetlands, and groundwater systems. 3 one-hour lectures. Prereq. CE 370, 371, 408.

**679 Advanced Water and Wastewater Treatment 3**
Principles of treatment, application, and disposal of water and wastewater sludge; theory and design of biological and physico-chemical unit processes for advanced water and wastewater treatment. 2 one-and-a-half hour lectures. Prereq: CE 370, 371, 410.

**686 Fundamentals of Nanotechnology and Nanomaterials 3**
Principles of nanotechnology and nanomaterials, tools of nanotechnology, nanoscale materials characterization, nanoscale physics, processing, current trends in nanotechnology. Prereq: Graduate standing in science or engineering.

**722 Theory of Models 2**
Physical, analog, mathematical, and computer models; application of dimensional analysis to physical hydraulic model studies, scaling ratios, and distorted models. 2 one-hour lectures. Prereq. CE 309.

**768 Advanced Water and Wastewater Laboratory 3**
Studies on selected processes, efficiency and evaluation of water and wastewater treatment. Selected methods of water and wastewater analyses. 2 one-hour lectures and 1 three-hour laboratory. Prereq: CE 370, 371, or instructor's permission.

**770 Hazardous Waste Management 3**
Characterization of hazardous waste, legislation related to hazardous waste, brief toxicology, environmental audits, pollution prevention, hazardous water treatment/ remediation technologies and disposal. 3 one-hour lectures. Prereq: CE 370, 408

**776 Groundwater and Seepage 3**
Characterization of hazardous waster, legislations related to hazardous waster, brief toxicology environmental audits, pollution prevention, hazardous waster treatment/ remediation technologies and disposal. Prereq. CE 408.

The following variable credit courses are also offered:

**790 Graduate Seminar 1-3**

**793 Individual Study/Tutorial 1-5**

**796 Special Topics 1-5**

**797 Master's Paper 1-3**

**798 Master's Thesis 1-10**

## Graduate Faculty

701-231-7667

**Douglas Freeman, DVM, PH. D.**
Food Safety Program Director
D.V.M., University of Minnesota, 1983
Ph.D., University of Idaho, 1991
Research Interests:
Reproductive physiology; clinical fertility; animal health, management and welfare.

**Julie A. Garden-Robinson, Ph. D.**
Food Safety Extension and Outreach Coordinator
North Dakota State University, 1994
Research Interests:
Consumer issues and their impact on food safety

**Penelope Gibbs, Ph.D.**
University of Georgia, 2001
Research Interests:
Avian E Coli, bacterial molecular pathogenesis, antimicrobial resistance and food safety.

**Clifford Hall, Ph.D.**
Food Safety Program Associate Director
University of Nebraska-Lincoln, 1996
Research Interests:
Flax Seed, antioxidants, toxin analysis

**Verlin Hinsz, Ph.D.**
University of Illinois, Champaign-Urbana
Research Interests:
Social and Organizational Psychology. The Cognitive Psychology of Groups and Teams, Small Group Processes and Performance, Group and

# Food Safety

## Program Description

The lack of individuals with food safety expertise is becoming increasingly evident in government, business, and academia. This food safety expertise gap is widespread and exists in many professions. Individuals earning a Ph.D. degree through the Great Plains Institute of Food Safety will be educated as independent researchers, expanding their potential to become principal investigators of food safety research in various arenas, including business, academia, and government. The M.S. degree will prepare students for supervisory roles in the food industry, with regulatory agencies, or in healthcare. Students earning the Graduate Certificate will likely be business people returning to college to augment their skills.

These programs are administered through the Great Plains Institute of Food Safety (GPIFS) which is composed of faculty from the Colleges of Agriculture, Food Systems, and Natural Resources; Arts, Humanities, and Social Sciences; Engineering and Architecture; Human Development and Education; and Science and Math. The GPIFS graduate programs report directly to the College of Graduate and Interdisciplinary Studies.

## Admissions Requirements

1. A relevant baccalaureate degree from an accredited institution of recognized standing. Appropriate degrees might be in food science, food safety, meat science, cereal science, microbiology, veterinary science, economics, engineering, dietetics, nutrition, or communication.
2. A strong academic record in a pertinent area with a minimum cumulative grade point average of 3.0 on a 4.0 scale.
3. The Graduate Record Examination General Test scores are required for evaluation purposes.
4. Adequate preparation and demonstrated potential for advanced studies.

## Doctor of Philosophy (Ph.D.) Requirements

Individual Judgment and Decision Making, Work Motivation, Goal Setting, Organizational Behavior.

**Margaret Khaitsa, Ph.D.**
Ohio State University, 1999
Research Interests:
Epidemiology of foodborne pathogens

**Gregory P. Lardy, Ph.D.**
University of Nebraska, 1997
Research Interests:
Cow-calf nutrition, by-product utilization, range nutrition

**Catherine M. Logue, Ph.D.**
University of Ulster, 1996
Research Interests:
Isolation and characterization of food-borne pathogens and production issues that impact food safety

**John M. McEvoy, Ph.D.**
University of Ulster, 2002
Research Interests:
The study of pathogenic mechanisms and identification of virulence factors in human pathogenic *Cryptosporidium* species

**William E. Nganje, Ph.D.**
Food Safety Research Program Coordinator
University of Illinois, 1998
Research Interests:
Agribusiness, food safety, and finance

**Suranjan Panigrahi, Ph.D.**
Iowa State University, 1992
Research Interests:
Machine systems, machine vision, and artificial intelligence

**Timothy L. Sellnow, Ph.D.**
Communication and External Program Coordinator
Wayne State University, 1987
Research Interests:
Organizational communication, rhetoric, and pedagogy

**Dennis P. Wiesenborn, Ph.D.**
Rice University, 1988

The Ph.D. is awarded in recognition of satisfactory completion of advanced studies, written and oral preliminary examinations, performance of novel research in the area of food safety, and development and defense of an acceptable dissertation detailing the student's research. For each doctoral student admitted to the program, an advisory committee will be established. This committee will consist of the major adviser, who is a member of the GPIFS graduate faculty and who will chair the committee, and three other GPIFS graduate faculty. Additionally, the Graduate School will appoint a member of the committee. One committee member must be from outside the Food Safety Graduate Program. The student and major adviser will prepare the plan of study, which is subject to the approval of the committee, the GPIFS director, the academic dean, and the Graduate School dean. The plan of study, which must be filed in the Graduate School, will include not less than 90 semester credits. Fifteen of these credits must be at the 700-789 level. An overall grade point average of 3.0 must be maintained on the required course work.

The plan of study for the Ph.D. will be multidisciplinary. All plans will include sufficient course work to demonstrate a minimum proficiency in food safety. The plan of study should be signed off by the Graduate School by the end of the first semester of enrollment in the program. In addition, students will choose an area of emphasis in 1) Etiology and Prevention in Food Safety or 2) Social Science Aspects of Food Safety. A list of required and recommended courses can be found at http://www.ndsu.nodak.edu/foodsafety/PHD.HTM .

## Examinations

1. **Preliminary Examinations**
   Both written and oral preliminary examinations shall be taken no later than the end of the third year in residence after all the required course work has been completed. The written examination will consist of questions over the food safety core plus additional questions covering the empahsis area chosen by the student. The written examination must be successfully completed prior to scheduling the oral preliminary examination. The oral preliminary examination will be based on a non-dissertation research proposal that the student will submit in the form of a USDA, NIH, NSF, or FDA grant proposal. Successful completion of both preliminary examinations will formally admit a student to candidacy for the Ph.D. in Food Safety. At least one academic semester must elapse between admission to candidacy and the final examination.
2. **Final Examination (defense of the dissertation)**
   Under the mentorship of the major adviser and in frequent consultation with the student's graduate committee, the student will design an original research project to answer a question of food safety significance. The student will perform the project and then describe it in a public seminar and dissertation. The dissertation may be arranged in classical or manuscript style as described in the Graduate School 's Guidelines for the Preparation of Disquisitions. Additionally, the student must defend this dissertation in a final oral examination given by the graduate committee.

## Master's of Science (M.S.) Requirements

Students may choose a non-thesis M.S. degree or opt for the research-oriented, thesis-requiring program. The non-thesis option is available for students seeking a broad range of knowledge and skills suitable to the workplace. This degree is a terminal one and would not prepare students for careers in research. In this case, students will be required to compose a novel, comprehensive paper, which is a synthesis of the literature regarding some aspect of food safety.

The thesis-requiring degree is a research degree and, as such, can prepare the student for future study at the doctoral level. The student will perform a novel research project designed to contribute to the body of knowledge in some area pertinent to food safety, prepare a thesis on this research, and defend it in a final oral examination administered by the examining committee.

In both cases, the graduate or examining committee will be composed of the major adviser, who is a member of the GPIFS graduate faculty and who will chair the examining committee, two additional GPIFS graduate faculty, and a Graduate School appointee. The appointee must be from outside the Food Safety Program. The student and major adviser, in consultation with the

Research Interests:
Food engineering, process development, oilseeds processing.

**Charlene E. Wolf-Hall, Ph.D.**
Food Safety Academic Program Coordinator
University of Nebraska-Lincoln, 1995
Research Interests:
Food microbiology, food toxicology, and pedagogy

committee, will design the student's plan of study which will include courses from the list of requirements found at http://www.ndsu.nodak.edu/foodsafety/MASTERS.HTM and additional courses pertinent to the individual student's interests and/or research. The plan of study should be signed off by the Graduate School by the end of the first semester of enrollment in the program.

1. Non-Thesis Option:
   Of the 30 graduate credits required, a minimum of 21 must be in courses approved for graduate credit (601-689 or 700-789). The paper credits must not be fewer than two hours nor more than four. The paper's topic and scope will be determined by the student in consultation with the major adviser and graduate committee.
2. Thesis Option:
   Of the 30 graduate credits required, a minimum of 16 credits must be approved for graduate credit (see above), and thesis credits must not be fewer than 6 nor more than 10 credits. In this case, the student, under the guidance of a major adviser and with the approval of the graduate committee, will perform a novel research project designed to contribute to the body of knowledge in some area pertinent to food safety, prepare a thesis on this research, and defend it in a final oral examination administered by the examining committee.

### Graduate Certificate in Food Protection Requirements

To be admitted to this program, students must demonstrate that they have a baccalaureate degree in an area pertinent to food safety from an accredited educational institution of recognized standing.

To obtain a Graduate Certificate in Food Protection, students must successfully complete the following 9 semester credits. The student must receive a grade of B or better in each course to obtain the certificate.

The required courses are

**SAFE 650 Food Safety for the Food Industry and Consumers**

**SAFE 664 Etiology of Foodborne Illness**

**SAFE 670 Economic, Epidemiologic, and Regulatory Issues in Food Safety**

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## Courses Offered

**SAFE 650 Food Safety for the Food Industry and Consumers 3**
A brief overview about food safety hazards, followed by discussions of sanitation, handling, processing, and serving food leading to explanation of Quality Assurance Programs at the farm and HACCP in food processing and food service. S

**SAFE 652 Food Laws and Regulations 3**
Regulations, laws, and dynamics governing development of food policy. Cross-listed with AGEC. S

**SAFE 664 Etiology of Foodborne Illness 3**
Study of the etiology, prevention, pathogenesis, and disease manifestations of foodborne illnesses, including those caused by pathogens, allergens, toxins, and contaminants; detection of the etiologic agents and their entrance into the food chain. Prereq: MICR 202, 202L or equivalent; or permission of instructor. Cross-listed with MICR. F

**SAFE 670 Economic, Epidemiologic, and Regulatory Issues in Food Safety 3**
The study of the economic impact of foodborne illness and its prevention and tracking,

and the regulations governing food safety in the U.S. and their impact on global trade. Prereq: Stat 330 or equivalent, or permission of instructor. S

**SAFE 674 Epidemiology 3**
The study of the distribution and dynamics of disease in populations. Prereq: Stat 330 Cross-listed with MICR. S

**SAFE 684 Food Safety Practicum 2**
An integrated laboratory study of food safety. Field trips, specialty speakers, workshops, and case studies will be used to foster student's abilities to solve food safety problems from farm to fork. Prereq: SAFE 650, 664, and 670. SS

**SAFE 720 Food Safety Costs and Benefits Analysis 3**
Theoretical and empirical impacts of food safety costs and benefits. Prereq: SAFE 470/670, AgEc 741, or permission of instructor. Cross-listed with AGEC.

**SAFE 725 Food Policy 3**
Provides quantitative tools and models used to analyze general food safety policies. Prereq: SAFE 470/670 or permission of instructor. Cross-listed with AGEC.

**SAFE 750 Advanced Topics in Epidemiology 3**
Distribution and dynamics of disease in populations and factors contributing to the costs of foodborne illness and its prevention. Prereq: SAFE 474/674 or equivalent, Micr 460 recommended. Cross-listed with MICR.

**SAFE 752 Advanced Food Microbiology 3**
State-of-the-art techniques in isolation, detection, and characterization of food-borne pathogens. Prereq: Micr 653 or permission of instructor. Cross-listed with CFS and MICR.

**SAFE 753 Food Toxicology 2**
Discussions on the properties of toxic substances found both naturally and as contaminants in foods, the hazards they present to humans and their food supplies, and ways to reduce risks. Prereq: BIOC 460 or equivalent. S (even years)

**SAFE 762 Advanced Pathogenic Bacteriology 3**
Biophysical and biochemical mechanisms by which microorganisms cause infectious disease and host reactions to the disease. Prereq: Micr 460, 460L. Cross-listed with MICR.

**Comm 785 Advanced Crisis Communication 3**
Long-term and short-term issues for managing communication related to organizational crises are discussed in the stages of pre-crisis, crisis, and post-crisis. Prereq: permission of instructor. Cross-listed with COMM.

**SAFE 786 Risk Communication 3**
Explores the relationship between communication strategies and risk perception, assessment, and management. Prereq: permission of instructor. Cross-listed with COMM.



E-Mail: The Graduate School
Prospective students may schedule a visit by calling 1-800-488-NDSU.
The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701-231-8443

**Eugene Berry, Ph.D.**
Northeastern University, 1983
Department:
Veterinary and Microbiological Sciences
Research Interest:
Animal Virology

**Joseph P. Brennan, Ph.D.**
University of Illinois, Champaign-Urbana, 1984
Department:
Mathematics
Research Interest:
Communative Algebra, Representation Theory, Enumerative Combinatorics, Invariant Theory

**Xiwen Cai, Ph.D.**
Washington State University, 1998
Department:
Plant Sciences
Research Interest:
Cytogenetics

**Michael J. Christoffers, Ph.D.**
University of Missouri-Columbia, 1998
Department:
Plant Sciences
Research Interest:
Weed Molecular Genetics

**Edward L. Deckard, Ph.D.**
University of Illinois, Champaign-Urbana, 1970
Department:
Plant Sciences
Research Interest:
Crop Physiology

**Justin D. Faris, Ph.D.**
Kansas State University, 1999
Department:
Plant Sciences
Research Interest:

# Genomics and Bioinformatics

## Program Description

Genomics and Bioinformatics is an interdisciplinary graduate program that involves faculty from nine departments. Advanced research and study will focus on either functional or computation genomics. The program is designed to provide both M.S. and Ph.D. students the necessary skills and intellectual background to work cooperatively with others in a research area that takes a systems-wide approach to the study of the organization and expression of the many genes and their products expressed in an organism. Exposure to modern techniques and instrumentation will prepare the student for success in both industrial and academic careers.

## Admissions Requirements

It is the intent of the program to admit students in either of two tracks. The Functional Genomics Track will be for students interested in the generation and application of genomic information. The Computational Bioinformatics Track is intended for students interested in using computer science and statistical approaches to analyze large amounts of genomic data.

The Genomics graduate program is open to qualified graduates of universities of recognized standing. The Graduate School minimum for the TOEFL examination applies. In addition, the following are the requirements to be admitted with full standing.

Functional Genomics Track: a B.S. degree with courses in genetics, physiology, biochemistry; an upper-division statistics class; an introductory biology class emphasizing molecular biology; and minimum undergraduate GPA is 3.0.

Computational Bioinformatics Track: a B.S. degree with courses in calculus, comparative computer languages, data structures, an upper-division statistics class, an introductory biology class emphasizing molecular biology, and minimum undergraduate GPA is 3.0

Students can be accepted conditionally into either track without meeting the course or GPA requirements, but will be required to meet those requirements while in residency.

## Degree Requirements

### Adviser and Graduate Committee:

During the first year, the student will select an adviser, form a graduate committee, and submit the Plan of Study to The Graduate School. The committee must include the student's major adviser, at least one other faculty member of the genomics program, and The Graduate School

Wheat Molecular Genetics

**Marvin W. Fawley, Ph.D.**
Miami University, 1985
Department:
Biological Sciences
Research Interest:
Evolutionary Biology

**David P. Horvath, Ph.D.**
Michigan State University, 1993
Department:
Plant Sciences
Research Interest:
Perennial Weed Physiology

**Shahryar F. Kianian, Ph.D.**
University of California-Davis, 1990
Department:
Plant Sciences
Research Interest:
Wheat Molecular Genetics

**Phillip E. McClean, Ph.D.**
Colorado State University, 1982
Department:
Plant Sciences
Research Interest:
Plant Molecular Genetics

**Steven W. Meinhardt, Ph.D.**
University of Illinois, Champaign-Urbana, 1984
Department:
Biochemistry and Molecular Biology
Research Interest:
Protein Structure/Function

**Kendall Nygard, Ph.D.**
Virginia Polytechnic Institute and State University, 1978
Department:
Computer Science
Research Interest:
Bioinformatics

**William Perrizo, Ph.D.**
University of Minnesota, 1972
Department:
Computer Science and Operation Research
Research Interest:
Distributed Database Systems, Centralized Database Systems

**Jack B. Rasmussen Ph.D.**

appointee. For Ph.D. students only, one member of the committee must be from outside the student's home college.

### Core Courses

PLSC 611 Genomics – 3 cr
CSCI/MATH/STAT 732 Bioinformatics – 3 cr
PLSC 721/BIOC 721 Genomic Techniques – 2 cr
796 Current Topics in Genomics – 2 [2 x 1 cr. (MS)] or 3 [3 x 1 cr. (Ph.D.)] cr
790 Graduate Seminar – 1 (M.S.) or 2 (Ph.D.) cr

## The Ph.D. Program

### Functional Genomics Option

**Ph. D. Core Courses** – 13 cr
**Support Courses** (required unless on incoming transcript)
BIOL 659 Evolution – 3 cr
PLSC 631 Intermediate Genetics – 3 cr
STAT 726 – Applied Regression and Analysis of Variance – 3 cr
**Electives** – minimum of 15 credits from the Physiology, Gene Expression, Genetics and Computational Elective areas; one course from each of the Physiology, Gene Expression, Genetics elective areas is required
**Thesis Research** – to 90 credits total
**(NOTE: a minimum of 15 didactic credits must be 700-level courses)**

### Bioinformatics Option

**Ph. D. Core Courses** – 13 cr
**Support Courses** (required unless on incoming transcript)
CSCI 668 – Database System Design – 3 cr
PLSC 631 – Intermediate Genetics – 3 cr
STAT 661 – Applied Regression Models – 3 cr
CSCI 796 – Computational Methods in Bioinformatics – 3 cr
**Electives** - minimum of 15 credits; a minimum of three courses must be from the Computational area and a minimum of one course must be from either the Physiology, Gene Expression or Genetics Elective areas
**Thesis Research** – to 90 credits total
**(NOTE: a minimum of 15 didactic credits must be 700-level courses)**

## Elective Areas

### Physiology

ARSC 728 – Advanced Reproductive Biology – 3 cr
BIOC 718 – Metabolic Regulation – 3 cr
BOT 780 – Plant Metabolism and Stress Physiology – 3 cr
BOT 784 – Photobiology – 3 cr
MICR 670 - Basic Immunology – 3 cr
MICR 680 – Bacterial Physiology – 3 cr
MICR 781 – Advanced Bacterial Physiology – 3 cr
PPTH 751 – Physiology of Plant Disease – 3 cr
ZOO 660 – Animal Physiology – 4 cr
ZOO 664 - Endocrinology – 3 cr
ZOO 682 – Developmental Biology – 3 cr
ZOO 764 – Neuroendocrine and Endocrine Systems – 3 cr
ZOO 766 – Neurophysiology – 3 cr

Michigan State University, 1987
Department:
Plant Pathology
Research Interest:
Molecular Plant/Microbe Interactions

**Mark Sheridan, Ph.D.**
University of California-Berkeley, 1985
Department:
Biological Sciences
Research Interest:
Control of Growth, Development and Metabolism

**Mary Stewart, Ph.D.**
Kansas State University, 1992
Department:
Biological Sciences
Research Interest:
Cell Growth in Signaling and Development

**Alan White, Ph.D.**
University of North Carolina, 1981
Department:
Biological Sciences
Research Interest:
Plant Cell Biology, Cell Wall Biosynthesis

**Birgit Pruess, Ph.D.**
Ruhr-Universitat Bochum, Germany, 1991
Department:
Veterinary and Microbiological Sciences
Research Interest:
Microbial Physiology and Gene Regulation

**Marc D. Anderson, Ph.D.**
Iowa State University, 1995
Department:
Biological Sciences
Research Interest:
Plant Stress Physiology

**Vasant A. Ubhaya, Ph.D.**
University of California-Berkeley, 1971
Department:
Computer Science and Operations Research
Research Interest:
Algorithm Analysis, Operations Research

### Gene Expression

BIOC 719 – Molecular Biology of Gene Expression and Regulation – 3 cr
BOT/ZOOL 720 – Advanced Cell Biology – 3cr
MICR 775 – Molecular Virology – 3 cr
PLSC 731 – Plant Molecular Genetics – 3 cr

### Genetics

BIOL 659 – Evolution – 3 cr (required for Functional Genomics Ph.D. Option)
BIOL 796 – Molecular Evolution and Phylogenetics – 3 cr
MICR 682 – Bacterial Genetics and Phage – 2 cr
MICR 783 – Adv. Bacterial Genetics and Phage – 2 cr
PLSC 631 – Intermediate Genetics – 3 cr (required for Functional Genomics Option)
PLSC 741 – Cytogenetics – 4 cr
PLSC 751 – Advanced Genetics – 3 cr
PLSC 780 – Population Genetics – 2 cr
PLSC 781 – Quantitative Genetics – 2 cr
PPTH 759 – Host-Parasite Genetics – 3 cr

### Computational

CSCI 724 – Survey of Artificial Intelligence – 3 cr
CSCI 760 – Dynamic Programming – 3 cr
CSCI 765 – Introduction to Database Systems – 3 cr
CSCI 783 – Data Mining– 3 cr
CSCI 759 – Computational Methods in Bioinformatics – 3 cr
CSCI 796 – Knowledge Discovery in Biological Data – 3 cr
CSCI 796 – Signal Processing and Analysis in Bioinformatics – 3 cr
MATH 635 – Mathematical Models of Biological Processes– 3 cr
MATH 647 – Molecular Topology – 3 cr
STAT 650 – Stochastic Processes – 3 cr
STAT 651 – Bayesian Statistical Decision Theory – 3 cr
STAT 661 – Applied Regression Models – 3 cr (required for Bioinformatics Ph.D. option)
STAT 731 – Biostatistics – 3 cr
STAT 764 – Multivariate Methods – 3 cr
STAT 796 – Computational Statistics – 3 cr (required for Bioinformatics Ph.D. option)

## The M.S. Program -- Thesis Option

### Functional Genomics Option

**M.S. Core Courses** – 11 cr
**Electives** – minimum of 9 credits from the Physiology, Gene Expression, and Genetics areas; a minimum of one course must be selected from each of two of these areas
**Research** – to 30 cr total

### Bioinformatics Option

**M.S. Core Courses** – 11 cr
**Electives** - minimum of 9 credits; a minimum of one course must be from the the Physiology, Gene Expression or Genetics Elective areas; the remainder of the courses must be from the Computational area
**Research** – to 30 cr total

## The M.S. Program -- Comprehensive Study Option

### Functional Genomics Option

**M.S. Core Courses** – 11 cr
**Electives** – minimum of 15 credits from the Physiology, Gene Expression, and Genetics areas; a minimum of one course must be selected from each of two of these areas
**Masters Paper** – to minimum of 30 credit total

**Anne Denton, Ph.D.**
University of Mainz, Germany, 1996
Department:
Computer Science
Research Interest:
Data Mining, Bioinformatics

## Bioinformatics Option

**M.S. Core Courses** – 11 cr
**Electives** - minimum of 15 credits; a minimum of two courses must be from the the Physiology, Gene Expression or Genetics Elective areas; the remainder of the courses must be from the Computational area
**Masters Paper** – to minimum of 30 credit total

## Examinations

1. **Qualifying Exam (Ph.D. only):**
   This exam consists of written and oral portions. The student will complete a written exam that emphasizes the application of materials presented in the core courses. The members of the genomics graduate program will submit these questions. The oral exam will be administered by the student's graduate committee and will focus on material beyond the core courses that are specific to the research of the student. Upon completion of the qualifying exam, the student will be accepted as a Ph.D. candidate.
2. **Final Exam (M.S. and Ph.D.):**
   The final exam will be an oral defense of the student's research results. The student's graduate committee will administer the exam.
3. **Comprehensive Study Option Paper (M.S. only):**
   M.S. students pursuing the Comprehensive Study Option will be required to complete an in-depth paper of a specific topic relevant to Genomics. The paper will be reviewed and accepted by the student's graduate committee.

## Research

The student is required to perform original research in an area of genomics. This will be under the direction of the student's major adviser. To promote cross-disciplinary research, the student is encouraged to collaborate with a student in the other track. This does not apply to M.S. students pursuing the Comprehensive Study Option.



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The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701-231-8681

**David Barney, Ph.D.**
Florida State University, 2002
Research Interests:
Physical Education Pedagogy

**Thomas C. Barnhart, Ph.D.**
University of New Mexico, 1978
Research Interests:
Recreation Management, Playground Safety

**Ardith Brunt, Ph.D.**
Iowa State University, 1999
Research Interests:
Nutrition, Gerontology

**Bryan Christensen, Ph.D.**
University of Kansas, 2000
Research Interests:
Biomechanics, Sports Psychology

**Michael Craw, Ph.D.**
University of Tasmania , 2005
Research Interests:
Sport Management, Sport Marketing, Olympic Education

**Gary Liguori, Ph.D.**
North Dakota State University, 2005
Research Interests:
College Fitness and Wellness, Cardiac Rehabilitation, Obesity

**Pamela Hansen, Ed.D.**
University of South Dakota, 2000
Research Interests:
Athletic Training

**Arthur W. Maughan, M.S.**
North Dakota State University, 1966

# Health, Nutrition, & Exercise Sciences


## Program Description

The Department of Health, Nutrition and Exercise Sciences (HNES) offers graduate study leading to the Master of Science (M.S.) degree. Graduate options in the areas of nutrition, exercise science, sport pedagogy, public health, entry-level athletic training, and sport and recreation management are offered.

Degree candidates are encouraged to work closely with their academic advisers to design their programs of study relative to their individual personal and professional goals. Academic and research foci are tailored to the student's interests, with the programs designed to prepare the graduate for positions in the field of choice.

## Exercise Science

The Exercise Science option prepares the graduate for advanced positions in the areas of physical activity and exercise science, with an emphasis on applying knowledge to the general population, as well as sport and athletic populations. This option is appropriate for athletic trainers, human performance, and exercise science students. Students may select either the 30-credit thesis, which requires a 6-credit research thesis; or the comprehensive study option, which requires a 3-credit master's paper. Students who want to conduct research or continue in a Ph.D. program should select the thesis option.

## Nutrition Science

The Nutrition science option provides opportunities for registered dieticians strengthening their education in the areas of nutrition and dietetics. The curriculum provides an advanced understanding of nutrition science to facilitate the pursuit of a variety of careers in clinical and/or applied settings.Students may select either the 30 credit thesis or comprehensive study option. Students selecting the thesis option will complete a 6-10 credit research thesis while students selecting the comprehensive study option will complete a 3 credit master's paper. It is recommended that students interested in conducting research or desiring to continue into a Ph.D. program select the thesis option.

## Sport Pedagogy

Sport Pedagogy is the youngest subdiscipline to emerge from the field of physical education over the past two decades. Research in sport pedagogy focuses on the teaching and learning processes in various physical activity settings and the process of teacher education in school based physical

Research Interests:
Coaching

**Yeong Rhee, Ph.D.**
Oklahoma State University, 1999
Research Interests:
Trace Elements, Chronic Disease, Immune Function, Functional Foods

**Julie Garden Robinson, Ph. D.**
North Dakota State University, 1994
Research Interests:
Food Safety, Applied Nutrition

**Bradford N. Strand, Ph.D.**
University of New Mexico, 1988
Research Interests:
Physical Education Curriculum and Instruction, Fitness Education, Sport Sociology

**Donna J. Terbizan, Ph.D.**
The Ohio State University, 1982
Research Interests:
Exercise Physiology, Fitness, Wellness, Human performance.

education programs as well as youth sport, interscholastic, collegiate and elite level sport programs. This option is appropriate for k-12 and intercollegiate personnel interested in teaching physical education and coaching. Students may select either the thesis or comprehensive study option. With the thesis option students will complete a 6-9 credit research thesis. With the comprehensive study option students will complete a 3 credit master's paper. It is recommended that students interested in conducting research or desiring to continue into a Ph.D. program select the thesis option.

## Sport and Recreation Management

The Sport and Recreation Management program of study option prepares the student for advanced positions in the sport and recreation management career field. Students interested in 1)investigating and interrogating management and leadership styles in sport and recreation, 2)gaining insight into marketing of sports and recreation, 3)understanding the ethnography related to sport how it impact society, and 4) improving overall written and oratory communication skills would be interested in pursuing this masters of Science degree study option. The course work and a culminating field experience provides an interdisciplinary approach to the study of sport and recreation management, and is intended to provide a thorough foundation in the buisness of sport and recreation while allowing flexibility for students to explore a wide variety of opportunities within the field.

## Public Health

The goal of public health is to improve the health of populations through planning, implementing, and evaluating health promotion and disease prevention programs. Public health professionals design these intervention programs by using a combination of health education and related organizational, economic, legislative, and environmental supports to enhance the probability of creating a healthier populace. Students may select either the 30-credit thesis, which requires a 6-9 credit research thesis; or the comprehensive study option, which requires a 3-credit master's paper. Students who want to conduct research or continue in a Ph.D. program should select the thesis option.

## Entry Level Athletic Training

The Entry- Level Athletic Training program prepares students to take the Board of Certification, Inc. (BOC) exam to become a certified athletic trainer (ATC). Course work and clinical experience focus on prevention, assessment, treatment, and rehabilitation of injuries resulting from physical activity. Knowledge and skills taught in the didactic setting are mastered in the athletic training room setting. This degree is 36 credits and requires a 3 credit comprehensive paper. Program is pending accreditation.

**Admission Requirements:**

1. A Bachelors of Science degree in a related field from an accredited institution.
2. Undergraduate overall GPA of 3.0 on a 4.0 scale.
3. Acceptance into the NDSU Graduate School

**Academic Requirements:**

1. Minimum of 50 hours of observation under a BOC ATC in an athletic training room setting
2. Minimum of “C” or higher in the following college courses:
    a. Human Anatomy/Lab 4 cr
    b. Human Physiology Lab 4 cr
    c. Exercise Physiology/Lab 4 cr
    d. Kines/Biomechanics/ Lab 4 cr
    e. Nutrition 3 cr
    f. Psychology 3 cr
    g. Personal/Community Health 3 cr

h. Current Professional Rescuer First Aid/CPR/AED card

**Application Process:**

1. Must meet the minimum Admission and Academic requirements listed above
2. Submission of MS ATEP application
3. Two letters of recommendation
    i. One from Instructor
    ii. One from ATC
4. Statement of Career Goals
5. Interview with MSAT Application Committee
6. Physical exam signed by physician
7. Technical Standards form signed by physician
8. Criminal background check form
9. Signed compliance/consent form
10. TB test and Hepatitis B vaccine (or Hep B waiver)

See website for additional academic and admission requirements. www.ndsu.nodak.edu/HNES/graduate.html (follow MS options link).

## Admissions Requirements

Qualified students may apply for admission in graduate programs in the HNES department leading to the Master of Science (M.S.) degree in Nutrition Science, Exercise Science, Sport Pedagogy, Sport and Recreation Management, Public Health, or Entry-level Athletic Training. In addition to requirements described under academic information elsewhere in this bulletin, the following criteria will be considered at the time of application for admission into graduate study. Admission to a master's degree program is considered ONLY after all required application materials have been received and reviewed.

The required materials are

1. Completed, signed application form;
2. Official transcripts of all previous collegiate work, including one verifying graduation with a baccalaureate degree from an accredited institution;
3. Three references that evaluate the applicant's potential for success as a graduate student in the chosen master's degree program; and
4. An exhibit of the applicant's written competency through an essay discussing professional philosophy and professional goals.

The Department of Health, Nutrition and Exercise Sciences reserves the right to obtain additional information about the student's professional competence from qualified professionals. Admission decisions are based upon the predicted success of the applicant as a student and professional in the chosen field and are made only after considering all available data. The criteria for admission follows:

### Admission with full standing

1. Students must meet all requirements for full admission.
2. The following criteria act as guidelines for full acceptance:
   a. Cumulative baccalaureate GPA of 3.0 or better on a 4.0 scale.
   b. OR a GPA of at least 3.25 during the final 30 semester credits of graded undergraduate coursework.

### Admission with conditions

1. Students who do not meet full admission requirements may be admitted with conditions by showing evidence that the applicant's potential is not reflected by the record.
2. Minimum cumulative GPA of 2.8 on a 4.0 scale.

To move to full standing a student must achieve a minimum of 3.00 on the first nine credits of graduate course work.

### Financial Assistance

Both research and teaching assistantships may be available. Applications are considered on the basis of scholarship, potential to undertake advanced study and research, and financial need. To be considered for an assistantship, a completed Graduate School Application, official transcripts, and three letters of reference must be received by The Graduate School not later than Feb 1. Students are also required to complete a department application for teaching assistantships after they have been accepted into the department as a graduate student. Graduate assistants teach approximately six credits each semester, receive a financial stipend for their work, and a full tuition waiver for fall, spring, and summer semesters. Assistantships are available contingent upon current funding.

### Degree Requirements

The Master of Science options in the HNES Department require a minimum of 30 semester credits in Thesis, Comprehensive Study or Field Experience options (see program for requirements). The entry level athletic training option requires 36 semester credits. Students may complete three credits of independent study in HNES programs.

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## Courses Offered

**HNES 630 Socio-Cultural Dimensions in Sport (3 credits)**
Through ethnographic analysis, students will gain a level oof understanding of how and why sport has and does contribute to nation building in the United States and across the western world.

**HNES 635 Nutrition, Disease and Health Professional (2 credits)**
Principles of client assessment and care that reflect recent advances in nutrition management together with their application to practice. Prereq: HNES 250

**HNES 652 Nutrition, Health and Aging (3 credits)**
Physiological changes with aging and their relationship to food habits and nutritional need. Common nutritional health problems with emphasis on prevention and treatment. Prereq: Nutr 240 or HNES 250

**HNES 655 Sports Nutrition (3 credits)**
Provides both current research and the translation of research findings into practical advice, offering unique insights on how nutrition can be used to design and effectively implement the optimal diet for lifelong physical fitness. Prereq: HNES 240

**HNES 658 Advanced Medical Nutrition Therapy (4 credits)**
Principles in the nutrition care of patients with conditions requiring nutrition care. Prereq: HNES 354.

**HNES 684 Therapeutic Exercise (3 credits)**
Planning and implementing a comprehensive rehabilitation program of athletes with injuries/ illnesses.

**HNES 685 Therapeutic Modalities (3 credits)**

Practical use of various therapeutic modalities used in treating athletic injuries. Emphasis on physiological effects, indications, and contraindications of each form of treatment.

**HNES 686 Medical Aspects of Athletic Training (3 credits)**
Information on a variety of illnesses and conditions that affect the athlete will be discussed.

**HNES 687 Administration of Athletic Training Programs (3 credits)**
Planning, coordinating, and supervising all administrative components of athletic training programs.

**HNES 701 Administrative leadership in HNES (3 credits)**
Introduction to administrative leadership in health, physical education, recreation and sports, designed to provide students with skills, techniques and practices for successful leadership.

**HNES 702 Sport Marketing and Public Relations in HNES (3 credits)**
Understanding the issues and areas involved in marketing and public relations in the areas of HNES. Discussed are both fund raising strategies and the development of communication skills needed for success in this field.

**HNES 703 Scientific Aspects of Sport (3 credits)**
Essentials of physical training and biomechanical analysis in sport.

**HNES 704 Psychological Foundation of Sport and Physical Activity (3 credits)**
Comprehensive description of sport psychology, application of concepts to sport performance improvement as well as other areas in physical activity.

**HNES 710 Recent Literature and Research (3 credits)**
Directed readings and class discussions of recent literature, steps involved in problem solving, and critical analysis of research in the field.

**HNES 711 Physical Education Curriculum (3 credits)**
Provide an understanding of the role and importance of physical education in today's society, steps involved in curriculum planning, trends and issues in physical education curriculum and to orient students to various ideas in physical education curriculum design.

**HNES 712 Supervision and Analysis in HNES (3 credits)**
To study the scope of supervision, techniques for improvement of various phases of the learning process of teaching or coaching, and means of evaluating the effectiveness of supervision in the field. Will also provide practicing physical education teachers with practical field-based observational experiences via the viewing of teaching situations. Students will learn and use a number of observational techniques as they evaluate teacher behaviors, student behaviors, and teacher-student interaction.

**HNES 713 Graduate Exercise Physiology (3 credits)**
Comprehensive state-of-the-art review of the current knowledge of the physiological responses to exercise.

**HNES 714 Legal Liability in HPER (3 credits)**
Focused on risk management and legal liability in health, physical education, and recreation. Overview of civil and criminal law related to sport and recreation.

**HNES 717 Recreation and Sport Complex Management (3 credits)**
Explore guidelines and develop a base of information important for the design and management of facilities for physical activity and sport.

**HNES 719 Wellness and Leisure for Adults (3 credits)**
Explores the role of leisure in adult development with specific focus on the aging process, leisure needs, and leisure services. Basic concepts associated with leisure, aging, targeting leisure services, research, and public policy are presented in light of forecasting leisure demand in the 21st century.

**HNES 721 Health Promotion Programming (3 credits)**

This course is designed to help students understand and develop skills for health promotion programming, regardless of settings.

**HNES 723 Advanced Techniques in Sports Medicine (3 credits)**
Review of current literature in the latest and most advanced techniques in Sports Medicine.

**HNES 724 Nutrition Education (3 credits)**
Principles and practices of teaching individuals and groups to translate nutrition knowledge into action. Emphasis on research in and evaluation of nutrition education. Prereq: Nutr 240, HNES 250, or instructor approval.

**HNES 726 Nutrition and Wellness (3 credits)**
Epidemiology and pathophysiology of chronic disease related to nutrition (e.g., obesity, cardiovascular disease, osteoporosis, hypertension, diabetes, cancer). Nutritional risk and protective factors will be examined as they relate to public health and individual nutrition.

**HNES 727 Physical Activity and Wellness (3 credits)**
Information and discussion regarding the influence of physical activity on personal wellness. Review of the association between sedentary habits, risk for chronic disease, and the most recent physical activity recommendation to battle disease.

**HNES 750 Advanced Human Nutrition (4 credits)**
Physiological and biochemical aspects of human digestion and metabolism. Prereq: HNES 351. Coreq: BIOC 701.

**HNES 754 Assessment in Nutrition and Exercise Science (3 credits)**
Selected techniques for assessment and interpretations of nutritional status.

**HNES 781 Orthopedic Assessment I (5 credits)**
Practical exposure to evaluation, application, and construction of protective taping devices and techniques. In addition, practice and guidance of injury recognition and evaluation techniques of the lower extremity. Prereq: Instructor approval.

**HNES 782 Orthopedic Assessment II (5 credits)**
Guidance and practice in the evaluation and recognition of athletic injuries to the upper extremity, head, neck, and back, and skin disorders. In addition, environmental conditions will be discussed. Prereq: Instructor approval.

The following variable credit courses are also offered:

**790 Seminar 1-3 credits**

**793 Individual Study 1-5 credits**

**794 Practicum/Internship 1-6 credits**

**795 Field Experience 1-15 credits**

**797 Master's paper 1-3 credits**

**798 Master's thesis 1-15 credits**

**799 Doctoral dissertation 1-15 credits**

## Graduate Faculty

701-231-8654

**Gerald Anderson, Ph.D.**
University of Iowa, 1973
Field:
Modern Britain, Scandinavians in America

**David B. Danbom, Ph.D.**
Stanford University, 1974
Field:
Agriculture and Rural Life, Recent U.S., Progressive Period

**Mark Harvey, Ph.D.**
University of Wyoming, 1986
Field:
American West, Environmental History, Public History

**John A. Helgeland, Ph.D.**
University of Chicago, 1973
Field:
History of Christianity, History of Culture, Roman Empire, Philosophy of History

**Thomas D. Isern, Ph.D.**
Oklahoma State University, 1977
Field:
History and Folklore of the North American Plains, History of Agriculture

**Gerritdina Justitz, Ph.D.**
University of California--San Diego, 1996
Field:
Early Modern Europe, Social and Cultural History of the Reformation

**Jim Norris, Ph.D.**
Tulane University, 1992
Field:
Latin America, Mexico, Spanish Frontier in North America

**Larry R. Peterson, Ph.D.**

# History

## Program Description

The graduate program in history at North Dakota State University has offered a master's degree program since The Graduate School was founded in 1954. In 2002, a joint program for a Ph.D. in History was instituted between NDSU and the University of North Dakota. A complete program description follows the M.S./M.A. requirements. The graduate faculty also provides instruction to non-history majors in other departments as well as the region's secondary education instructors who require continuing education credits for certification.

The department offers both the Master of Arts and Master of Science degrees in the areas of United States history, modern European history, or world history. Candidates with two years of foreign language study at the baccalaureate level or who have passed a standard foreign language examination meet the requirements for the Master of Arts. Students taking either degree may choose either the thesis or comprehensive study option.

The history graduate program provides a rigorous and highly personalized graduate experience. This experience produces confident people with a sense of achievement. They are ready to contribute as scholars and teachers.

## Admissions Requirements (Master's Degree)

The Department of History graduate program is open to qualified graduates of universities and colleges of recognized standing.

To be admitted with full status to the program, the applicant must

1. Hold a baccalaureate degree from an educational institution of recognized standing.
2. Submit a statement of intent clearly outlining the applicant's research interests, career goals, and purpose for seeking a master's in history.
3. Have earned an undergraduate grade point average of at least 3.0 or equivalent. The department will closely examine grades in history, and other humanities and social science courses.
4. Provide three letters of recommendation that attest to the applicant's critical thinking skills, writing abilities, and motivation. These letters must be received before action will be taken on an application.
5. Provide a statement of intent that clearly outlines the applicant's interest and purpose for seeking a master's degree in history. The department uses this statement to assess the applicant's ability to organize thoughts, to formulate a plan of academic study, and to complete the graduate program. This statement also enables the department to determine whether North Dakota State University's graduate history program suits the

University of Minnesota, 1978
Field:
U.S. Intellectual, Women and Families

**Claire Strom, Ph.D.**
Iowa State University, 1998
Field:
Public, U.S. South, American West

applicant's needs and objectives.
6. Submit a substantial paper submitted for an upper-division history class or for a class in the humanities and social sciences. The paper should provide evidence of an applicant's ability to synthesize information, to organize his/her thoughts logically, and to communicate clearly and effectively.
7. Take the general Graduate Record Examinations (GRE) and submit these scores before admission to the program. Students admitted to the program generally score an average of 500 on the verbal and quantitative sections of the GRE's. Students scores on the new analytic writing section should be comparable, i.e. 3.5-4.0. The department requires students whose native language is not English to have a minimum TOEFL score of 600 (paper test) or 247 (computer test).

Official transcripts (transcripts having an appropriate seal or stamp) of all previous undergraduate and graduate records must be received by The Graduate School before the application is complete. When a transcript is submitted in advance of completion of undergraduate or graduate studies, an updated transcript showing all course credits and grades must be provided prior to initial registration at NDSU. All application materials should be submitted directly to The Graduate School.

## Financial Assistance

The graduate department has graduate assistantships for qualified students. Assistantships are 10-20 hours/week with graduate tuition waiver. Students wishing to apply for a teaching assistantship should express this in writing to the chair of the department. The deadline for assistantship applications is April 1.

The department awards and renews assistantships based on maintenance of good standing in the program and full-time registration during the appointment, demonstration of historical knowledge and good communication skills, progress towards completion of a degree, interest and potential in teaching as a career, financial need, and minority status in cases of equally qualified candidates.

The department awards assistantships for a one-year (10 month) contract period. It renews these assistantships for one additional year pending the availability of funds, progress toward the completion of a degree, and satisfactory job performance.

## Degree Requirements

### Thesis Option:

A student selecting the thesis option must complete at least 30 semester credits of graduate work with a minimum of 21 credits in history. Most graduate students in history choose this option. The thesis should reflect original thought and research using primary materials. The department recommends that students intending to continue to a Ph.D. program select this option. Students selecting this track must meet the following requirements:

**3 credits, Hist 701 (Methods of Historical Research) taken first semester**

**6 credits from the following (one to be declared the student's major area and the other the minor area):**
**Hist 730 Readings in North American History**
**Hist 760 Readings in European History**
**Hist 780 Readings in World History**

**1 credit, Hist 705 (Directed Research) taken during second year**
**9-12 credits, history course work at 600 level or above**
**6-9 credits, course work in approved outside field, at 600 level or above**

**1 written comprehensive exam in student's major area**
**6-10 credits, Hist 798 (Master's Thesis)**
**1 final oral defense**

## Non-Thesis Option:

A student choosing the comprehensive study option must complete at least 30 semester credits of graduate work with at least 21 credits in history. The student must present three comprehensive study papers. Students write one comprehensive study paper for their major and each of their minor areas of program study. These papers involve substantial research and synthesis in secondary materials. The department does not expect these papers to be original contributions to the world of scholarship, but rather syntheses that demonstrate mastery of particular topics. Students selecting this track must meet the following requirements:

**3 credits, Hist 701 (Methods of Historical Research) taken first semester**

**9 credits, all of the following (one to be declared the student's major area, the others are minor areas):**
**Hist 730 Readings in North American History**
**Hist 760 Readings in European History**
**Hist 780 Readings in World History**

**6-9 credits, history course work at 600 level or above**
**6-9 credits, course work in approved outside field, at 600 level or above**
**1 written comprehensive exam in student's major area**
**2-4 credits, Hist 797 (Master's Paper)**
**3 comprehensive study papers**
**1 final oral defense**

## Suggested Curricula

**Year 1-Fall**

701 Methods of Historical Research
730 Readings in North American History
600 or 700 level history elective

**Year 1-Spring**

760 Readings in European History or 780 Readings in World History
600 or 700 level history electives
600 or 700 level approved outside field elective

**Year 2-Fall**

600 or 700 level history elective
600 or 700 level history elective
600 or 700 level approved outside field elective
705 Directed Research (thesis option)

**Year 2-Spring**

760 Readings in European History
or 780 Readings in World History
(both required in comprehensive study option)
797 Master's Paper
or 798 Master's Thesis

## Ph.D. in History

The Ph.D. program is jointly conducted by the History Departments of North Dakota State University (Fargo) and the University of North Dakota (Grand Forks). Students should contact The Graduate School on the campus of their choice for application materials.

For more information on this program, please contact at **NDSU**:

Dr. Jim Norris
(701) 234-9120
jim.norris@ndsu.edu

at **UND**:

Dr. Gordon Iseminger, Professor and Graduate Director
(701) 777-2688
gordon_iseminger@und.nodak.edu

## Admissions Requirements

1. Preference for admission into the Ph.D. program with full graduate standing will be given to applicants who have a GPA of at least 3.5 in history courses in an earned bachelor's or master's degree.
2. Applicants shall submit a statement of intent clearly outlining their research interests, potential major adviser, career goals, and purpose for seeking a Ph.D. in History.
3. Applicants will submit a substantial paper submitted for a class in History to provide evidence of ability to research thoroughly, to interpret and analyze primary and secondary sources, to synthesize information, to organize thoughts logically, and to communicate clearly and effectively.
4. Preference for admission into the Ph.D. program with full graduate standing will be given to applicants who score a combined total of 1,000 points on the verbal and analytical sections of the GRE aptitude test.
5. The program requires a student for whom English is not a native language to have a minimum TOEFL score of 600.

## Degree Requirements

1. Students must satisfactorily complete 90 credits beyond the bachelor's degree. Students entering with an M.A. degree must complete at least 60 additional semester graduate credits. Core course requirements must be met, which include Methods of Historical Research, Historiography, Seminar in the Teaching of History, at least 2 research seminars, and at least 2 readings courses. Students must complete 36 credits with at least 27 credits in History. Students will earn at least 12 credits in one major field. Students must have at least nine hours each in two minor fields; one minor field must be in History.
2. Students must have a proficiency in two languages other than their native language, or one foreign language and one special research skill such as statistics or computer science.
3. The program will require at least one academic year in residence at either campus. Students will register at one of the universities that will be the student's academic "home". The student's adviser must be employed at the home university. At least one member of the student's committee must be employed at the other (not home) university. Students will have to take courses at both universities.
4. Students will write three comprehensive examinations in their major and minor fields. The exams will be read and graded by the supervisory committee. Students will complete an oral examination based on the written exams. The oral examination is to be conducted by the supervisory committee.
5. Students will write a dissertation (up to 24 credits) on an approved topic in consultation

with the faculty adviser and the supervisory committee of five faculty. The dissertation must be based on extensive research in primary and secondary sources, must argue an original thesis, and must be defended before the supervisory committee.

6. The committee will be composed of the faculty adviser who represents the student's field of study and will direct the research and writing of the dissertation. A second member of the committee (second reader) also represents the student's major field of study. A third member of the committee will represent the student's first minor field of study. The fourth member of the committee represents either the student's major field or second minor field. At least one of the four History faculty must be from the cooperating (non-home) university. The Graduate School will appoint the fifth member of the committee.

## Major Fields

Students will be required to write three comprehensive exams in their major and minor (or outside) fields. The exams will be read and graded by the student's supervisory committee. Students will complete an oral examination based on the written exams. The oral examination is to be conducted by the supervisory committee.

### Major Fields:

Great Plains History
Rural History
North American History
Western European History

### Minor Fields:

Public History
World History

## Residency Requirements

Students enrolled in the Ph.D. program are required to complete at least one academic year (18 credits minimum) in residence at one campus.

Resident students may qualify for teaching assistantships. Students who have completed an M. A. degree may be assigned full responsibility for undergraduate courses or may be assigned to assist a faculty member in teaching courses.
Students will be required to take some courses from faculty at both campuses but will register at only one university. Some courses will be offered by interactive video network; some will be offered through Internet online systems; some courses will require students to travel to the other campus. Students not residing on one of the cooperating campuses will have to have access to a satisfactory research library for various courses and for dissertation research.

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# Courses Offered

**601 Archival Theory and Practice 3**
Archival theory and its practical application in supervised projects utilizing the resources of the Institute for Regional Studies and University Archives.

**604 Historical Editing 3**
This course enables students to experience historical editing. They will research historical topics; edit manuscripts focusing on thesis statements, grammar, and footnoting; and annotate primary sources to make them accessible to the general reader.

**610 U.S. Intellectual History I 3**
American intellectual trends in areas such as religion, education, racism, science, and feminism; social and political thought; 1600-1860. Prereq: Hist 103, 104.

**611 U.S. Intellectual History II 3**
American intellectual trends in areas such as religion, education, racism, science, and feminism; social and political thought; 1860-present. Prereq: Hist 103, 104.

**622 U.S. History 1829-1917 I 3**
Political, social, and economic history of the United States 1829-1877; emphasizing socioeconomic change, the sectional crisis, the Civil War, and Reconstruction.

**623 U.S. History 1829-1917 II 3**
Political, social, and economic history of the United States 1877-1917; emphasizing industrialization, urbanization, and progressive reform.

**624 U.S. History 1917-Present I 3**
Political, social, and economic history of the United States 1917-1960; emphasizing the New Deal, the world wars, and the Cold War era.

**625 U.S. History 1917-Present II 3**
Political, social, diplomatic, and economic history of the United States since 1960; emphasizing foreign policy, domestic developments, and socioeconomic change.

**631 The North American Plains 3**
Historical treatment of the Great Plains of North America as an international region comprising the Canadian prairies and the American plains.

**634 History and Politics of Environmental Science 3**
Designed to acquaint students with seminal thinkers and events that have influenced the history of environmental science, politics, and policy, primarily in the United States, since the late 19th century.

**636 American Frontier to 1850 3**
Key aspects of the early American frontier from the 1500s to mid-1800s, emphasizing Indian-White relations, colonial wars, social life in the backcountry, and exploration and settlement.

**637 American West Since 1850 3**
The time period centers on a century of enormous change in the trans-Mississippi west. Major topics include the Plains Indian wars, post-conquest Indian history, mining, cattle, homesteading frontier, the urban west, and environmental history.

**639 History of American Agriculture 3**
American agriculture from its Native American and European roots to the present.

**640 European Intellectual History I 3**
Important changes in ideas about science, religion, ethics, political thought, and the arts; Medieval world view, Renaissance, Reformation, Scientific Revolution, the Enlightenment, Romanticism. Prereq: Hist 101, 102.

**650 Ancient History 3**
Cultural, political, economic, and social history of the ancient Near East, Greece, and Rome.

**651 Medieval History 3**
Cultural, political, economic, and social history of the Middle Ages.

**654 Renaissance and Reformation 3**
Political, social, and economic history of continental Europe from 1400 to 1650 with a focus on Renaissance and Reformation.

**655 The Eighteenth Century 3**
Political, social, and economic history of continental Europe from 1650 to 1815 with a

focus on Enlightenment and French Revolution.

**656 Europe 1815-1914 3**
Political, social, and economic history of Europe from the defeat of Napoleon to the outbreak of World War I.

**657 Europe Since 1914 3**
Political, social, and economic history of Europe, including World War I, the Russian Revolution, Nazism, World War II, and the postwar era.

**660 History of England I 3**
England from ancient times to the Hanoverian Succession (1714), emphasis on the Middle Ages and the Tudor-Stuart period.

**661 History of England II 3**
England from 1714 to the present; emphasis on the Georgian Era industrialization, liberalism, social reform, and the impact of World War I and World War II.

**666 History of Russia I 3**
Cultural, diplomatic, intellectual, and political history of Russia; evolution of the Russian state, expansion of imperial Russia, Great Reforms, populism, and socialism.

**667 History of Russia II 3**
Cultural, diplomatic, intellectual, and political history of Russia and the Soviet Union; agriculture, industry, Marxism in Russia, revolution of 1905 and 1917, and the Soviet Union from Lenin to present.

**670 Modern Latin America I 3**
Examines the social, economic, political, and cultural developments in Latin American history. Begins with the wars of independence (circa 1800) and concludes with the emergence of modern states at the close of the 19th century.

**671 Modern Latin America II 3**
Study of important social, economic, political, and cultural developments in Latin America from the late 19th century through the modern epoch.

**673 Mexico I 3**
Study of the important social, economic, political, and cultural developments in Mexican history from the pre-Columbian epoch through the wars for independence, ending in 1821.

**674 Mexico II 3**
Study of the important social, economic, political, and cultural developments in Mexican history from independence in 1821 through the contemporary era.

**676 Southwestern Borderlands to 1848 3**
Study of the important social, economic, political, and cultural developments of the American southwest from the pre-Columbian epoch through Spanish and Mexican ownership to U.S. acquisition in 1848.

**680 Recent East Asia I 3**
Political and diplomatic history of China, Japan, Korea, and Vietnam; interactions between East Asian countries and Western powers; World War I and aftermath in East Asia.

**681 Recent East Asia II 3**
Political and diplomatic history of China, Japan, Korea, and Vietnam; World War II in the Pacific; Communism in China, Korea, and Vietnam; and the industrialization of Japan and Korea.

**701 Methods of Historical Research 3**
Techniques and frameworks of historical research, introduction to types of evidence, and evaluation of sources. Taken during the student's first semester in the program.

**702 Historiography 3**
An introduction to the history of historical thought, from the classical Greeks to the present, with examination of some of the works of important historians writing in the western tradition.

**705 Directed Research 1**
Directed research on student's thesis prospectus. Taken close to end of the student's course work. Prereq: HIST 701, HIST 730, HIST 760 & HIST 780.

**706 Seminar in the Teaching of History 3**
Includes methods appropriate to college-level teaching. Class consists of discussion, demonstration, and practice. S/U grading only.

**710 Research Seminar in North American History 3**
Required for all graduate students who do not take History 712 or 714.This course requires preparation of a research paper. The subject of the research will be within an announced general topic area of North American History. May be repeated. Prereq. or Coreq. Hist 701 or 702.

**712 Research Seminar in European History 3**
Required for all graduate students who do not take History 710 or 714. This course requires preparation of a research paper. The subject of the research will be within an announced general topic area of European History. May be repeated. Prereq. or Coreq. Hist 701 or 702.

**714 Research Seminar in World History 3**
Required for all graduate students who do not take History 710 or 712.This course requires preparation of a research paper. The subject of the research will be within an announced general topic area of World History. May be repeated. Prereq. or Coreq. Hist 701 or 702.

**730 Readings in North American History 3**
Historiographical survey of a selected topic in U.S. history. Topics vary by semester. May be repeated. Prereq or Coreq: Hist 701.

**760 Readings in European History 3**
Historiographical survey of a selected topic in European history. Topics vary by semester.
May be repeated. Prereq or Coreq: Hist 701.

**780 Readings in World History 3**
Historiographical survey of a selected topic in world history. Topics vary by semester. May be repeated. Prereq or Coreq: Hist 701.

The following variable credit courses are also offered:

**790 Seminar 1-3**

**793 Individual Study 1-5**

**795 Field Experience 1-15**

**696/796 Special Topics 1-3**

**797 Master's Paper 1-3**

**798 Master's Thesis 1-10**

## Graduate Faculty

701-231-8211

Faculty members participating in the doctoral program are from the following units:

**Apparel & Design, Facility and Hospitality Management, and Interior Design;**

**Child Development and Family Science;**

**Education;**

**Health, Nutrition, and Exercise Science.**

# Human Development and Education

## Program Description

The College of Human Development and Education offers a doctoral degree program in Human Development. The purpose of the program is to train doctoral students in three areas of human development: Applied Gerontology, Wellness, and Counselor Education.

The program is intended to produce professionals with strong skills inresearch, teaching, and service. These professionals will have a strong interdisciplinary understanding of human development and the needs of a changing society.

With the Applied Gerontology track, graduates can work directly with older persons in such areas as health promotion programs, intergenerational activities for older persons, senior centers, or retirement communities. Gerontologists can also work in education and research, including conducting research on the aging process and social and developmental aspects of aging; teaching students, professionals, and older adults and their families about aging; aging policy development; and program planning and administration.

The purpose of the Wellness track is to prepare researchers/scholars, leaders, and teachers in the health and wellness promotion area. The continued growth of exercise and wellness in a variety of settings, including corporate, educational, governmental, medical, and private programs, has created a demand for scholars in this area.

The Counselor Education track prepares researchers/scholars, leaders, and teachers in the counselor education field. The focus of the program is on training students for university faculty positions.

## Admissions Requirements

1. Students could enter with an approved master's degree or with a bachelor's degree. The candidate's master's degree should include a research thesis. A student without a completed thesis could be accepted if the faculty determined that he/she had appropriate research skills or could recommend an appropriate research experience. In addition, a student may be required to complete prerequisite courses.
2. Candidates must have adequate preparation in an appropriate field of study for the chosen track and show potential to undertake advanced study and research as evidenced by academic performance and experience.
3. At the baccalaureate level, students must have earned a cumulative grade point average of at least 3.0 or equivalent. Students with a previous graduate degree with a GPA of 3.0 or equivalent may be admitted in full standing.
4. The Graduate Record Exam is recommended.

The following materials should be received by The Graduate School no later than February 1 to be considered for the next fall semester admission. Applications received after this date will be considered on a space available basis:

Official transcripts, having appropriate seal or stamp, of all previous undergraduate and graduate records.

Forms: Application for Admission to Graduate School and Application for the doctoral program in Human Development.

Three letters of recommendation. Personal reference report forms are available from the NDSU Graduate School.

## Financial Assistance

The student must be accepted in full or conditional status before he/she is eligible for a teaching or research assistantship in the College of Human Development and Education. To be considered for an assistantship, the student must submit a letter to the college indicating interest and special skills/experiences that would qualify him/her for an assistantship.

## Degree Requirements

## Doctor of Philosophy in Human Development:

## I. Human Development Core (34 credit minimum)

| Courses | Credits |
|---|---|
| HDE 720 Interdisciplinary Approaches to Human Development | 3 |
| HDE 790 Doctoral Seminar Orientation | 1 |
| Two Additional Seminar Credits | 2 |
| | |
| Research Courses | |
| Three additional credits in research methods (beyond the equivalent of CDFS 702/EDUC 703) | 3 |
| Three additional credits in statistics (beyond the equivalent of STAT 725) are required as approved by the students' committee. | 3 |
| 794 Teaching Internship | 3 |
| 799 Doctoral Dissertation | 10 |

*(794 and 799 credits are available from each department)*

***The following courses are required prerequisites to the Doctoral program in Human Development. Students who have not had these courses or equivalents as part of a masters program are required to complete them as part of this core. Students who have completed any of the courses below will take an additional equivalent number of elective credits to complete the total number of program credits required.***

### Developmental Foundation Course

| | |
|---|---|
| CDFS 782 Advanced Human Development: Birth Through Childhood | 3 |
| CDFS 784 Advanced Human Development: Adolescence Through Adulthood | 3 |
| CNED 712 Dynamics of Self; OR EQUIVALENT | 3 |

Research Methods and Statistics

| | |
|---|---|
| CDFS 703 Research Methods in Child Development and Family Science | 3 |
| EDUC 703 Research, Measurement and Program Evaluation | 3 |
| OR EQUIVALENT AND | |
| STAT 725 Applied Statistics | 3 |
| OR EQUIVALENT | |
| **TOTAL CORE** | **34 Credits Minimum** |

# Track I: Applied Gerontology

## Gerontology Foundation Courses (15 cr.)

| | |
|---|---|
| CDFS 760 Aging Policy | 3 |
| CDFS 761 Applied Gerontology Programs | 3 |
| ATID 696 Aging and the Environment | 3 |
| HPER 719 Wellness and Leisure in Adulthood | 3 |
| CDFS 722 Applied Research in Gerontology | 3 |

## Elective Courses (15 credits minimum)

Students must take a minimum of 9 credits of didactic courses. It is also recommended that students take some credits of CDFS or HNES 793 Individual Study: Research in Gerontology or 794 Practicum. Students should confer with their advisor regarding elective course selection.

Didactic Courses with a Gerontology focus include the following:

| | |
|---|---|
| CDFS 660 Adult Development and Aging | 3 |
| CDFS 682 Family Dynamics of Aging | 3 |
| CDFS 678 Financial and Consumer Issues of Aging | 3 |
| CNED 737 The Helping Relationship and the Elderly | 3 |
| SOC 641 Sociology of Death | 3 |
| SOC 640 Sociology of Aging | 3 |
| CDFS 681Women and Aging | 3 |
| HNES 652 Nutrition, Health and Aging | 3 |

**NOTE:** Doctoral students must have a minimum of 15 didactic credits at the 700 level.

**Total Credits required = 64 minimum following the master's degree; 94 minimum following the bachelor's degree.**

# Track II: Wellness

## Wellness Foundation Courses (12 credits)

| | |
|---|---|
| HNES 793 IS/Research in Wellness (may take 1 credit at a time) | 1-3 |
| HNES 725 Nutrition in Wellness | 3 |
| HNES 727 Physical Activity in Wellness | 3 |

| | |
|---|---|
| CDFS 782 or CDFS 784 | 3 |
| *(One course will meet the HDE Core requirement and the other course will meet the Wellness Track Foundation Course Requirement)* | |
| **Total** | **12** |

### Wellness Elective Courses (18 credits minimum)

Elective courses as determined by the student's committee. Twelve of the 18 credits must be didactic courses.

**Total 18**

**Total Credits 64**

**NOTE:** Doctoral students must have a minimum of 15 didactic credits at the 700 level.

**Total credits required = 64 minimum following the master's degree and 94 credits minimum following the bachelor's degree.**

## Track III: Counselor Education

Candidates for the Counselor Education track are required to have earned an approved Masters degree which would include the following prerequisite courses, or courses with documented content expected in these prerequisite areas. Candidates entering with a Bachelors degree or with Masters degrees not including these prerequisite areas would need to take courses in the deficient areas (in addition to the required credits necessary for the Doctoral degree).

Examples of "prerequisite" courses using NDSU Counselor Education courses:

CNED 755 Career Counseling and Testing

CNED 757 Professional Orientation and Ethics

CNED 758 Social and Cultural Foundations in Counseling

CNED 760 Counseling Techniques

CNED 761 Counseling Theory

CNED 762 Group Counseling

CNED 765 Advanced Group Counseling

CNED 766 Dynamics of Self (Human Growth and Development)

CNED 794A Practicum

CNED 794B Internship

### Counselor Education Foundation Courses (34 credits)

| | |
|---|---|
| CNED 763 Advanced Testing and Appraisal | 3 |
| CNED 767 Advanced Group Counseling | 3 |
| CNED 769 Theory and Practice for Counselor Education | 3 |
| CNED 770 Counselor Supervision | 3 |
| CNED 771 Counselor Education and Supervision in a Multicultural Society | 3 |
| CNED 772 Advanced Counseling Theories | 3 |
| CNED 776 Qualitative Research and Program Evaluation | 3 |
| CNED 779 Quantitative and Survey Research | 3 |
| CNED 780 Ethical and Legal Issues in Counselor Education | 3 |

| | |
|---|---|
| CNED 787 Professional Issues: Professional Development, Consultation, and Publishing | 3 |
| CNED 790 Doctoral Seminar | 4 |
| **Total** | **34** |

**Total credits required: 71 minimum following the master's degree; 101 minimum following the bachelor's degree.**

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## Courses Offered

**ADFH 696 Aging and the Environment 3**

Lecture-discussion course on the analysis of the built environment and how it impacts the aging population.
Note: Other courses in the Human Development doctoral program are listed under the Department of Child Development and Family Science; Department of Health, Nutrition, and Exercise Science; and School of Education.

**HDE 720 Interdisciplinary Approaches to Human Development 3**

An interdisciplinary approach to issues in development across the lifespan. The course will provide an overview of wellness, counseling, and aging approaches to human development issues.



E-Mail: The Graduate School
Prospective students may schedule a visit by calling 1-800-488-NDSU.
The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701-231-7287

**Canan Bilen Green, Ph.D.**
Statistics, University of Wyoming, 1998
Research Interests:
Quality and Reliability Engineering, Productivity Analysis, Design and Auditing of Quality and Productivity Monitoring Systems, Statistical Modeling and Applications in Industry, Statistical quality control applied to manufacturing, Material strength characterization, Inventory management, and Healthcare

**John R. Cook, Ph.D.**
Human Factors Engineering, Purdue University , 1991
Research Interests:
Human Factors Engineering, Ergonomics, Person-System Optimization, Healthcare Management Engineering, Cognitive and physical ergonomics job design, Human-centered product design and job satisfaction research methods, Analysis of human factors issues associated with space-based manufacturing, Framework for automation of surveillance of complex systems

**Kambiz Farahmand, Ph.D., P.E.**
Industrial Engineering, University of Texas, 1992
Research Interests:
Manufacturing Systems, Nano technology implementation in manufacturing, Simulation & Modeling, Ergonomics Design, Lean Manufacturing, ISO Quality Management System, EMS 14001, Productivity Analysis & Waste Management, Respiratory & Life Support System

**Reza A. Maleki, Ph.D., P.E., C.**

# Industrial and Manufacturing Engineering


## Program Description

The Department of Industrial and Manufacturing Engineering offers graduate studies at both the Master of Science and Doctor of Philosophy levels. A Master of Science degree may be earned in either Industrial Engineering and Management (IE&M) or Manufacturing Engineering (MfgE). The Master of Science degree can be completed through a thesis option or project option. The project option is available only to candidates who have been professionally employed in industrial engineering, manufacturing engineering or a related field and are working in their field at the time of application for admission to graduate study. The IE&M master's programs is designed to equip students with the ability to analyze, design, and manage industrial and business systems as well as to enable students to develop scholarly abilities to further pursue a Ph.D. degree in industrial and manufacturing engineering. Students have an opportunity to conduct research in the development of theoretical concepts and industrial systems.

For more information about our department and programs please visit our department site at http://www.ndsu.edu/ndsu/ime/ .

## Admissions Requirements

Graduate study in the Industrial and Manufacturing Engineering Department is open to all qualified baccalaureate graduates from universities and colleges of recognized standing.

To be admitted for M.S. or Ph.D. studies with full standing, the applicant must:

1. Have earned a baccalaureate degree from an educational institution of recognized standing;
2. Have obtained adequate preparation in industrial engineering, manufacturing engineering, or a closely related field
3. Have demonstrated a potential to undertake advanced study and research, through such evidence as prior academic performance and/or professional experience and/or recognized academic examination;
4. Have earned, at the baccalaureate level, a cumulative grade point average [GPA] in all courses of at least 3.0 or equivalent. Students who have earned a graduate degree with a GPA of 3.0 or equivalent may be admitted in full standing.
5. For students applying from countries where English is not the official language, achieve

**Mfg.E.**
Engineering, North Dakota State University , 1989
Research Interests: Plant-wide Assessment, Manufacturing and Productivity Improvements, Rapid Product Development and Realization, Production Systems Design, Supply- Chain management, Product analysis for manufacturability

**Valery R. Marinov, Ph.D.**
Manufacturing Engineering, Technical University of Sofia, 1992
Research Interests: Process Modeling for Machining, Theory of Metal Cutting, Tribological Coatings, Including Nanocomposite Coatings and Deposition Methods, Design for Composites Manufacturing Processes, Packaging for low-cost disposable microelectronics, Direct-write material deposition methods, Laser processing

**Jing Shi, Ph.D.,**
Industrial Engineering, Purdue University , 2004
Research Interests: Microelectronics Packaging, Direct Write Material Depositing, Laser Processing for Electronics, RFID Applications, Numerical Modeling of Manufacturing Processes, Computer Integrated Manufacturing

**David L. Wells, Ph.D., C.Mfg.E.**
Engineering Management, University of Missouri-Rolla, 1996
Research Interests: Assembly of Micro and Nano Components, Printed Electronics, Process Engineering for Electronics Manufacturing, Advanced Manufacturing Processes, Product Realization, Application of RFID Technology, Quantitative Manufacturing Management, Advanced Manufacturing in Economic Development

**Om Prakash Yadav, Ph.D.**
Industrial Engineering, Wayne State University , 2002

a score of 550 (paper test) or 213 (computer test) or 79 (internet test) on the Test of English as a Foreign Language [TOEFL] and 4.0 on the Test of Written English [TWE].

6. A Graduate Record Examinations (GRE) general test score of 1100 (Verbal + Quantitative) and Analytical Writing score of 4.0 or better for masters degrees and 1200 or better (Verbal + Quantitative) and Analytical Writing score of 4.5 or better for doctoral degree is required of all students admitted.

7. Three letters of recommendation are generally required before action is taken on any application. Personal reference report forms are available from the Graduate School .

(For more detailed information, please refer to the Graduate Policy Handbook available online.)

Applications should be submitted directly to the Graduate School before April 1 of the upcoming academic year. However, applications will be considered at any time they are submitted.

Official transcripts of all previous undergraduate and graduate records must be received by the Graduate School before the application is complete. When a transcript is submitted in advance of completion of undergraduate or graduate studies, an updated transcript showing all course credits and grades must be provided prior to initial registration at North Dakota State University .

## Degree Requirements

The Master of Science degree in *Industrial Engineering and Management* or *Manufacturing Engineering* requires 30 credits of graduate-level study. For the thesis option, the research and preparation of the thesis may account for a minimum of 6 credits or a maximum of 10 credits. Didactic course work must account for at least 21 credits while research and preparation of the project may account for a minimum of 2 credits or a maximum of 4 credits.

The Doctor of Philosophy degree requires 60 credits beyond the M.S. requirement. Didactic coursework must account for at least 27 credits, and of these, 15 credits must be earned in 700-level courses. It is customary for the remainder of the didactic credit requirement to be dedicated directly to the dissertation, either through course preparation, focused research or writing.

For either the M.S. or Ph.D., all courses taken outside of the IME Department must be approved in advance by the student's academic adviser. The total course of study must be approved by the student's academic adviser, thesis committee and department chair. Students completing graduate degrees within the IME Department responsibility are expected to exhibit demonstrable expertise in the core competencies of either industrial engineering or manufacturing engineering. Students whose undergraduate major is in another field may be required to include some or all of the core competencies in their graduate coursework. For further information in this regard, please consult the IME Department.

All graduate students are required to register for Research Seminar [IME 790] for each semester in residence. This is a one-credit experience for the academic year, but does not count towards the total degree credit requirement. Each new student must complete a preliminary thesis or project proposal within six months of beginning graduate studies, and it is recommended that this be completed during the first semester in residence. The proposal, if approved by the IME Graduate Studies Committee, will provide the direction for the remainder of the student's degree work. At the same time, the student will choose a thesis or project adviser from the IME Department faculty. By the end of the first year in residency, the student must have selected a supervisory committee. This committee will be chaired by the faculty advisor and will provide direction, advice and examination of the student's work and achievement. For additional information, please refer to the Graduate Bulletin.

Research Interests: Quality and Reliability Engineering; Robust Product/ Process Design, Concurrent Engineering, TQM, Lean Manufacturing, Six Sigma Methodologies, Production & Operations Management, Optimization Techniques, Supply-Chain Management, Fuzzy Logic And Neural Networks, Quantitative Analysis of Operations Management

## Financial Assistance

Various types of financial assistance are available to graduate students, such as (but not limited to) student loans, scholarships, graduate assistantships, graduate tuition waivers, and part-time employment opportunities both on and off campus.

A number of well-qualified graduate students, upon recommendation from the department concerned, are employed either as teaching or research assistants by most academic departments of the university. There are a limited number of teaching assistantships in Industrial and Manufacturing Engineering available, which are normally assigned as support for classes with large enrollments and/or heavy laboratory content. Research assistantships are more common than teaching assistantships, and are offered when student capabilities and background experience match the needs of the project. While teaching assistantships are funded through the University, research assistantships are generally funded through externally-funded grants and contracts. In both cases, assistantships are considered as employment, and the graduate student should view these appointments as a job. The student's thesis or dissertation may or may not be in the area of their job duties for the assistantship.

Full assistantships are for half-time employment (20 hours per week). Tuition for all graduate credits, resident or nonresident, are waived for individuals officially appointed as research or teaching assistants. Student activity fees are not waived. Many assistantships are structured for less than that amount of work commitment. When a student is offered an appointment as a Graduate Research Assistant, the faculty and the department will carry the expectation that the student has made a full commitment to fulfill both the degree requirements and the job responsibilities.

For more information about the IME graduate program, please visit http://www.ndsu.edu/gradschool/depts/industrialmaneng.shtml

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# Courses Offered

**611 Human Factors Engineering 2**
Study and application of human factors engineering fundamentals. Emphasis on human-system integration and optimization covering both physical and cognitive ergonomics. Human physical and cognitive characteristics, research methods, interface design, task analysis, usability. Prereq: IME 311, 460. Offered fall, even years.

**627 Electronics Manufacturing 3**
Process and production engineering for manufacture of electronic components; specialty materials, process parameters, production system design factors, production performance metrics. Introduction to concurrent engineering applied to development of electronic products. Open to all engineering majors. Offered fall, odd years.

**630 Process Engineering 3**
Comprehensive analysis of selected manufacturing processes; development of process flow maps and models of process dynamics, application of IDEF and cascade process modeling, evaluation of processing alternatives. Design of effective and efficient processes for selected industrial products. Seminar/case study format. Prereq: IME 330. Offered fall.

**631 Production Engineering 3**
In-depth analysis of production systems for selected manufactured products; development of production system flow maps and linked process dynamic models, evaluation of take time, and identification of constraints. Design of alternative solutions for production constraints. Seminar/case study format. Prereq: IME 330; IME 430/630 desirable. Offered spring.

**635 Plastics and Injection Molding Manufacturing 3**
Materials properties. Manufacturing processes and apparatus for production of plastic parts. Comparative analysis with competitive materials and production methods. Prereq: IME 330. Offered spring, odd years.

**640 Engineering Economics 3**
Capital investment decision-making within the rules of general and project accounting. Benefit-cost analysis for engineering installations, operations, life cycle, and buy-rent-lease decisions. Offered fall, spring, and summer.

**650 Systems Engineering and Management 3**
Integration of technical disciplines through the stages of systems life cycle: needs and requirements determination, operating and support concepts, design and prototyping, test and evaluation, facilitation, manuals and documentation, training, supportability. Offered fall.

**651 Logistics Engineering and Management 2**
Integrated view of logistics: systems, methods, production, inventory management, facilities. Emphasis on reliability, maintainability, tools, test equipment, spares, operating and maintenance instructions, training. Prereq or Coreq: IME 450 or 650. Offered fall, odd years.

**652 Integrated Industrial Information Systems 3**
Integration of technical, business, and operational information for status, progress and decision-making in product development, manufacturing, and logistical support. Prereq: IME 450 or 650. Offered spring.

**653 Hospital Management Engineering 3**
Survey of management engineering roles in the delivery of healthcare. Review of functional relationships present in healthcare delivery systems. Application of industrial engineering tools to solve healthcare delivery problems focused on cost reduction, process redesign, facility design, quality improvement, and systems integration. Prereq: departmental approval; students should have taken core industrial engineering courses. Offered spring, even years.

**655 Management of People Systems 2**
Study of traditional management functions (planning, organizing, influencing, and controlling) in the context of engineering and management system interactions. Emphasis on communication skills, teaming, job design, leadership, facilitation, and improving employee productivity. Offered fall.

**656 Program and Project Management 3**
Multidisciplinary teams identify, define, solve, and document substantive problems for industrial clients. Integrates technical, business and operational specialties. Matrix management. Project format. Prereq: departmental approval. Offered spring.

**660 Evaluation of Engineering Data 3**
Design of engineering experiments and evaluations. Curve fitting, regression, analysis of variance, hypothesis testing, Taguchi methods. Prereq: Math 166. Offered fall and spring.

**661 Quality Assurance and Control 3**
Proactive and reactive quality assurance and control techniques. Emphasis on quality planning, statistical process control, acceptance sampling. Prereq: IME 460 or 660. Offered spring.

**662 Total Quality in Industrial Management 3**
Analysis and achievement of total quality in all dimensions of industrial activities and organizations. Continuous improvement strategies, applications of statistically based methods, leadership, training, and performance measures. Prereq or Coreq: IME 455 or 655. Offered fall, even years.

**663 Reliability Engineering 3**
Study and application of statistical models and methods for defining, measuring, and evaluating the reliability of products, processes, and services: life distributions, reliability functions, reliability configurations, reliability estimation, parametric reliability models, accelerated life testing, reliability improvement. Prereq: IME 460 or 660. Offered spring, odd years.

**670 Operations Research I 3**
Analysis and optimization in industrial operations. Linear programming, transportation models, networks, integer programming, goal programming, dynamic programming, nonlinear programming. Prereq: Math 229, Math 265. Offered spring.

**671 Operations Research II 3**
Probabilistic operations research. Queuing theory, decision analysis, Markov processes. Prereq: IME 460 or 660, 470 or 670. Offered by demand.

**672 Simulation of Business and Industrial Systems 3**
Fundamentals and techniques of simulating business and industrial systems. Applications of modern software. Monte Carlo methods. Prereq: IME 460 or 660, high-level computer language. Offered spring.

**680 Production and Inventory Control 3**
Planning and controlling industrial production and inventories. Demand forecasting, master scheduling, materials requirements planning, job scheduling, line balancing, just-in-time production. Prereq: IME 460 or 660, 470 or 670. Offered fall.

**682 Automated Manufacturing Systems 3**
Design of integrated production systems, with flexible, programmed automatic controls for fabrication, assembly, packaging, movement, and storage of goods. Numerical control, flexible manufacturing, integrated manufacturing concepts. Prereq: IME 311, 330; ECE 303. Offered fall.

**685 Industrial and Manufacturing Facility Design 3**
Integration of analysis and design tools to convert product design into production plans and plants. Prereq: departmental approval. Offered spring.

**711 Advanced Human Factors Engineering 3**
Research-based study of current human factors engineering problems. Students will review current human factors topics, design and conduct research studies, and produce technical papers reporting results. Prereq: IME 411 or 611, 460 or 660. Offered fall, odd years.

**720 Surface Engineering 3**
Structure and properties of engineering surfaces. Tribology: surface contacts, friction, wear. Surface treatment. Solid, liquid and vapor phase deposition processes for tribological coatings. Emerging processes: nano- and diamond-based coatings. Evaluation and characterization of tribological coatings. Offered fall, odd years.

**740 Advanced Engineering Economics 3**
Development and analysis of models for replacement analysis, capital budgeting, income tax effects on equipment selection, and manufacturing costing. Probabilistic and algorithmic models. Prereq: IME 440 or 640. Offered fall, odd years.

**761 Quality Engineering 3**
Study and application of advanced statistical tools and techniques for defining, monitoring, and improving the quality of products, processes, and services: statistical control charts, process capability analysis, acceptance sampling of variables and attributes, application of design-of-experiments for product and process optimization, response surface methodology, Taguchi methods. Prereq: IME 461 or 661. Offered fall, odd years.

**770 Advanced Operations Research Topics 3**
Theory and applications of linear programming, network flows, and nonlinear

programming. Prereq: IME 470 or 670. Offered fall, odd years.

**772 Advanced Simulation 3**
Special purpose simulation languages to model, analyze, and design industrial and engineering systems. Deterministic and stochastic models. Prereq: IME 472 or 672. Offered spring, even years.

**774 Neural Networks 3**
See Computer Science 735 for description.

**780 Advanced Production and Inventory Control 3**
Theory and application of production scheduling, inventory management, production planning, just-in-time production , materials requirements planning. Prereq: IME 480 or 680. Offered fall, even years.

**782 Robotics/CAD/CAM/Control Systems 3**
Integration and automation of fabrication and assembly systems, including automated materials handling and intelligent control systems. Prereq: IME 482 or 682. Offered spring, odd years.

**784 Computer Integrated Manufacturing 3**
Continuum integrated manufacturing systems, where computer technology is incorporated into conception, configuration design, process engineering, and fabrication of a good or service. Philosophy and methodologies for systematically building flexible and efficient production systems. Prereq: IME 472 or 672. Offered spring, even years.

**786 Manufacturing Systems Analysis 3**
Comprehensive analysis of complex issues in the technology and management of modern manufacturing systems and enterprises. Technological issues will impinge on product realization, production of goods, and manufacturing equipment and facilities; management issues addressed will be those drawn from the operation of global production enterprises. Seminar format. Prereq: IME 630 or 631. Offered spring.

The following variable courses are also offered:

**790 Research Seminar 1-1**

**692/792 Case Studies 1-3**

**793 Individual Study 1-5**

**794 Practicum/Internship 1-8**

**695/795 Field Experience 1-15**

**696/796 Special Topics 1-5**

**797 Master's Paper 1-4**

**798 Master's Thesis 1-10**

**799 Doctoral Dissertation 1-15**

## Graduate Faculty

701-231-7441

**Cheryl S. DeVuyst, Ph.D.**
University of Illinois, 1999
Research Interests:
Agribusiness

**Eric A. DeVuyst, Ph.D.**
Purdue University, 1993
Research Interests:
Production and Resource Economics, Farm Management, Operations Research

**George K. Flaskerud, Ph.D.**
Oklahoma State University, 1970
Research Interests:
Grain Marketing

**Justin Garosi, Ph.D.**
University of Michigan, 2005
Research Interests:
Public Finance, Taxation Policy

**Robert Hearne, Ph.D.**
University of Minnesota, 1995
Research Interests:
Natural Resource and Environmental Economics

**Robert S. Herren, Ph.D.**
Duke University, 1975
Research Interests:
Economic History, Labor, Money and Banking

**Siew Hoon Lim, Ph.D.**
University of Georgia, 2005
Research Interests:
Production Economics, Transportation, Industrial Organization

**Won W. Koo, Ph.D.**
Iowa State University, 1974
Research Interests:
International Trade, Grain Marketing

# International Agribusiness

## Program Description

Billions of dollars worth of food and farm products are traded each year on international markets. Food companies scour the globe for customers and suppliers. Policy makers actively promote expanded markets for their country's food producers. Global food and agricultural policies command intense debate in world trade forums. International agribusiness is an exciting and rewarding career!

Entering the world of international agribusiness requires not only a solid educational foundation, but one must also be comfortable with a variety of cultures, have international experience, and demonstrate a desire to learn foreign languages.

The International Agribusiness M.S. program offered by the Department of Agribusiness and Applied Economics at North Dakota State University provides both the academic training and the international experience required to excel in an international agribusiness career. Studies at NDSU are complemented by international internships and a required semester of international study at partner universities in Europe, Asia, Latin America, or Australia.

International agribusiness students spend a minimum of two semesters at NDSU and one semester at a partner university. The program of study includes coursework in applied economics, quantitative methods, and international agribusiness strategy, management, finance, and marketing. Following the first year of study at NDSU, students will participate in an international internship with a government agency such as the Foreign Agricultural Service, with an international agribusiness firm, or will conduct field work associated with their research paper.

Students will enroll for their final semester of coursework at one of our partner universities. Partners currently include l'Ecole Supérieure d'Agriculture in France , the Monterrey Institute of Technology in Mexico , and Konkuk University in Korea . We are currently expanding our partners to include universities in China , Australia , and Latin America Brazil . Students complete the program by writing and defending their professional research papers under the supervision of professors from NDSU and partner universities.

## Admissions Requirements

The Department of Agribusiness and Applied Economics graduate program is open to all qualified graduates of universities and colleges of recognized standing. To be admitted with full status to the program, an applicant must

**David K. Lambert, Ph.D.**
Oregon State University, 1985
Research Interests:
Production Economics

**F. Larry Leistritz, Ph.D.**
University of Nebraska, 1970
Research Interests:
Economic Development, Resource Economics

**Gregory McKee, Ph.D.**
University of California, Davis, 2006
Research Interests:
Industrial Organization, Agribusiness, Cooperatives

**Dragan Miljkovic, Ph.D.**
University of Illinois, 1996
Research Interests:
Agricultural Prices, International Trade, Agricultural and Food Marketing and Policy

**William E. Nganje, Ph.D.**
University of Illinois, 1998
Research Interests:
Agribusiness, Food Safety, Finance

**David M. Saxowsky, J.D.**
The Ohio State University, 1979
Research Interests:
Agricultural Law

**Cheryl J. Wachenheim, Ph.D.**
Michigan State University, 1994
Research Interests:
Agribusiness

**William W. Wilson, Ph.D.**
University of Manitoba, 1980
Research Interests:
Commodity Marketing, Agribusiness, Industrial Organization

1. Hold a baccalaureate degree from an educational institution of recognized standing.
2. At the baccalaureate level, have earned a cumulative grade point average (GPA) of at least 3.0 or equivalent.
3. Have completed courses in intermediate microeconomic theory, calculus, and statistics .
4. Show potential to undertake advanced study and research as evidenced by academic performance and experience.

The TOEFL examination is required of international applicants. A minimum score of 550 (paper test) or 213 (computer test) must be achieved.

The Graduate Record exam (GRE) is required of all applicants not receiving their baccalaureate degrees from U.S., Canadian, or partner universities.

Students who do not meet all requirements for admission or have deficiencies in prerequisite course work, but show potential for successful graduate study, may be admitted under a conditional status. Evidence must be provided showing that the applicant's potential is not adequately reflected by his/her record. After meeting the specified standards of performance set by the department, the student, in consultation with the major adviser, may request a change to full graduate standing.

It is desirable that students begin their program in the fall semester, although students may also begin their programs of study in January. Application for admission to graduate school should be as far in advance as possible, preferably by March 1 for international applicants to ensure visa documents will be completed for a fall matriculation.

**Application information is available at the NDSU Graduate School webpage:** http://www.ndsu.edu/gradschool/

## Program of Study

Students pursuing a Master of Science in International Agribusiness must complete all core courses. Students select elective courses (with approval of their adviser and supervisory committee) to fulfill the remaining Graduate School credit requirements. The core requirements assure breadth and competence in key areas of knowledge and professional activity. It is recommended that students participate in an international internship. The following courses, or their equivalent, constitute the core of the Master of Science program:

## Required Courses at NDSU:

**AgEc 710** - Econometrics (3 credits), or

**AgEc 739** - Analytical Methods for Applied Economics (3 credits)

**AgEc 741** - Advanced Microeconomics (3 credits)

**AgEc 744** - Agribusiness I (3 credits)

**AgEc 746** - Agribusiness II (3 credits)

**AgEc 791** - Stochastic Simulation (1 credit)

**AgEc 797 or 798** - Comprehensive Study or Thesis (2-4 credits)

## Approved electives

At least six credits must be taken at an international partner university and are subject to approval by the student's supervisory committee. A minimum of 30 credits is necessary to complete the M.S. in International Agribusiness.

# Courses Offered

**AGEC 644 Crops Marketing 3**
Capstone course for commodity marketing option. Advanced work on topics related to marketing of crops.

**AGEC 646 Agribusiness Finance 3**
Application of financial theory to investment and liability management problems of agribusiness and farm firms.Characteristics, operations, and management of agricultural financial institutions.

**ECON 656 History of Economic Thought 3**
Development of economic thought from the mercantilists to current paradigms underlying micro-and macroeconomics.

**ECON 661 Economic Development 3**
Analysis of the main causes of economic development.

**ECON 665 Labor Economics 3**
Theoretical analysis and survey of empirical studies relating to labor markets, human capital formation, and nature and causes of unemployment.

**ECON 670 Public Finance 3**
Taxation, intergovernmental fiscal relations, and public expenditures; implications of various taxation policies.

**ECON 672 International Trade 3**
Theories of international trade, payments, and foreign exchange markets.

**ECON 676 Monetary Theory and Policy 3**
Analysis of relationships among money, credit, employment, price stability, and national monetary policy.

**ECON 680 Industrial Organization 3**
Structural analysis of American industry in terms of the markets for business enterprise. Analysis of antitrust policy and its application to large corporations.

**ECON 681 Natural Resource Economics 3**
Application of economic tools to evaluate natural resource policies. Concepts such as property rights, non-market goods, resource allocation over time, externalities, open access, and public goods are discussed in an inter mediate micro-economics and calculus-based format.

**AGEC 701 Research Philosophy 1**
Role of the scientist, reasoning, values, and decisions. Problem formulation, literature review, hypothesis development, data collection, analysis, and interpretation.

**AGEC 710 Econometrics 3**
Applications of statistical methods to specification, estimation, and forecasting of linear economic models, including multiple regression models, cross-section data analysis, time-series data analysis, and qualitative dependent variable models.

**AGEC 711 Advanced Topics in Econometrics 1-3**
Advanced econometric methods appropriate to a variety of research areas in economics and agribusiness will be offered. Analytical methods covered will vary by semester.

Repeated enrollment allowed.

**AGEC 739 Analytical Methods for Applied Economics 3**
Study and application of operations research techniques and other decision methods to problems in agriculture, transportation, and resource management.

**AGEC 741 Advanced Microeconomics 3**
Advanced analysis of demand, production, and costs; pricing output; and resource allocation under various market structures.

**AGEC 743 Advanced Macroeconomics 3**
Advanced analysis of macroeconomic theories, economic growth, business fluctuations, and inflation.

**AGEC 744 Agribusiness I: Agricultural Product Marketing and Agribusiness Strategy 3**
Conceptual foundations of agribusiness strategic planning are presented. Emphasis is placed on quantitative strategic decision making for the agribusiness firm.

**AGEC 746 Agribusiness II: Agrifinance and Commodity Trading 3**
Conceptual foundations of agribusiness finance, trading, and strategy are presented. Emphasis is placed on financial instruments and planning for agribusiness firms, and trading and risk management in agricultural commodities.

**AGEC 771 Economics of Transportation Systems 3**
The course will provide an understanding of transportation economics and policy issues facing society. Topics include transportation demand, modal costs, transportation competition and market power, transportation regulation, transportation investment, and the economics of transportation safety.



E-Mail: The Graduate School
Prospective students may schedule a visit by calling 1-800-488-NDSU.
The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

## Affiliated Faculty

**Iskander Akhatov, Ph. D.**
Lomonosov University of Moscow, 1983
Research Interests: Fluid Dynamics, Multiphase Systems, Heat and Mass Transfer

**Stefan Balaz, Ph.D. , D.Sc.**
Slovak Technical University, Bratislava, Slovakia, 1986
Postdoctorals: Institute for Experimental Biology and Medicine, Borstel, Germany, 1988-89; University of Minnesota, Minneapolis, 1996
Research Interests: Subcellular, Pharmacokinetics and Quantitative Structure-Time-Activity Relationships

**Gordon P. Bierwagen, Ph.D.**
Iowa State University, 1968
Research Interests: Surface chemistry of coatings materials, corrosion, electrochemistry of coatings, coating lifetime prediction, concentrated random composites

**Bret Chisholm, Ph.D.**
University of Southern Mississippi, 1993
Research Interests: Combinatorial

# Materials and Nanotechnology

## Program Description

North Dakota State University offers an interdisciplinary program leading to the Ph.D. degree in Materials and Nanotechnology (MNT). The program includes a series of required MNT core courses; additional elective courses; written and oral preliminary examinations; a doctoral dissertation based on independent, original research in the area of materials and nanotechnology; and a final oral examination of the dissertation.

## Admissions Requirements

The Ph.D. program in Nanotechnology and Nanomaterials is open to qualified graduates of universities and colleges of recognized standing. To be admitted with full status the applicant must

1. Hold a baccalaureate or graduate degree from an educational institution of recognized standing. Students with a degree in the disciplines of chemistry, engineering, material science and engineering, physics, polymer science, polymer engineering, or related fields will be considered for admission.

2. At the baccalaureate or graduate level, have earned a cumulative grade point average (GPA) in all courses of at least 3.0 or equivalent. Students with a previous graduate degree with a GPA of 3.0 or equivalent may be admitted in full standing.

3. Submit scores for the general Graduate Record Examination (GRE).

Applications should be submitted directly to The Graduate School. Official transcripts (transcripts having an appropriate seal or stamp) of all previous undergraduate and graduate records must be received by the Graduate School before the application is complete. When a transcript is submitted in advance of completion of undergraduate or graduate studies, an updated transcript showing all course credits and grades must be provided prior to initial registration at North Dakota State University .

Three letters of recommendation are required before action is taken on any application. Personal reference report forms are available from the Graduate School .

## Financial Assistance

Students are routinely supported through research assistantships. Applicants are considered on the basis

chemistry methods for coatings, novel organic-inorganic coatings applications, new polyester nanocomposites

**Stuart G. Croll, Ph.D.**
University of Leeds, UK, 1974
Postdoctoral: National Research Council, Canada
Research Interests: Weathering durability of coatings, physical chemistry and suspension stability, pigment-polymer interactions, film formation processes, coating and polymer physics

**Alan R. Denton, Ph.D.**
Cornell University, 1991
Postdoctoral, University of Guelph, 1991-94; Technical University of Vienna, 1994-95, Research Center Julich, 1996-98
Research Interests: Soft Condensed Matter Theory, Computational Physic

**Daniel L. Ewert, Ph.D.**
University of North Dakota, 1989
Research Interests: Biomedical Engineering

**Thomas P. Freeman, Ph.D.**
Arizona State University, 1968
Research Interests: Plant Structure, Light and Electron Microscopy, Ultrastructure of Chloroplasts

**Victoria Johnston Gelling, Ph.D.**
North Dakota State University, 2001
Research Interests:

of scholarship, potential to undertake advanced study and research, and financial need. All students who submit complete applications by the appropriate deadlines are considered for assistantships. Exceptional students are also eligible for university fellowships that are awarded on a competitive basis.

## Degree Requirements

## Requirements for the Doctoral Degree in Materials and Nanotechnology

By the end of the first academic year, the student will select an academic adviser from among the MNT faculty and arrange for the appointment of a Graduate Advisory Committee. This committee will consist of at least four members of the graduate faculty. This includes the student's major adviser, at least one additional MNT faculty member, and an appointee of The Graduate School.

The plan of study will be prepared by the student, in consultation with the major adviser, by the end of the first year in residence. The plan shall be approved by the student's Graduate Supervisory Committee, the MNT Program Director, and the Graduate School dean. The plan of study must be filed in the Graduate School prior to scheduling the comprehensive written examination.

The Graduate School requires the plan of study for the Ph.D. degree to include not less than 90 semester graduate credits. Of this total, not less than 27 credits must be in courses other than seminar or research credits. Of the 27 course credits, 15 must be at the 700-789 level. The MNT Ph.D. program requires students to complete a series of 7 core courses totaling 17 semester credits. The student will complete additional elective courses to fulfill The Graduate School requirement of 27 semester credits in academic courses. An overall GPA of 3.0 or better must be maintained.

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## Course Offered

1. All students must complete the core curriculum which consists of:
**MNT 732** Electronic Properties of Materials 3 credits
**MNT 729** Materials Characterization 3 credits
**MNT 760** Materials Synthesis and Processing 3 credits
**MNT 730** Fundamentals of Nanotechnology 3 credits
**MNT 756** Molecular Modeling of Materials 3 credits
**MNT 745** Preparing Future Researchers 1 credit
**MNT 790** Graduate Seminar 1 credit

2. Students must complete at least an additional 12 credits of graduate level coursework. The courses should be chosen by the students in consultation and with the approval of the student's committee. Suggested courses include the following

## Suggested Courses in the Microelectronics Focus

**ABEN 682** Instrumentation and Measurements 3 credits
**CPM 796** Supramolecular Chemistry 2 credits
**CHEM 766** Quantum Chemistry I 3 credits
**CHEM 767** Quantum Chemistry II 3credits
**ENGR780** Electromagnetic Theory 3 credits
**ECE 751** Electromagnetic Theory and Applications 3 credits
**IME 635** Plastics and Injection Molding Manufacturing 3 credits
**IME 627** Electronics Manufacturing 3 credits
**IME 720** Surface Engineering 3 credits
**MN 735** Optoelectronic Materials Processing 3 credits
**PHYS 771** Quantum Physics 3 credits

Corrosion control of active metal substrates by environmentally friendly coating, electroactive conducting polymers (ECPs) as corrosion inhibitors, electrochemical experimental techniques for the examination of coated substrates

**Chung-Souk Han , Ph. D.**
University of Hannover , Germany , 1999
Research Interests: Computational mechanics and simulation techniques, Crystal plasticity and composite materials, Micromechanical characterization/ modeling at the micron and nanometer scale, Mechanics of polymers, Macroscopic modeling of anisotropic materials

**Thomas Ihle, Ph.D.**
Aachen, 1996.
Research Interests: Theory and Simulation of Complex Fluids (Colloids and Biopolymers).

**Alan R. Kallmeyer, Ph. D.**
University of Iowa, 1995
Research Interests: Theoretical, Computational, and Experimental Solid Mechanics, Fatigue and Fracture of Engineering Materials, Composite Materials

**Ghodrat Karami, Ph. D.**
Imperial College of Science and Technology, University

## Suggested Courses in the Biomaterials Focus

**ABEN 758** Applied Computer Imaging and Sensing Techniques for Biosystems 3 credits
**BIOC 716** Biochemistry of Proteins and Enzymes 4 credits
**BIOC 673** Methods of Biochemical Research 3 credits
**CE 725** Introduction to Biomaterials: Materials in Biomedical Engineering 3 credits
**CPM 771** Methods of Polymer Characterization 3 credits
**CHEM 685** Industrial Biotechnology 2 credits
**CHEM 665** Principles of Physical Chemistry and Biophysics 3 credits
**ECE 685** Biomedical Engineering 3 credits
**ECE 687** Cardiovascular Engineering 3 credits
**MN 786** Tissue Engineering 3 credits
**ME 694** Biomechanics 3 credits
**MN 785** Biocompatibility Testing 3 credits
**PSCI 611** Pharmacodynamics and Applied Theraputics 3 credits
**PSCI 701** Quantitative Drug Design 2 credits

## Suggested Courses in the Nanomaterials Focus

**CE 783** Nanomechanics 3 credits
**CE 641**Finite Element Analysis 3 credits
**CHEM 767** Quantum Chemistry II 3 credits
**CHEM 766** Quantum Chemistry I 3 credits
**CPM 796** Nanomaterials Chemistry 3 credits
**CPM 686** Corrosion and its Control by Coatings (cross-listed with CHEM) 2 credits
**CPM 782** Physical Chemistry of Coatings 3 credits
**CPM 673** Polymer Synthesis 3 credits
**CPM 773** Organic Chemistry of Coatings 3 credits
**IME 720** Surface Engineering 3 credits
**ME 682** Fuel Cells 3 credits

**ME 733** Nanocomposites and Functionalities
**ME 734** Smart Materials/Structures 3 credits
**ME 712** Advanced Finite Element Analysis 3 credits
**PHYS 696** Molecular Modeling of Materials 3credits
**PHYS 758** Statistical Physics 3 credits
**PHYS 781** Solid State Physics I 3 credits

### Suggested Courses in the General Materials Science and Engineering Focus

**ABEN 658** Food Process Engineering 3 credits
**ABEN 644** Transport Processes in Biological and Environmental Systems 3 credits
**ABEN 658** Food Process Engineering 3 credits
**ABEN 644** Transport Processes in Biological and Environmental Systems 3 credits
**ME 673** Engineering Plastics for Design 3 credits
**CE 641** Finite Element Analysis 3 credits
**CE 720** Continuum Mechanics 3 credits
**CHEM 732** Electrochemistry 3 credits
**CHEM 736** Mass Spectroscopy 3 credits
**CPM 673** Polymer Synthesis 3 credits
**ME 751** Advanced Thermodynamics 3 credits
**ME 633** Composites Science and Engineering 3 credits
**PHYS 611** Optics for Scientists and Engineers 3 credits
**PHYS 781** Solid State Physics I 3 credits

of London, 1984
Research Interests: Computational Solid Mechanics, Finite and Boundary Elements, Composite Micro and Nanomechanics, Continuum Mechanics, Structural Mechanics, Nonlinear and Large Deformation and Analysis, Thermoelastic Analysis.

**Dinesh Katti, Ph.D.**
University of Arizona, 1991
Research Interests: Geotechnical Engineering, Constitutive Modeling of Geologic Materials, Expansive Soils, Multiscale Modeling, Steered Molecular Dynamics, Computational Mechanics, Nanocomposite, and Bio-nanocomposites. Computational Biophysics

**Kalpana Katti, Ph.D.**
University of Washington, 1996
Research Interests: Advanced Composites, Nanomaterials, Biomaterials, Biomimetics, Materials Characterization and Modeling, Analytical Electron Microscopy, and Microspectroscopy, Bone Tissue engineering

**Rajesh G. Kavasseri, Ph.D.**
Washington State University, 2002
Research Interests: Power Systems, Nonlinear Dynamics, Renewable Energy resources

**Daniel M Kroll, Ph.D.**

University of Chicago, 1973.
Research Interests: Theoretical and Computational Modeling of Complex Fluids and Biomembranes.

**Ivan T. Lima Jr., Ph.D.**
University of Maryland, Baltimore County, 2003
Research Interests: Photonics

**Mohammad Mahinfalah, Ph.D.**
Iowa State University, 1988
Research Interests: Experimental Mechanics, Stress Analysis, Composite Materials, Fracture Mechanics

**Valery R. Marinov, Ph. D.**
Manufacturing Engineering, Technical University of Sofia, 1992
Research Interests: Process Modeling for Machining, Theory of Metal Cutting, Tribological Coatings, Including Nanocomposite Coatings and Deposition Methods, Design for Composites Manufacturing Processes, Packaging for low-cost disposable microelectronics, Direct-write material deposition methods, Laser processing

**Sylvio May, Ph.D.**
Jena, 1997.
Research Interests: Theoretical and Computational Biophysics

**Suranjan Panigrahi, Ph.D.**

Iowa State University, 1992
Research Interests: Machine Systems, Machine Vision, Artificial Intelligence

**Seth C. Rasmussen, Ph.D.**
Clemson University, 1994; Postdoctoral, University of Oregon, 1995-1999
Research Area: Inorganic/Organic Materials Chemistry, Chemical History

**Jing Shi, Ph.D.,**
Industrial Engineering, Purdue University , 2004
Research Interests: Microelectronics Packaging, Direct Write Material Depositing, Laser Processing for Electronics, RFID Applications, Numerical Modeling of Manufacturing Processes, Computer Integrated Manufacturing

**Jagdish Singh, Ph.D.**
Banaras Hindu University, Varanasi, India, 1982
Postdoctoral: University of Otago, New Zealand, 1985-88; University of California--San Francisco, 1992-94
Research Interests: Novel Dosage and Drug Delivery Systems, Biopharmaceutics

**Dean D. Steele, Ph.D.**
University of Minnesota, 1991
Research Interests: Irrigation and Environmental Engineering

**James J-S. Stone, Ph. D.**
University of Wisconsin-Madison, 1992
Postdoctoral, Mayo Clinic, 1992-1993
Research Interests: Tissue/Cell Engineering, Biomaterials, Bioengineering, Computer-Aided Design, Rapid Prototyping and Manufacturing, Nanotechnology, Composites, Experimental Mechanics, Finite Element Analysis

**Wenfang Sung, Ph.D.**
Institute of Photographic Chemistry, Chinese Academy of Sciences, 1995; Postdoctoral, University of Alabama, Birmingham, 1997-1999
Research Area: Organic Materials Chemistry

**Orven Swenson, Ph. D.**
Air Force Institute of Technology, 1982
Research Interests: Laser Ionization Detection, Optics

**Dennis E. Tallman, Ph.D.**
The Ohio State University, 1968; Postdoctoral, Cornell University, 1968-1970
Research Area: Electrochemistry, Materials

**Alexander J. Wagner, Ph.D.**
University of Oxford, 1997
Postdoctoral MIT, 1998-2000, Edinburgh,

2000-2002
Research Interests: Computational Soft Matter Physics

**Jialai Wang, Ph.D.**
University of Akron, 2003
Research Interests: Analytical and Applied Mechanics, Advanced Polymer Composite Materials in Civil Infrastructure (Infrastructure Composites), Mechanics of Composite Materials and Structures, Fiber Reinforced Plastic (FRP) Structural Shapes, Smart Composites and Structures, Structural Health Monitoring, Fracture of Bonded Interfaces (FRP-Wood and FRP-Concrete), Advanced and High Performance Materials for Highway Bridge Applications, Homeland Security Technology

**Dean Webster, Ph.D.**
Virginia Polytechnic Institute and State University 1984
Research Interests: Synthesis of high performance polymers, polymerization reactions, crosslinking chemistry, and quantitative structure-property relationship

**David L. Wells, Ph.D., C.Mfg.E.**
Engineering Management, University of Missouri-Rolla, 1996
Research Interests: Assembly of Micro and Nano Components, Printed Electronics, Process Engineering for Electronics

Manufacturing, Advanced Manufacturing Processes, Product Realization, Application of RFID Technology, Quantitative Manufacturing Management, Advanced Manufacturing in Economic Development

**Dennis P. Wiesenborn, Ph.D.**
Rice University, 1989
Research Interests: Food and Added Value Process Engineering

**Frank Yazdani, Ph.D.**
University of New Mexico, 1987
Research Interests: Structures, Constitutive Modeling of Materials, and Continuum Mechanics

**Weihong (Katie) Zhong, Ph.D.**
Beijing University of Aeronautics and Astronautics, China, 1994
Research Interests: Polymer and Composite Materials, Nanocomposites, Composite Processing Technologies, Mechanical, Electrical, and Thermal Properties of Materials.



E-Mail: The Graduate School
Prospective students may schedule a visit by calling 1-800-488-NDSU.

The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701-231-8171 or 8561

**Maria Angeles Alfonseca, Ph.D.**
Universidad Autonoma de Madrid, Spain, 2003
Research Interests:
Fourier Analysis, Partial Differential Equations

**Nikita Barabanov, Ph.D.**
University of Kiev, 1979
Research Interests:
Differential Equations, Control Theory, Optimization, Neural Networks.

**Marian Bocea, Ph.D.**
Carnegie Mellon University, 2004
Research Interests:
Partial Differential Equations, Calculus of Variations, Mechanics of Deformable Solids

**Joseph Brennan, Ph.D.**
University of Illinois, 1984
Research Interests:
Commutative Algebra, Representation Theory, Enumerative Combinatorics, Invariant Theory

**Catalin Ciuperca, Ph.D.**
University of Kansas, 2001
Research Interests:
Commutative Algebras, Algebraic Geometry

**Dogan Cömez, Ph.D.**
University of Toronto, 1983
Research Interest:
Ergodic Theory, Measure Theory, Lp-spaces, Operator Theory, Topology

**Davis Cope, Ph.D.**
Vanderbilt University, 1980
Research Interests:
Partial Differential Equations,

# Mathematics

## Program Description

The Department of Mathematics offers graduate study leading to the degrees of Master of Science (M.S.) and Doctor of Philosophy (Ph.D.). Advanced work may be specialized among the following areas: algebra, applied mathematics, approximation theory, calculus of variations, combinatorics, differential equations, dynamical systems, ergodic theory, graph theory, harmonic analysis, number theory, operator theory and topology.

Beginning with their first year in residence, students are strongly urged to attend research seminars and discuss research opportunities with faculty members. By the end of their second semester, students select an advisory committee and develop a plan of study specifying how all degree requirements are to be met. One philosophical tenet of the Department of Mathematics graduate program is that each mathematics graduate student will be well grounded in the two very basic areas of mathematics: algebra and analysis. To this end, each student's background will be assessed, and the student will be directed to the appropriate level of study in these areas.

## Admissions Requirements

The Department of Mathematics graduate program is open to all qualified graduates of universities and colleges of recognized standing. To be admitted with full status to the program, the applicant must:

1. Hold a baccalaureate degree (or equivalent) from an institution of higher education of recognized standing.
2. Have adequate preparation in higher mathematics, showing potential to successfully undertake advanced study and research as evidenced by academic performance and experience.
3. Have earned a cumulative grade point average (GPA) of at least 3.0 or equivalent in all advanced mathematics courses at the baccalaureate level. Students with a GPA of at least 3.0 or equivalent in a previous graduate degree program may be admitted in full standing.

In some of the requirements are not met, admission on a conditional status is possible in certain cases.

Applications for admission should be sent to The Graduate School rather than the Department of Mathematics. The Graduate School may be contacted for application materials. Applications

Numerical Methods, Applied Mathematics

**James B. Coykendall, Ph.D.**
Cornell University, 1995
Research Interests:
Algebraic Number Theory, Commutative Algebra, Ideal Theory, Dimension Theory, Factorization Theory and K-theory

**Benton Duncan, Ph.D.**
University of Nebraska, 2004
Research Interests:
Operator Algebras, Noncommutative Functional Analysis, K-theory

**Friedrich Littmann, Ph.D.**
University of Illinois, Urbana, 2003
Research Interests:
Approximation theory, Number theory

**William Martin, Ph.D.**
University of Wisconsin, 1993
Research Interests:
Mathematics Education

**James H. Olsen, Ph.D.**
University of Minnesota, 1968
Research Interests:
Ergodic Theory, Probability Theory and Related Areas

**Cristina Popovici, Ph.D.**
Carnegie Mellon University, 2005
Research Interests:
Calculus of Variations, Partial Differential Equations, Mechanics of Deformable Solids

**Warren Shreve, Ph.D.**
University of Nebraska, 1967
Research Interests:
Graph Theory, Combinatorics, Matrix Theory

**Abraham Ungar, Ph.D.**
Tel-Aviv University, 1973
Research Interests:
Differential Equations, Integral Transforms, Wave Propagation, Special Relativity

will be considered at any time. However, opportunities are improved for those received by March 1 preceding the fall semester of intended enrollment.

Official transcripts (transcripts having an appropriate seal or stamp) of all previous undergraduate and graduate records must be received by The Graduate School before the application is complete. When a transcript is submitted in advance of completion of undergraduate or graduate studies, an updated transcript showing all course credits and grades must be provided prior to initial registration at North Dakota State University.

Three letters of recommendation are required before action is taken on any application. Personal reference report forms are available from The Graduate School.

The Test of English as a Foreign Language (TOEFL) examination is required of international applicants. A minimum TOEFL score of 525 (paper test) or 193 (computer test) must be achieved.

## Financial Assistance

Teaching assistantships and a small number of research assistantships are available. Graduate tuition is waived for research and teaching assistants.

All students in full standing and, in certain situations, students in conditional status are eligible for assistantships.

International students must show proficiency in reading, writing, and speaking English. In particular, they must pass an oral proficiency interview, which is a Test of Spoken English (TSE) prior to receiving a teaching assistantship. This interview is the culmination of the five-week Intensive English Language Program (IELP) available each summer. An indication, but not a guarantee, of being able to pass this interview is a TOEFL score of at least 600 (paper test) or 247 (computer test). All international students applying from outside the United States for a teaching assistantship must expect to take the IELP.

Assistantship applications will be considered at any time. However, opportunities are improved for those received by March 1 preceding the fall semester of intended enrollment.

## Degree Requirements

At least one year of academic work must be spent in residence at NDSU in fulfilling graduate requirements for each graduate degree earned. The M.S. customarily takes two years to complete: the Ph.D. usually last three years beyond the master's. Students must maintain a cumulative GPA of at least 3.0 throughout their graduate career.

### Master of Science

Two options are available: the Thesis Option and the Comprehensive Study Option. The Thesis Option emphasizes research and preparation of a scholarly thesis, whereas the Comprehensive Study Option emphasizes a broader understanding of a major area of Mathematics. Degree requirements include:

1. A total of 30 credit hours in approved graduate-level course work, depending on the degree option (see below). Subject to the approval of the supervisory committee, at most 6 of these 30 credits may be earned in 600-level mathematics courses (but NOT Math 620, 621, 650, or 651) or in courses in fields other than mathematics.

   **Thesis option:** A total of 6 to 10 credit hours of Math 798 (Master's Thesis), in addition to 18 credit hours in courses numbered 700-789. These must include the two-semester sequences in Algebra (Math 720, 721) and Real Analysis (Math 750, 751).

**Comprehensive Study Option:** A total of 2 to 4 credit hours of Math 797 (Master's Paper), in addition to 24 credit hours in courses numbered 700-789. These must include the two-semester sequences in Algebra (Math 720, 721) and Real Analysis (Math 750, 751).

2. A passing grade in written preliminary examinations in Algebra and Real Analysis.
3. Demonstrated proficiency in a computer programming language.
4. A thesis or expository paper written under the supervision of a faculty member and defended at an oral examination administered by the student's supervisory committee.

## Doctor of Philosophy

Degree requirements include:

1. A total of 90 credit hours in approved graduate-level course work, including:

   **a.** At least 42 credit hours in courses numbered 700-789. These must include the two-semester sequences in Algebra (Math 720, 721) and Real Analysis (Math 750, 751), and four courses form the following list, which must be passed with a grade of B or higher: Math 728 (Linear Algebra), Math 746 (Topology), Math 752 (Complex Analysis), Math 754 (Functional Analysis), Math 756 (Dynamical Systems), Math 772 (Number Theory), Math 788 (Numerical Analysis).

   **b.** At least 3 credit hours of Math 790 (Graduate Seminar).

   **c.** At least 6 credit hours of Math 799 (Doctoral Dissertation).

   **d.** Subject to the approval of the advisory committee, at most 12 credits may be earned in 600-level mathematics courses (but NOT Math 620, 621, 650, or 651) or in courses in fields other than mathematics.

2. A passing grade in written preliminary examinations in Algebra and Real Analysis.
3. Demonstrated proficiency in one foreign language commonly used in the mathematical literature, normally French, German, or Russian, as well as a demonstrated proficiency in a computer programming language. A student's advisory committee may require a second foreign language.
4. A passing grade in an oral preliminary examination administered by the student's advisory committee after the written examinations, language requirements and all didactic coursework have been completed. Upon passing the oral examination, the student advances to candidacy for the Ph.D.
5. A dissertation which must embody original work constituting a definite contribution to mathematical knowledge and demonstrate capacity for independent research, defended at a final oral examination administered by the candidate's advisory committee.
   Credits used to satisfy the requirements for a Master's degree at NDSU may be included in the total 90 credits required for the Ph.D.

Students entering the doctoral program with a Master's degree from another institution need only complete 60 credit hours, including:

1. At least 30 credit hours in courses number 700-789 (but NOT Math 720, 721, 750, or 751).
2. Subject to the approval of the advisory committee, at most 6 credits may be earned in 600-level mathematics courses (but NOT Math 620, 621, 650, or 651) or in courses in fields other than mathematics.

All other requirements must be satisfied as above.

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## Courses Offered

**620 Abstract Algebra I 3**
Groups, permutations, quotient groups, homomorphisms, rings, ideals, integers. Prereq: Math 270 or departmental approval.

**621 Abstract Algebra II 3**
Division rings, integral domains, fields, field extensions, Galois Theory. Prereq: Math 620 or departmental approval.

**629 Linear Algebra 3**
Vector spaces, linear transformations eigenvalues and eigenvectors, canonical forms, inner product spaces, and selected applications. Prereq: Math 270 or departmental approval.

**630 Graph Theory 3**
Graphs and directed graphs, graph models, subgraphs, isomorphisms, paths, connectivity, trees, networks, cycles, circuits, planarity, Euler's formula, matchings, bipartite graphs, colorings, and selected advanced topics. Prereq: Math 270 or departmental approval.

**636 Combinatorics 3**
Recurrence relations, formal power series, generating functions, exponential generating functions, enumeration, binomial coefficients and identities, hypergeometric functions, Ramsey theory, Sterling and Eulerian numbers. Prereq: Math 270 or departmental approval.

**640 Axiomatic Geometry 3**
Hilbert's axioms for Euclidean geometry, projective geometry, history of parallel axiom, hyperbolic geometry, elliptic geometry. Prereq: Math 270 or departmental approval.

**645 Differential Geometry 3**
Basic properties of curves and surfaces, Frenet equations, the Gauss Map, intrinsic geometry of surfaces, geodesics, Gauss-Bonnet Theorem, and applications. Prereq: Math 270 or departmental approval.

**646 Introduction to Topology 3**
Topology of Euclidean space, metric spaces, topological spaces, bases and neighborhoods, Hausdorff property, continuity, homeomorphisms and embeddings, connectivity, and compactness. Prereq: Math 270 or departmental approval.

**647 Molecular Topology 3**
Applications of topological techniques to stereochemistry. Topics include three-dimensional manifolds, knots, embedded graphs, chirality, topological rubber gloves, Möbius ladders, topology of DNA, tangles, and the Ernst-Sumners theorem. Prereq: Math 270 or departmental approval.

**650 Real Analysis I 3**
Sequences and convergence in R, continuity, uniform convergence, spaces of continuous functions, compactness, fixed point theorems, differentiability, inverse and implicit function theorems, applications. Prereq: Math 266, and 270 or departmental approval.

**651 Real Analysis II 3**
Riemann and Riemann-Stieltjes integration, convergence theorems, multiple integration and Fubini's Theorem, elements of Fourier analysis, applications. Prereq: Math 650 or

departmental approval.

**652 Complex Analysis 3**
Complex number systems, analytic and harmonic functions, elementary conformal mapping, integral theorems, power series, Laurent series, residue theorem, and contour integration. Prereq: Math 265 or departmental approval.

**660 Intensive MATHEMATICA 1**
Thorough overview of the general purpose mathematical software MATHEMATICA: numerical and symbolic calculations for algebra and linear algebra, single and multivariable calculus, ordinary and partial differential equations, 2D- and 3D-graphics, animation, word processing. Satisfies computer programming proficiency requirement. Prereq: Math 259 or departmental approval.

**672 Number Theory 3**
Properties of integers, number theoretic functions, quadratic residues, continued fractions, prime numbers and their distribution, primitive roots. Prereq: Math 270 or departmental approval.

**678 History of Mathemactics 3**
Historical consideration emphasizing the source of mathematical ideas, growth of mathematical knowledge, and contributions of some outstanding mathematicians. Prereq: Math 270 or departmental approval.

**680 Applied Differential Equations 3**
Power series expansions and the method of Frobenius, special functions, and their use (Bessel functions, Legendre polynomials); phase plane analysis. Prereq: Math 266 or departmental approval.

**681 Fourier Analysis 3**
Discrete and continuous Fourier transforms, Fourier series, convergence and inversion theorems, mean square approximation and completeness, Poisson summation, Fast-Fourier transform. Prereq: Math 265 or departmental approval.

**682 Survey of Mathematical Models 3**
Lagrangian and Hamiltonian dynamics, potential theory, diffusion, hydrodynamics, elasticity; dimensional analysis, tensors; emphasis on how physical concepts are formulated mathematically rather than solution methods. Prereq: Math 266 or departmental approval.

**683 Partial Differential Equations 3**
Solution methods for potential, diffusion, and wave equations; treatments of homogeneous and nonhomogeneous equations; boundary conditions; separation of variables, Green's functions, transform techniques. Prereq: Math 680 or departmental approval.

**688 Numerical Analysis I 3**
Numerical solution of nonlinear equations, interpolation, numerical integration and differentiation, numerical solution of initial value problems for ordinary differential equations. Prereq: Math 266 or departmental approval.

**689 Numerical Analysis II 3**
Numerical solutions of linear and nonlinear systems, eigenvalue problems for matrices, boundary value problems for ordinary differential equations, selected topics. Prereq: Math 629 and 688 or departmental approval.

**720, 721 Algebra I, II 3 each**
Graduate level survey of algebra: groups, rings, fields, Galois theory, and selected advanced topics. Prereq: Math 621 or departmental approval .

**724, 725 Theory of Rings I, II 3 each**
The ideal theory of commutative rings, structure of (non-commutative) rings, and selected advanced topics. Prereq: Math 721or departmental approval.

**726 Homological Algebra 3**
An overview of the techniques of homological algebra. Topics covered will include categories and functors, exact sequences, (co)chain complexes, Mayer-Vietoris sequences, TOR, and EXT. Applications to other fields will be stressed. Prereq: Math 621 or departmental approval.

**728, 729 Linear Algebra I, II 3 each**
Theory of linear transformations and matrices, canonical forms, inner product spaces, unitary spaces, symmetric forms, generalized inverses, and selected advanced topics. Prereq: Math 629 or departmental approval.

**730, 731 Graph Theory I, II 3 each**
Graduate-level survey of graph theory: paths, connectivity, trees, cycles, planarity; genus, Eulerian graphs, Hamiltonian graphs, factorizations, tournaments, embedding, isomorphism, subgraphs, colorings, Ramsey theory, girth. Prereq: Math 630 or departmental approval.

**732 Introduction to Bioinformatics 3**
An introduction to the principles of bioinformatics including information relating to the determination of DNA sequencing. Prereq: Stat 661or departmental approval.

**736, 737 Discrete Mathematics I, II 3 each**
Combinatorial reasoning, generating functions, inversion formulae. Topics may include design theory, finite geometry, Ramsey theory, and coding theory. Advanced topics may include cryptography; combinatorial group theory; combinatorial number theory, algebraic combinatorics, (0,l)-matrices, and finite geometry. Prereq: Math 636 or departmental approval.

**746, 747 Topology I, II 3 each**
Topological spaces, convergence and continuity, separation axioms, compactness, connectedness, metrizability, fundamental group, and homotopy theory. Advanced topics may include homology theory, differential topology, three-manifold theory, and knot theory. Prereq: Math 646 or departmental approval.

**750, 751 Analysis I, II 3 each**
Lebesgue and general measure and integration theory, differentiation, product spaces, metric spaces, elements of classical Banach spaces, Hilbert spaces, and selected advanced topics. Prereq: Math 651or departmental approval.

**752, 753 Complex Analysis I, II 3 each**
Analytic and harmonic functions, power series, conformal mapping, contour integration and the calculus of residues, analytic continuation, meromorphic and entire functions, and selected topics. Prereq: Math 651or departmental approval.

**754, 755 Functional Analysis I, II 3 each**
Normed spaces, linear maps, Hahn-Banach Theorem and other fundamental theorems, conjugate spaces and weak topology; adjoint operators, Hilbert spaces, spectral theory, and selected topics. Prereq: Math 751or departmental approval.

**756 Dynamical Systems 3**
A study of basic notions of topological and symbolic dynamics. Introduction to measurable dynamics and ergodic theory. Ergodicity, mixing and entropy of dynamical systems. Prereq: Math 750 or departmental approval.

**760, 761 Ordinary Differential Equations I, II 3 each**
Existence, uniqueness, and extendibility of solutions to initial value problems, linear systems, stability; oscillation, boundary value problems, difference equations, and selected advanced topics. Prereq: Math 751or departmental approval.

**762, 763 Integral Equations I, II 3 each**
Existence and uniqueness of solutions of Fredholm and Volterra integral equations, Fredholm Theory, singular integral equations, and selected advanced topics. Prereq:

Math 751or departmental approval.

**764 Calculus of Variations 3**
Variational techniques of optimization of functionals, conditions of Euler, Weierstrass, Legendre, Jacobi, and Erdmann, Pontryagin Maximal Principle, applications, and selected advanced topics. Prereq: Math 651or departmental approval.

**772, 773 Number Theory I, II 3 each**
Number theoretic functions, algebraic number fields, prime numbers and their distribution, the Prime Number Theorem and related results, Fermat's Theorem. Prereq: Math 672 or departmental approval.

**778 Modern Probability Theory 3**
See Statistics for description.

**782, 783 Mathematical Methods in Physics I, II 3 each**
Tensor analysis, matrices and group theory, special relativity, integral equations and transforms, and selected advanced topics. Prereq: Math 629and 652 or departmental approval. Cross-listed with Phys 752, 753.

**784, 785 Partial Differential Equations I, II 3 each**
Classification in elliptic, parabolic, hyperbolic type; existence and uniqueness for second-order equations; Green's functions and integral representations; characteristics, nonlinear phenomena. Prereq: Math 751or departmental approval.

**786, 787 Mixed Boundary Value Problems I, II 3 each**
Methods for transient and steady-state solutions of diffusion problems with mixed boundary conditions; integral transforms; Green's function and integral equation formulations, asymptotics. Prereq: Math 652 or 752 or departmental approval.

**788, 789 Numerical Analysis I, II 3 each**
Numerical solutions to partial differential and integral equations, error analysis, stability, acceleration of convergence, numerical approximation, and selected advanced topics. Prereq: Math 689 or departmental approval.

The following variable credit courses are also offered:

**790 Graduate Seminar 1-3**

**793 Individual Study/Tutorial 1-5**

**797 Master's Paper 1-5**

**798 Master's Thesis 1-10**

**799 Doctoral Dissertation 1-15**



E-Mail: The Graduate School Prospective students may schedule a visit by calling 1-800-488-NDSU.

The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701-231-8671

**Iskander Akhatov, Ph.D.**
Lomonosov University of Moscow, 1983
Research Interests:
Fluid Dynamics, Multiphase Systems, Heat and Mass Transfer

**Sherman P. Goplen, Ph.D.**
Texas A & M University, 1977
Research Interests:
Applied Thermodynamics, Technology Transfer

**Alan R. Kallmeyer, Ph.D.**
University of Iowa, 1995
Research Interests:
Theoretical, Computational, and Experimental Solid Mechanics, Fatigue and Fracture of Engineering Materials, Composite Materials

**Ghodrat Karami, Ph.D.**
Imperial College of Science and Technology, University of London, 1984
Research Interests:
Computational Solid Mechanics, Finite and Boundary Elements, Composite Micro and Nanomechanics, Continuum Mechanics, Structural Mechanics, Nonlinear and Large Deformation and Analysis, Thermoelastic Analysis.

**Mohammad Mahinfalah, Ph.D.**
Iowa State University, 1988
Research Interests:
Experimental Mechanics, Stress Analysis, Composite Materials, Fracture Mechanics

**Gholamreza Nakhaie-Jazar, Ph. D.**
Sharif University of Technology, Tehran, Iran, 1997

# Mechanical Engineering and Applied Mechanics

NDSU College of Engineering and Architecture MECHANICAL ENGINEERING

## Program Description

The Department of Mechanical Engineering and Applied Mechanics offers graduate programs leading to the M.S. and Ph.D. degrees. Graduate work may be concentrated in engineering mechanics, fatigue and fracture, biomechanics and biomaterials, thermal engineering, fluid mechanics, automatic controls, or engineering materials with an emphasis on plastics and composite materials. Students with a B.S. degree in physics or mathematics may pursue a special graduate program of studies and earn an M.S. degree in Mechanical Engineering.

## Admissions Requirements

In addition to minimum Graduate School admission requirements, applicants must have a bachelor's degree in Mechanical Engineering or in a closely related field. International students must provide both TOEFL (or IELTS)and Graduate Record Examination general test scores before their applications will be considered.

## Financial Assistance

Research and/or teaching assistantships may be available to qualified students. Applicants are considered on the basis of scholarship, potential to undertake advanced study and research, and financial need. To be considered for an assistantship, a completed Graduate School application, official transcripts, and three letters of reference must be submitted to The Graduate School. For international students, TOEFL (or IELTS)and GRE results are also required. Research and teaching assistantships are available contingent upon current funding.

## Degree Requirements

The minimum total semester credits required for the M.S. degree in Mechanical Engineering is 30. The M.S. degree can be earned with either of two options: the thesis option or the comprehensive study option. With the thesis option, a student must complete a core curriculum of 9 credits (three courses) of graduate courses in mechanical engineering, a master's thesis of 6 to 9 credits of ME 798, and the remaining credits from other approved graduate level courses. At the conclusion of the graduate program, the student will be examined orally on the thesis and coursework. With the comprehensive study option, a student must complete a core curriculum of 9 credits (three courses) of graduate courses in mechanical engineering, a master's paper of no more than 3 credits of ME 797, and the remaining credits from other approved graduate level courses. At the conclusion of the graduate program, the student must pass a comprehensive oral examination on the Master's paper and coursework. For more detailed

Research Interests:
Nonlinear Dynamics, Vibrations, Perturbations and Approximation Methods, Vehicle Dynamics, Nonlinear and Optimal Control, Robotics

**Robert V. Pieri, Ph.D.**
Carnegie-Mellon University, 1987
Research Interests:
Design, Materials and Nanomaterials Characterization, Instructional Pedagogy, Fracture Mechanics, Measurements, Alternative Energy, and Industrial Support

**Michael Stewart, Ph.D.**
University of Illinois, 1979
Research Interests:
Computational Fluid Dynamics, Heat and Mass Transfer in Porous Media

**Majura Selekwa, Ph.D.**
Florida A&M University, 2001
Research Interests:
Robotics, Machine Intelligence, Softcomputing Applications, Numerical Methods and Numerical Optimization, Optimal and Robust Control, Smart Actuation Control Systems, Real-Time Control in Mechatronics.

**James J-S. Stone, Ph.D.**
University of Wisconsin-Madison, 1992
Postdoctoral, Mayo Clinic, 1992-1993
Research Interests:
Tissue/Cell Engineering, Biomaterials, Bioengineering, Computer-Aided Design, Rapid Prototyping and Manufacturing, Nanotechnology, Composites, Experimental Mechanics, Finite Element Analysis

**Yildirim Bora Suzen, Ph.D.**
Wichita State University, 1998
Research Interests:
Computational Fluid Dynamics, Aerodynamics, Modeling of Industrial Transport Processes, Transition and Turbulence Modeling, Active/Adaptive Flow Control, Turbomachinery, Multiprocessor CFD

information on the requirements for the M.S. degree, contact the department.

The Ph.D. program requires the completion of 90 credit hours of graduate study beyond the baccalaureate degree (60 credits beyond the M.S. degree). In addition to the credit requirements for the M.S. degree, the Ph.D. degree requires a minimum of 24 course credits and a minimum of 24 credits of research-based dissertation. The remaining 12 credits may consist of any approved graduate level credits. Each student is required to pass a series of written qualifying exams on core subjects within 24 months of enrollment in the Ph.D. program. After the majority of coursework has been completed, an oral preliminary exam will be administered focusing on the student's proposal for the dissertation research. At the conclusion of the Ph.D. program, each student is required to pass a comprehensive oral final examination primarily focused on the dissertation, but which may also cover material from coursework, particularly courses fundamental to the dissertation. For more detailed information on the requirements for the Ph.D. degree, contact the department.

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## Courses Offered

**612 Engineering Measurements* 3**
Principles and characteristics of instruments used for engineering measurements, statistical analysis of data, signal conditioning, data acquisition systems. Includes laboratory. Prereq: ECE 303, ME 223.

**621 Theory of Vibrations* 3**
Fundamentals of vibrations; free, forced, and damped vibration of single and multiple degrees-of-freedom systems. Prereq: ME 213, 222; Math 266.

**635 Plastics and Injection Molding Manufacturing 3**
See Industrial and Manufacturing Engineering for description.

**642 Machine Design I* 3**
Application of engineering mechanics, material properties, and failure theories to the design of reliable machine components. Prereq: ME 213, ME 331, ME 423.

**654 Heat and Mass Transfer* 3**
Principles of heat transfer by conduction, convection, and radiation. Introduction to mass transfer principles. Prereq: ME 213, 352; Math 266.

*Courses 612, 621, 642, and 654 are not acceptable for credit in graduate programs in Mechanical Engineering (M.S. or Ph.D.).

**671 Stress Analysis 3**
Coordination of mathematical and modern experimental analysis as applied to engineering materials. Includes laboratory. Prereq: ME 223, ME 331.

**672 Fatigue and Fracture of Metals 3**
Causes and effects of fatigue failure and fracture of metals, analytical methods for fatigue design and fatigue life prediction, fatigue crack initiation and propagation, fatigue testing and validation. Prereq: ME 442.

**673 Engineering Plastics for Design 3**
Mechanical and thermal properties of plastics materials as needed to design and manufacture plastic components to support constant and time-varying loads. Prereq: ME 331.

**674 Mechanics of Composite Materials 3**
Materials, properties, stress, and strength analyses; engineering design and manufacturing aspects of short and continuous fiber-reinforced materials. Prereq: ME 423.

**Chad A. Ulven, Ph.D.**
University of Alabama at Birmingham, 2005
Research Interests:
Advanced Composites Materials Development, Environmentally Friendly Materials Processing, Nondestructive Evaluation, Impact/ High Strain Rate Characterization of Advanced Materials

**Weihong (Katie) Zhong, Ph.D.**
Beijing University of Aeronautics and Astronautics, China, 1994
Research Interests:
Polymer and Composite Materials, Nanocomposites, Composite Processing Technologies, Mechanical, Electrical, and Thermal Properties of Materials.

**Mariusz Ziejewski, Ph.D.**
North Dakota State University, 1986
Research Interests:
Impact Biomechanics, Human Body Dynamics, Head and Neck Trauma, Impact Trauma, Human Brain Modeling, Statistical Methods.

**675 Automatic Controls 3**
Introduction to industrial automatic controls. Theory and applications of pneumatic control, continuous process control, and programmable logic control. Demonstrations and discussion of the current industrial practice. Prereq: Math 266.

**677 ME Finite Element Analysis 3**
Introduction to the finite element method and its application to problems in mechanical engineering, including stress analysis. Prereq: ME 423 and ME 213 or ABEn 255.

**679 Fluid Power Systems Design 3**
Fluid dynamics principles and fluid properties are applied to the study of function, performance, and design of system components and systems for power transmission and control purposes. Prereq: ME 222, 352.

**681 Fundamentals of Energy Conversion 3**
Introduction to electric power generating systems and their major components, such as turbines, boilers, condensers, and cooling towers. Prereq: ME 353.

**682 Fuel Cell Science and Engineering 3**
This course describes the fundamental principles, technologies, and applications of fuel cells, and emerging class of energy storage/conversion devices. Prereq: CHEM 121 and ME 351.

**684 Gas Turbines 3**
Theory and design of gas turbines and components. Prereq: ME 353, ME 454.

**685 Heating, Ventilation, and Air Conditioning 3**
Application of the basic fundamentals of thermodynamics, heat transfer, and fluid flow to heating, ventilating, and air conditioning. Prereq: ME 353, Coreq: ME 454/654.

**686 Nanotechnology and Nanomaterials 3**
See Civil Engineering for description.

**687 Internal Combustion Engines 3**
Theory and practice of power and propulsion engines utilizing gas as a working substance. Study of gas turbines, spark, and compression ignition engines. Prereq: ME 351.

**689 Vehicle Dynamics 3**
Fundamental science and engineering underlying the design and operation of vehicles. Use of previous knowledge of statics, kinematics, dynamics, and machine design. Prereq: ME 341, ME 421.

**711 Advanced Engineering Analysis 3**
Mathematical analysis and numerical treatment of engineering problems, eigenvalue problems in lumped and distributed parameter systems, advanced mathematics applied to engineering design. Departmental approval.

**712 Advanced Finite Element Analysis 3**
Application of finite element methods to problems of plasticity, viscoplasticity, fracture, vibrations, fluids, material and geometric nonlinearity, and heat transfer. Prereq: ME 477/677.

**717 PC-Based Measurements and Controls 3**
Introduction to digital electronics. Discussion of sensors, personal computers, signal conditioning, analog to digital converters, and digital to analog converters; selection of commercial hardware and software. Prereq: ME 412/612.

**720 Continuum Mechanics 3**
See Civil Engineering for description.

**721 Advanced Dynamics and Vibrations 3**
Kinematics and dynamics of a particle, a system of particles, and a rigid body, orbital

motion. Lagrange's equations, vibration theory. Prereq: ME 421/621.

**722 Mechanics of Deformable Solids 3**
Special problems in theories of failure, contact stresses, thick-walled cylinders, thin tubes, curved beams, energy methods. Prereq: ME 223.

**723 Experimental Stress Analysis 3**
Measurement of deformations that are of significance in the engineering design of load resisting members. Use of optical, electrical, and mechanical instrumentation; brittle coating and photoelastic techniques. Includes laboratory. Prereq: ME 471/671.

**725 Advanced Mechanics and Failure of Composites 3**
Concepts in static, dynamics, impact, and thermal analysis of anistropic elastic materials are covered. Different failure theories, laminated theories, and micromechanics formulations of composites are reviewed in detail. Prereq: ME 474 and 477.

**734 Smart Materials and Structures 3**
This course describes the physics, chemistry, engineering principles and applications of smart materials and structures. Prereq: Any basic materials science (ME 331), solid state physics class (PHYS 401, 402, or 485), or P&C 472/672 and 474/674.

**743 Biomechanics of Impact 3**
The course will describe the fundamental sciences of engineering and human anatomy that form the basis of biomechanics of soft tissue and bone under dynamic conditions. Prereq: ME 223, ME 331 or instructor approval.

**751 Advanced Thermodynamics 3**
Rigorous treatment of thermodynamic principles. Emphasis on the concept of availability methods as applied to various engineering systems. Prereq: ME 353.

**753 Gas Dynamics 3**
Fundamental concepts of fluid dynamics and thermodynamics are used in the treatment of compressible flow, frictional flows, and flows with heat transfer or energy release. Prereq: ME 352.

**754 Boundary Layer Theory 3**
Fundamental laws of motion of a viscous fluid are derived and used in the consideration of laminar boundary layers, transition phenomena, and turbulent boundary layer flows. Prereq: ME 352.

**755 Multiscale Fluid Dynamics 3**
This course describes the fundamental principles of fluid dynamics in micro and nano scales and their applications to direct write nanofabrication technologies and fuel cells. Prereq: ME 351, 352.

**761 Heat Transmission I 3**
Advanced study of heat conduction in solids. Analytical, graphical, and numerical evaluations of the temperature field. Use of advanced mathematical methods in the solution of boundary value problems. Prereq: ME 454/654 or equivalent.

**779 Selected Topics in Mechanical Engineering 3**
Topics or studies require departmental approval.

The following variable credit courses are also offered:

**790 Graduate Seminar 1-3**

**793 Individual Study/Tutorial 1-3**

**795 Field Experience 1-10**

**696/796 Special Topics 1-5**

**797 Master's Paper 1-3**

**798 Master's Thesis 1-10**

**799 Doctoral Dissertation 1-15**



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NDSU

NORTH DAKOTA STATE UNIVERSITY
FARGO, ND




# Merchandising

Graduate Bulletin Page
Departmental Home Page
College Home Page

**Contact Information:**

Phone: (701)231-8223
Fax: (701)231-5273

Dr.Holly E Bastow- Shoop
Appare, Design, Facility;
HM EML 178
North Dakota State University
Fargo, ND 58105-5051

Evelyn Morrow Lebedeff Hall
Room 255

Evelyn Morrow Lebedeff Hall is located in the center of campus on Centennial Boulevard and is connected to the east end of the Katherine Kilbourne Burgum Family Life Center (building #22 on the Campus Map)

## Graduate Faculty

701-231- 7667

**Eugene S. Berry, Ph.D.**
Northeastern University, 1983
Research Interests:
Animal virology, Molecular pathogenesis of ss(+) RNA viruses

**Neil W. Dyer, D.V.M., M.S.**
Iowa State University, 1991
Research Interests:
Studies with Bacillus anthracis, porcine pneumonia, new malignant catarrhal fever herpesvirus

**Douglas A. Freeman, D.V.M., Ph. D.**
University of Minnesota, D.V.M. 1983, University of Idaho, Ph.D. 1991
Research Interests:
Reproductive physiology; clinical fertility; animal health, management and welfare.

**Penelope S. Gibbs, Ph.D.**
University of Georgia, 2001
Research Interests:
Avian E.coli, bacterial molecular pathogenesis, antimicrobial resistance, food safety.

**Margaret L. Khaitsu, Ph.D.**
Ohio State University, 1999
Research Interests:
Epidemiology, food safety.

**Catherine M. Logue, Ph.D.**
University of Ulster, 1996
Research Interests:
Food safety, food microbiology and foodborne pathogens of human concern

**John M. McEvoy, Ph.D.**
University of Ulster, 2002
Research Interests:

# Veterinary and Microbiological Sciences

## Program Description

The Department of Veterinary and Microbiological Sciences offers graduate study leading to the M.S. degree in Microbiology and the Ph.D. degree in Molecular Pathogenesis. Faculty in the department offer expertise in pathogenic microbiology, virology, immunology, epidemiology, microbial genetics, bacterial physiology and food microbiology. The Master's in Microbiology emphasizes research methodology and laboratory techniques. The Ph.D. in Molecular Pathogenesis is a comprehensive program that integrates microbial genetics, mechanisms of pathogen-host interaction and cellular immunology to better understand the molecular basis of disease. Graduate students have access to state-of-the-art technology including automated DNA sequencing facilities, microarray capabilities and flow cytometry. NDSU's Biotechnology Institute includes a cell biology center and electron microscopy laboratory. Departmental faculty members also participate in the Cellular and Molecular Biology, Genomics, Natural Resource Management and Food Safety graduate programs.

## Admissions Requirements

1. A relevant bachelor's degree from an accredited institution and a strong academic record in the sciences.
2. A minimum grade point average of 3.0 on a 4.0 scale.
3. The Graduate Record Examination (GRE)
4. Letters of Reference

### Biology

One year of general biology with laboratory and one course in genetics are required.

At least one course is required in Cellular biology or
Cellular physiology
Animal physiology
Bacterial physiology

Microbiology and immunology recommended.

### Chemistry

One year of general chemistry with laboratory and two sequential terms of organic chemistry

Pathogenicity and virulence of Cryptosporidium

**Lisa K. Nolan, D.V.M., Ph.D. (Adjunct)**
University of Georgia, D.V.M. 1988, Ph.D. 1992
Research Interests:
Virulence mechanisms of bacterial pathogens of production animals

**Birgit Prüß, Ph.D.**
Ruhr-Universitat Bochum, Germany, 1991
Research Interests:
Global gene regulation in enteric bacteria, complex regulatory networks

**Jane M. Schuh, Ph.D.**
North Dakota State University, 2000
Research Interests:
Immunology; biomedical significance of the initiation and maintenance of allergic asthma; the innate immune response in health and disease; murine models of human asthma; Aspergillus fumigatus -induced immune response

**Charlene E. Wolf-Hall, Ph.D.**
University of Nebraska-Lincoln, 1995
Research Interests:
Food microbiology and toxicology

with a laboratory course are required.
Biochemistry is required.

Physics

Two sequential terms of physics with a laboratory course are required.

Applications should be submitted directly to The Graduate School before November 15 for January admission or before March 15 for August admission.

Official transcripts (transcripts having an appropriate seal or stamp) of all previous undergraduate and graduate records must be received by The Graduate School before the application is complete. When a transcript is submitted in advance of completion of undergraduate or graduate studies, an updated transcript showing all course credits and grades must be provided prior to initial registration at North Dakota State University.

Three letters of recommendation are required before action is taken on any application. Personal reference report forms are available from The Graduate School. The Graduate Record Examination (GRE) scores for the General Test are required prior to evaluation of applications by the Department of Veterinary and Microbiological Sciences.

All international students must demonstrate proficiency in English. NDSU requires a minimum TOEFL score of 525 (Paper-based), 197 (Computer-based), or 71 (Internet-based); or a minimum IELTS score of 5.5.

Students who do not meet all requirements for admission or have deficiencies in prerequisite course work, but show potential for successful graduate study, may be admitted under a conditional status. However, evidence must be provided showing that the applicant's potential is not adequately reflected by his/her record. After meeting the specified standards of performance by the department, the student, in consultation with the major adviser, may request a change to full graduate standing. The student may not earn more than 12 semester credits of graduate credit in the conditional status. The request for change must be submitted to the Dean of The Graduate School by the major adviser and approved by the department chair.

Further Graduate School admission information and on-line application information are available at http://www.ndsu.edu/gradschool/index.shtml

## Financial Assistance

The student must first apply to The Graduate School and be accepted in full or conditional status before he/she is eligible for an assistantship. Research and teaching assistantships are contingent upon availability of funds and are awarded competitively. Applicants are considered on the basis of scholarship, potential to undertake advanced study and research, and financial need.

## Ph.D. in Molecular Pathogenesis:

The Ph.D. in Molecular Pathogenesis encompasses the study of molecular pathogenesis of infectious and non-infectious diseases with an emphasis on animal diseases of agricultural importance, zoonotic diseases and public health . The comprehensive Doctoral degree in Molecular Pathogenesis integrates the study of microbial genetics, mechanisms of pathogen-host interaction, and cellular immunology to better understand the molecular basis of disease. Doctoral candidates in Molecular Pathogenesis focus on research and utilize the expertise of one or more departmental faculty members. Course work is designed to be relevant to future careers in academia, industry , and government.

## Degree Requirements

Degree requirements are in agreement with NDSU Graduate School requirements. The student and major adviser will prepare a plan of study by the end of the first year in residence. The Graduate School requires the plan of study for the Ph.D. degree to include no less than 90 semester, graduate credits. Of these, no less than 27 credits must be in courses other than seminar or research credits, and must include 15 credits at the 700-789 level. An overall GPA of 3.0 or higher must be maintained. The plan of study must include the following minimum number of credits in core subjects:

### Molecular Studies (a minimum of 8 credits)*

**Bioc 701 Comprehensive Biochemistry I 4**
**Bioc 702 Comprehensive Biochemistry II 4**
**Bioc 719 Molecular Biology of Gene Expression and Regulation 3**
**Biol 720 Advanced Cell Biology 3**
**Micr 680 Bacterial Physiology 3**
**Micr 682 Bacterial Genetics and Phage 3**
**Micr 781 Advanced Bacterial Physiology 3**
**Micr 783 Advanced Bacterial Genetics and Phage 3**
**PlSc 631 Intermediate Genetics 3**

### Technique Courses (a minimum of 5 credits)*

**Bioc 673 Methods of Biochemical Research 3**
**Bioc 674 Methods of Recombinant DNA Technology 3**
**Micr 645 Animal Cell Culture Techniques 2**
**Micr 661 Pathogenic Microbiology Lab 2**
**Micr 671 Immunology and Serology Laboratory 2**
**Micr 782 Molecular Microbiological Techniques 3**

### Pathogenesis (a minimum of 9 credits)*

**Micr 653 Food Microbiology 3**
**Micr 660 Pathogenic Microbiology 3**
**Micr/Safe 664 Etiology of Foodborne Illness 3**
**Micr 665 Fundamentals of Animal Disease 3**
**Micr 670 Basic Immunology 3**
**Micr/Safe 674 Epidemiology 3**
**Micr 675 Animal Virology 3**
**Micr/Safe 750 Advanced Topics in Epidemiology 3**
**Micr/Safe/CFS 752 Advanced Food Microbiology 3**
**Micr 762 Advanced Pathogenic Bacteriology 3**
**Micr 770 Immunology of Chronic Infections 3**
**Micr 775 Molecular Virology 3**
**Micr 785 Pathobiology 3**

* Additional courses may be offered.

The core courses must be completed before the student takes the oral preliminary examination, whereas elective classes can be completed any time prior to the defense of the written dissertation. Each student will present one seminar each academic year throughout the program.

## Examinations

Both a written and an oral examination shall be taken no later than the end of the third year in

residence. The written examination will consist of a number of questions on a major area of study plus additional questions on a minor area of study. The oral examination will be based on a non-thesis research topic that will be submitted in the format of a National Institutes of Health, National Science Foundation, or USDA postdoctoral fellowship research proposal. After successful completion of the comprehensive written and oral examinations, the student will be formally admitted to candidacy for the Doctor of Philosophy degree.

### Dissertation Research

In addition to the defense of the written dissertation in the final oral examination, the candidate will present a final public seminar based on the dissertation research. At least one academic semester, and preferably two semesters, shall elapse between the preliminary examinations and the oral defense of the research-based dissertation.

### M.S. in Microbiology:

A Master's degree in Microbiology at NDSU emphasizes research methodology and laboratory techniques. Student research and academic programs are individually tailored to meet the needs and interests of each student. Graduates are prepared for positions in research or commercial laboratories or for further graduate study.

Students shall select a major adviser by the end of the first semester in residence. By the end of the first year in residence, the student and major adviser will select a supervisory committee. Students are encouraged to visit with each faculty member and spend time in each laboratory to acquaint themselves with the department's research programs.

### Degree Requirements:

The Master's program requires 24 months of full-time study, completing a minimum of 30 semester credits with an overall GPA of 3.0 or better. Students with inadequate undergraduate training in microbiology will be required to complete undergraduate courses in microbiology in addition to the required minimum 30 semester credits.

The M.S. degree in microbiology requires a research-based thesis, a public seminar of the thesis research, and a final oral defense of the thesis. The supervisory committee administers the oral thesis examination.

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## Courses Offered

**Micr 645 Animal Cell Culture Techniques 2**
Methods of animal cell culture propagation and uses for cell culture systems

**Micr 652 Microbial Ecology 3**
Influence of natural environments on microbial growth. Environmental selection and microbial succession of different species, population interactions, and environmental modification via microbial metabolism. Prereq: Micr 350, 350L.

**Micr/CFS 653 Food Microbiology 3**
Study of the nature, physiology, and interactions of microorganisms in foods. Introduction to foodborne diseases, effects of food processing on the microflora of foods, principles of food preservation, food spoilage, and foods produced by microorganisms. Prereq: MICR 202L or 350L.

**Micr/CFS 654 Bioprocessing 3**
The use of microorganisms and enzymes for processing agricultural materials into industrial products including foods, bio-fuels, and antimicrobials. Prereq: MICR 202L and Chem 260, equivalent, or graduate standing.

**Micr 660 Pathogenic Microbiology (CCN) 3**
Study of the microorganisms that cause disease and of disease processes. Prereq: Micr 202 or Micr 350.

**Micr 660L Pathogenic Microbiology Laboratory (CCN) 2**
Isolation and identification of pathogenic microorganisms. Prereq: Micr 350L.

**Safe/Micr 664 Etiology of Foodborne Illness 3**
Study of the etiology, prevention, pathogenesis, and disease manifestations of foodborne illnesses, including those caused by pathogens, allergens, toxins, and contaminants; detection of the etiologic agents and their entrance into the food chain. Prereq: MICR 202, 202L or equivalent; or permission of instructor.

**Micr 665 Fundamentals of Animal Disease 3**
Basic principles of disease processes and prevention. Comparative review emphasizing infectious related diseases in production and companion species. Regulation and oversight of animal health and welfare. Prereq: Vets 135, Biol 150, Micr 202 or 350.

**Micr 670 Basic Immunology 3**
Functions and dysfunctions of the immune system in health and disease. Prereq: MICR 350.

**Micr 671 Immunology and Serology Laboratory 2**
Basic immunological and serological procedures. Prereq: Micr 350.

**Safe/Micr 674 Epidemiology 3**
Study of the distribution and dynamics of disease in populations. Prereq: Stat 330 or permission of instructor.

**Micr 675 Animal Virology 3**
The biology of animal viruses with emphasis on virus replication and pathogenesis. Prereq: MICR 350.

**Micr 680 Bacterial Physiology 3**
Composition and function of eubacterial and archaeobacterial cell structure. Nutrition and nutrient transport in bacteria. Principles of energy-yielding carbohydrate metabolism, bacterial fermentation, and respiration. Prereq: Micr 350, 350L; Coreq: Bioc 460.

**Micr 682 Bacterial Genetics and Phage 3**
Principles of bacterial genetics and phage-host relationships. Prereq: Micr 350; Coreq: Bioc 460.

**Safe/Micr 750 Advanced Topics in Epidemiology 3**
Distribution and dynamics of disease in populations, and factors contributing to the costs of foodborne illness and its prevention. Prereq: SAFE 474/674 or equivalent; Micr 460 recommended.

**Safe//Micr/CFS 752 Advanced Food Microbiology 3**
State-of-the-art techniques in isolation, detection, and characterization of food-borne pathogens. Prereq: Micr 653 or 660L, or permission of instructor.

**Micr/Safe 762 Advanced Pathogenic Bacteriology 3**
Mechanisms by which bacteria cause infectious disease and host reactions to the disease. Prereq: MICR 460, equivalent, or instructor approval.

**Micr 770 Immunology of Chronic Infections 3**

A study of chronic infections, including pathogens involved, mechanisms of host immunity, and economic and social importance of these organisms. Prereq: Micr 470 /670

**Micr 775 Molecular Virology 3**
An in-depth study of current areas of research on human and animal viruses. The replication, pathogenesis, diagnosis, prevention, and control of viruses using contemporary molecular and cellular biology approaches will be examined. Prereq: MICR 460/660, 470/670, 475/675 or permission of the instructor.

**Micr 781 Advanced Bacterial Physiology 3**
In-depth consideration of various topics in bacterial physiology, such as autotrophy, bacterial growth and growth yields, energy-yielding metabolism, and regulation of catabolic pathways. Prereq: Micr 480/680.

**Micr 782 Molecular Microbiological Techniques 3**
Current molecular and immunologic strategies and techniques used to study infectious disease processes. Prereq: Bioc 460/461/474, Micr 471

**Micr 783 Advanced Bacterial Genetics and Phage 3**
Mechanisms of genetic rearrangement and regulation in bacteria and phage. Recombinant DNA. Prereq: Micr 482/682.

**Micr 785 Pathobiology 3**
A study of organ system pathology with attention to pathogenesis of disease and lesion development. Infectious, neoplastic, degenerative, and heritable diseases will be discussed. Emphasis is placed on animal disease. Prereq: Micr 460/660.

The following variable credit courses are also offered:

**Micr 790 Seminar 1**

**Micr 791 Special Topics 1-5**

**Micr 793 Individual Study/Tutorial 1-5**

**Micr 794 Practicum/Internship 1-8**

**Micr 696/796 Special Topics 1-5**

**Micr 797 Master's Paper 1-10**

**Micr 798 Master's Thesis 1-10**

**Micr 799 Doctoral Dissertation 1-15**



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201 Old Main
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Fax: (701) 231-6524

## Graduate Faculty

701-231-7932

**Andrew Froelich, Professor, D. M.A.**
Michigan State University, 1988

**Robert Groves, Professor, Ph.D.**
University of Iowa, 1981

**Robert Jones, Associate Professor, D.M.A.**
University of Oklahoma, 1991

**Kyle Mack, Associate Professor, D.A.**
Ball State University, 1992

**Jo Ann Miller, Associate Professor, D.M.A.**
University of Cincinnati, 1989,

**John Miller, Professor, Ph.D.**
Northwestern University, 1991

**Neil Mueller, Associate Professor, D.M.A.**
Boston University, 1999

**Warren Olfert, Associate Professor, Ph.D.**
Florida State University, 1992

**Matthew Patnode, Associate Professor, D.M.A.**
Arizona State University, 1999

**Michael Thrasher, Assistant Professor, D.M.A.**
University of North Texas, 1997

**Michael Weber, Associate Professor, D.M.A.**
University of Arizona, 1990

**Virginia Sublet, Associate Professor, D.M.A.**

# Music

## Program Description

The Department of Music offers two graduate degrees: the Master of Music and the Doctor of Musical Arts. Each degree offers tracks in Performance and Conducting.

Graduate study in music requires evidence of significant accomplishment at an undergraduate level, and equally significant musical and scholarly potential for advanced study. Accordingly, candidates for admission must

1. Hold a baccalaureate degree from a recognized institution or an equivalent international performance certificate, and demonstrate evidence of academic and communication skills that will ensure success at the graduate level.
2. Demonstrate evidence of outstanding graduate-level musical ability or potential through an audition and interview process. This will include a performance audition and diagnostic examinations in music history and theory.

As a result of the diagnostic examinations, additional course work or independent study may be required.

Applicants should prepare general NDSU Graduate School forms available in the front of this publication and arrange for an interview/audition through the Graduate Music Coordinator, Dr. Jo Ann Miller, at 701-231-7932 or Jo.Miller@NDSU.NoDak.edu.

## Financial Assistance

Assistantships are awarded to outstanding candidates after formal application to The Graduate School. Assistantship areas include Vocal Performance, Choral Studies, Instrumental Performance, Instrumental Ensembles, and Keyboard Studies. Graduate tuition is waived for students with assistantships.

# Degree Requirements

## The Master of Music Degree (M.M.)

The M.M. is the professional master's degree in music designed for three kinds of musicians: 1) performers, conductors, and music industry professionals wishing to augment and refine their skills; 2) music teachers wishing to update and increase their knowledge, especially in content areas of performance and/or conducting; and 3) those wishing to teach music at the college

University of California,1997

level.

Students in the D.M.A. program may receive the M.M. after completion of the requirements listed below, and all work taken in the M.M. may apply to parallel tracks in the D.M.A.

Recitals and a final written project are planned in conjunction with the candidate's committee, which consists of at least three graduate faculty members: the adviser, a representative from academic studies, and at least one other member at large.

All course work must be passed with a minimum grade of B. Comprehensive examinations in the student's primary focus area and in academic studies must be passed near the end of or after course work, and prior to a final oral examination by members of the candidate's committee.

Two tracks are offered: Performance and Conducting. Each requires a minimum of 30 credits.

### Master of Music in Performance (30 credits)

Musc 731 Applied Study 8
Musc 780 Recital 4
Musc 748 Music Bibliography and Research Methods 2
History/Theory: To be taken from
Musc 611, 630, 631, 734, 740, 741, 742, 743, 744 3
Musc 721 or 722 Vocal or Instrumental Pedagogy 2
Musc 709 Ensemble Performance 3
Musc 796 Special Topics (Repertoire) 3
Electives (in consultation with adviser ) 5

### Master of Music in Conducting (30 credits)

Musc 731 Applied Study 8
Musc 780 Recital 4
Musc 748 Music Bibliography and Research Methods 2
History/Theory: To be taken from
Musc 611, 630, 631, 734, 740, 741, 742, 743, 744 3
Literature: Two from Musc 760, 761, 762 (Choral Literature)
or Musc 765, 766 (Band Literature) 6
Musc 731 Applied Study (Secondary Instrument/Voice) 2
Musc 709 Ensemble Performance 2
Electives (in consultation with adviser ) 5

## The Doctor of Musical Arts (D.M.A.)

The D.M.A. is the terminal professional practical degree in music, designed for performers and conductors wishing to acquire the highest performance abilities. Graduates will have attained the academic qualifications generally accepted for teaching at the college level.

Entering students in the vocal performance track are expected to have appropriate language proficiencies in French, German, and Italian. Remedial work may be required upon recommendation of the adviser and committee.

Recitals and a final written project are planned in conjunction with the candidate's committee, which consists of at least three graduate faculty members: the adviser, a representative from academic studies, and at least one other member at large.

All course work must be passed with a minimum grade of B. Qualifying examinations in the student's primary focus area and in academic studies must be passed near the end of or after course work, and prior to a final oral examination by members of the candidate's committee. All D.M.A. graduates must have reading proficiency in at least one foreign language. For some, an

alternative such as a computer language or other research skill, if appropriate to the student's focus area, may be substituted. This proficiency will be determined and assessed by the candidate's committee. Further, students in Choral Conducting must demonstrate appropriate proficiency in foreign language diction.

Two tracks are offered: Performance and Conducting. Each track requires a minimum of 90 credits beyond the baccalaureate degree (93 for the D.M.A. in choral conducting). Students entering the program with an approved master's degree or its equivalent may apply credits toward the D.M.A. The graduate music faculty will determine the viability and number of transfer credits.

### Doctor of Musical Arts in Performance

Musc 731 Applied Study (4,4,4,4,4,4) 24
Musc 789 D.M.A. Thesis 4
Musc 780 Recital (4,4,4) 12
Musc 748 Music Bibliography and Research Methods 2
History/Theory: To be taken from
Musc 611, 630, 631, 734, 740, 741, 742, 743, 744 14
Musc 721 or 722 Vocal or Instrumental Pedagogy (2,2,2) 6
Musc 709 Ensemble Performance (1,1,1,1,1,1,1,1,1,1) 10
Musc 796 Special Topics (Repertoire) (3,3,3) 9
Electives (in consultation with adviser ) 9

### Doctor of Musical Arts in Conducting

Musc 731 Applied Study (4,4,4,4,4) 20
Musc 789 D.M.A. Thesis 4
Musc 780 Recital (4,4,4) 12
Musc 748 Music Bibliography and Research Methods 2
History/Theory: To be taken from
Musc 611, 630, 631, 734, 740, 741, 742, 743, 744 14
Musc 760, 761, 762 (Choral Literature) (3,3,3)
or
Musc 765, 766 (Band Literature) (3,3) 6-9
Musc 709 Ensemble Performance (1,1,1,1,1,1) 6
Cognate: Courses determined with adviser from
Conducting, Music Education, Performance 14
Electives (in consultation with adviser ) 12

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## Courses Offered

**611 Form and Analysis 2**
Study of tonal relationships that create musical works of art. Examination of small forms, such as motive and phrase, and progressing to large forms, such as fugue, variation, and sonata.

**630 Counterpoint 3**
Study of the contrapuntal techniques of the Renaissance and Baroque periods through analysis and composition exercises. Prereq: Musc 231 or equivalent.

**631 Contemporary Harmonic Techniques 3**
Study of harmonic and contrapuntal techniques of contemporary composers, with writing exercises in various styles. Prereq: Musc 231 or equivalent.

**701 Psychology of Music 2**

Psychological aspects of music, including acoustical, psychological, and experimental research describing the perception of music and sound.

**709 Graduate Ensemble 1**
Ensemble registration for graduate students. The study and performance of major works of each ensemble.

**721 Advanced Vocal Pedagogy and Repertoire 2**
Study of the physical and physiological considerations of vocal technique with application to specific voices and suitable repertoire.

**722 Advanced Instrumental Music Pedagogy and Literature 2**
Advanced pedagogy and literature of wind and percussion instruments. Subject matter varies by instrument.

**731 Applied Study 1-4**
Private applied music study (instrumental, keyboard, voice, conducting). Course credit determined by program and recommendation of instructor.

**734 Analytical Techniques 3**
Analysis of music of all periods, using a variety of techniques. Music to be analyzed will vary with each offering; may be repeated with permission of instructor.

**740 Medieval and Renaissance Music History 3**
Historical study of Medieval and Renaissance musical styles and genres through critical listening, discussions, and student and instructor presentations.

**741 Baroque Music History 3**
Historical study of Baroque musical styles and genres through critical listening, discussions, and student and instructor presentations.

**742 Classical Music History 3**
Historical study of Classical musical styles and genres through critical listening, discussions, and student and instructor presentations.

**743 Romantic Music History 3**
Historical study of Romantic (19th-century) musical styles and genres through critical listening, discussions, and student and instructor presentations.

**744 20th-century Music History 3**
Historical study of 20th-century musical styles and genres through critical listening, discussions, and student and instructor presentations.

**748 Music Bibliography and Research Methods 2**
Introduction to music reference works, general music bibliography, and research methods.

**760 Choral Literature, 1450-1700 3**
Choral literature of the Renaissance and early Baroque periods, including major composers, genres, forms, and compositional styles.

**761 Choral Literature, 1700-1820 3**
Choral literature of the mid-Baroque through the Classical period, including major composers, genres, forms, and compositional styles.

**762 Choral Literature, 1820-Present 3**
Choral literature of the Romantic period through the present, including major composers, genres, forms, and compositional styles.

**765 Band Literature, History and Development 3**
Historical survey of instrumental literature for wind band, covering repertoire from the Renaissance to the present.

**766 Band Literature: Chamber Music, Other Genres 3**

Survey of instrumental literature for wind band, including music for young bands, wind band and voice, wind band and solo instruments, chamber music, and other genres.

**780 Recital 4**
Preparation and presentation of a professional full-length recital in instrumental, keyboard, vocal, or conducting performance, with accompanying document.

**789 D.M.A. Thesis 4**
Preparation of the capstone written document. May be repeated.

**790 Seminar in Music History 2**
Study of a specific period, genre, or topic in music history. Involves lectures, specialized readings, score study, and listening, culminating in a research paper.

**793 Independent Study 1-3**
Guided study in particular project areas.

**794 Practicum in Music 3**
Capstone experience for the M.Ed. degree and directed study for the D.M.A. and M.M. Projects may include a recital, curriculum design, pedagogical study, written study, or other experience germane to the student's focus.

**796 Special Topics 1-5**
Repertoire or other studies specific to instruments, voice, or academic studies.



E-Mail: The Graduate School
Prospective students may schedule a visit by calling 1-800-488-NDSU.
The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701-231-8180

**Allan C. Ashworth, Ph.D.**
Professor of Geosciences,
University of Birmingham,
England, 1969

**William T. Barker, Ph.D.**
Professor of Animal and
Range Sciences,
University of Kansas, 1968

**David L. Berryhill, Ph.D.,**
Associate Professor of
Veterinary and Microbiological
Sciences,
Iowa State University, 1971

**Mario E. Biondini, Ph.D.**
Professor of Animal and
Range Sciences,
Colorado State University,
1984

**William J. Bleier, Ph.D.**
Professor of Zoology,
Texas Tech University, 1975

**Gary J. Brewer, Ph.D.**
Professor of Entomology,
Kansas State University, 1984

**Francis Casey, Ph.D.**
Assistant Professor of Soil
Science,
Iowa State University, 2000

**Gary K. Clambey, Ph.D.**
Associate Professor of Botany/
Biology
Iowa State University, 1975

**Lowell A. Disrud, M.S.**
Assistant Professor of
Agricultural and Biosystems
Engineering.
Kansas State University, 1969

# Natural Resources Management

## Program Description

The Master of Science and the Doctor of Philosophy degrees in Natural Resources Management are trans-disciplinary curricula dealing with problems of managing natural resources. Students gain a breadth of knowledge in relevant planning, analysis, and management areas while developing thorough knowledge in one of the following six area specialties: biotic resources science, environmental communication, natural resources economics, physical/earth resources sciences, pollution science, and social sciences. The trans-disciplinary program prepares students to work on problems that require assimilation of data, and methods and strategies from many supporting disciplines. Problem recognition, definition, analysis, and resolution are the ultimate learning objectives. The program prepares students to compete for, and be productive in, jobs where problems and issues extend beyond a single discipline or subject area.

After selecting one of the six area specialties, students planning a program in Natural Resources Management choose an adviser from the faculty of one of the cooperating units: Agribusiness and Applied Economics, Agricultural and Biosystems Engineering, Animal and Range Sciences, Biological Sciences, Civil Engineering, Communications, Entomology, Landscape Architecture, Plant Sciences, Sociology/Anthropology, Soil Science, Veterinary and Microbiological Sciences, and Zoology.

The educational objective of the program is to provide formal training in a chosen area of specialty, appropriate course work in analytical methods, and introductions to other subject matter areas and to provide course work, research, and writing experiences in the general area of environmental problem solving.

## Admissions Requirements

The graduate program in Natural Resources Management is open to qualified graduates of universities and colleges of recognized standing. To be admitted to the program, the applicant must:

1. Hold a baccalaureate degree from an educational institution of recognized standing. Degree requirements vary by department.
2. Have adequate preparation in specialty area and show potential to undertake advanced study and research as evidenced by academic performance and experience.
3. At the baccalaureate level, have earned a cumulative grade point average (GPA) in all courses of at least 3.0 or equivalent. Students awarded a previous graduate degree with a GPA of 3.0 or equivalent may be admitted in full standing.

**Gary A. Goreham, Ph.D.**
Professor of Sociology,
South Dakota State University, 1985

**Carolyn E. Grygiel, Ph.D., MBA, CPRM**
Director - Natural Resources Management Program
Associate Professor of Animal and Range Sciences
Colorado State University, 1983

**Robert Hearne, Ph.D.**
Assistant Professor of Agricultural Economics,
University of Minnesota, 1995

**Donald R. Kirby, Ph.D.**
Professor of Animal and Range Sciences,
Texas A & M University, 1980

**Jay A. Leitch, Ph.D.**
Professor of Agricultural Economics,
University of Minnesota, 1981

**Wei Lin, Ph.D.**
Assistant Professor of Civil Engineering,
State University of New York at Buffalo, 1992

**Mark Andrew Meister, Ph.D.**
Assistant Professor of Communication,
University of Nebraska, 1997

**Gary L. Nuechterlein, Ph.D.**
Professor of Zoology,
University of Minnesota, 1980

**G. Padmanabhan, Ph.D.**
Professor of Civil Engineering,
Purdue University, 1980

**David A. Rider, Ph.D.**
Associate Professor of Entomology,
Louisiana State University, 1988

**Dean D. Steele, Ph.D.**
Associate Professor of Agricultural and Biosystems

4. General Graduate Record Examination (GRE) scores may be recommended or required of students depending upon the department. Consult with the NRM Program Director to determine specific GRE requirements. Both general and subject GRE scores are required of all zoology applicants. TOEFL scores are required of all international applicants. Students should consult the specific department regarding these requirements.

Applications should be submitted directly to The Graduate School. Applications should specify the Natural Resources Management Program.

Official transcripts (transcripts having an appropriate seal or stamp) of all previous undergraduate and graduate records must be received by The Graduate School before the application is complete. When a transcript is submitted in advance of completion of undergraduate or graduate studies, an updated transcript showing all course credits and grades must be received prior to initial registration at NDSU.

Three letters of recommendation are required before action is taken on any application. Personal reference report forms are available from The Graduate School.

## Financial Assistance

Both research and teaching assistantships may be available through the participating academic departments. Application for financial aid must be made directly to a department. Applicants are considered on the basis of scholarship and potential to undertake advanced study and research. Limited scholarships are available. Contact the university's Financial Aid Office for information and applications.

## Degree Requirements

To qualify for the M.S. degree, the candidate must satisfactorily complete a course of study of not less than 30 semester credits and must present a thesis or comprehensive study paper. To qualify for the Ph.D. degree, the candidate must satisfactorily complete a course of study of not less than 90 semester credits (including 30 semester credits from the M.S. degree or equivalent), satisfactorily complete a written and oral preliminary examination, and present a dissertation.

Biotic resources science, environmental communication, natural resources economics, physical/ earth resources sciences, pollution science, and social sciences are areas of specialty in the program. The student will emphasize one of these areas and must earn a specified number of semester credits in the chosen area. A minimum of three semester credits should be earned in two of the other areas and in the supporting area of resource analysis. For more specific information, please refer to the Natural Resources Management Graduate Student Guidelines. A copy of these guidelines may be obtained by contacting the NRM Program Director.

The supporting areas of resource analysis include computer science, natural resources planning, mathematics, statistics, and resource systems analysis.

Most program courses are offered by individual academic departments. Suggested courses include, but are not limited to;

**Agribusiness and Applied Economics – 670, 680, 681, 701, 710, 711, 739, 741**

**Agricultural and Biosystems Engineering – 664, 682, 758, 765**

**Agricultural Systems Management – 654, 675**

Engineering
University of Minnesota, 1991

**Joshua F. Walter, M.L.A.**
Associate Professor of Landscape Architecture, Kansas State University, 1991

**Joseph D. Zeleznik,**
Extension Forester, Michigan State University, 2001

**Anthropology – 658, 662, 680**

**Animal and Range Sciences – 650, 652, 656, 658, 660, 716, 717, 765**

**Botany/Biology – 660, 671, 672, 680, 714, 716, 717, 720, 762, 764, 782**

**Civil Engineering – 672, 675, 677, 678, 770, 776**

**Computer Science – 653, 658, 668, 728, 734, 737, 765**

**Economics – 661, 670, 672, 681, 741, 743**

**Entomology – 731, 732, 742, 750, 765, 770**

**Environmental Communications – 611, 636, 642, 643, 700, 755, 767**

**Geosciences – 612, 613, 614, 628, 640, 650, 655**

**Industrial and Manufacturing Engineering – 640, 660**

**Microbiological Sciences – 645, 652, 653, 670, 671, 675, 680, 682, 750, 752, 762, 770, 775, 781, 782, 783, 785**

**Philosophy – 681**

**Plant Pathology – 655, 656**

**Plant Sciences – 653, 665, 686, 724, 734, 753, 763**

**Political Science – 620, 621, 642**

**Social Sciences – 603, 605, 609, 610, 612, 613, 620, 622, 631, 639, 643, 645, 665, 700, 701, 723**

**Soil Science – 610, 644, 647, 655, 680, 763, 784, 785**

**Statistics/Mathematics – 660, 661, 662, 663, 725**

**Zoology – 652, 654, 656, 658, 660, 662, 664, 670, 672, 674, 675, 676, 682, 720, 760, 770, 776**

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## Courses Offered

**653 Rangeland Resource/Watershed Management 3**
Study of the management of physical/biological settings and processes along with human activities on water and watersheds considering preventative and restorative strategies in a rangeland setting.

**690 Graduate Seminar - Natural Resources Management 1-3**
Employment of problem-based learning on topics relating to natural resources management. Prereq: Graduate standing.

**701 Terrestrial Resources Management 3**
Management and ecology of heterogeneous landscapes where ecosystem processes and human activities interact as dynamic components. Prereq: BOT 660 and 764, or program director approval.

**702 Natural Resources Management Planning 3**
Presentation of the principles, practices, and key policy issues of natural resources management and planning. Prereq: NRM 701, or program director approval.

**720 Natural Resources Administration and Policy 2**
A comprehensive analysis of the theory of externalities and their application to the design of natural resources policy. Prereq: Econ 681, NRM 702, or program director approval.

**730 Environmental Law 3**
Overview of the subject of environmental law.

**731 NEPA and Environmental Impact Assessment 2**
The interaction and effects of NEPA with national environmental policy, implementation of NEPA, public opinion on the state of the environment.

**732 Environmental Impact Statement 2**
An in-depth review of EISs, including instruction and practice in the preparation of an EIS.



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201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

218-477-4699 / 5877

**Sandra Alberty, MSN**
University of Mary, 2001

**Jane Bergland, Ph.D.**
UND, 2002

**Amy Fisher, MA**
College of St Catherine, 1992

**Jane Giedt, Ph.D.**
Wayne State University, 1999

**Beverly Greenwald, Ph.D.**
North Dakota State University, 1990

**Carla Gross, MSN**
University of Kentucky, 1987

**Dean Gross, DNSc**
Rush University, 1998

**Norma Kiser-Larson, Ph.D.**
University of Minnesota, 1999

**Polly Kloster, Ph.D.**
Oregon Health Sciences University, 2000

**Tina Lundeen, MS**
University of Minnesota, 1995

**Barbara Matthees, Ph.D.**
University of Minnesota, 2001

**Marjorie McCullagh, Ph.D.**
University of Michigan, 1999

**Mary Margaret Mooney, DNSC**
Catholic University of America, 1980

**Linda Scott, Ed.D.**

# Nursing


## Program Description

Through the Tri-College University Nursing Consortium, the Department of Nursing offers graduate study leading to the Master of Science degree. The Doctor of Nursing Practice degree, a clinical doctorate, is also offered in the Family Nurse Practitioner specialty. An individually tailored program of study is available for the advanced practice nurse with a master's degree.

The program includes advanced nursing courses, support courses, clinical practica and disquisition (comprehensive study or thesis). Master's degrees offered are in: Family Nurse Practitioner, Clinical Nurse Specialist in Adult Health, Nurse Educator, Parish Nurse Specialist and Transcultural Nurse Specialist.

Guidelines provided by the American Association of Colleges of Nursing (AACN), National Organization of Nurse Practitioner Faculties (NONPF), National Association of Clinical Specialists ( NACNS) and American Nurses Credentialing Center (ANCC) are utilized in the curriculum. The Tri-College University graduate nursing program is accredited by the Commission on Collegiate Nursing Education (CCNE).

## Admission Requirements

1. Baccalaureate degree in nursing from a nationally accredited nursing program.
2. Undergraduate and other transcripts sent directly from the institution to The Graduate School.
3. GPA of 3.0.
4. Undergraduate coursework in research and health assessment.
5. Current unencumbered RN licensure
6. Completed application to The Graduate School.
7. Three references: two from professional colleagues that address clinical competence and potential for graduate education, and one other reference.
8. Written narrative of professional experience and future goals.
9. Non-refundable $35 fee and $10 Program fee.
10. Interview, if requested. (Interview required for all FNP applicants.)

University of South Dakota, 1992

**Barbara Vellenga, Ph.D.**
University of Austin, 1989

## Degree Requirements

1. **Clinical Nurse Specialist in Adult Health:** A minimum of 44-48 (MS) semester credits.

   **Family Nurse Practitioner:** A minimum of 54-58 (MS) or a minimum of 84 (DNP) semester credits.

   **Nurse Educator:** A minimum of 36 (MS) semester credits.

   **Parish Nurse Specialist:** A minimum of 44-48 semester credits.

   **Transcultural Nurse Specialist:** A minimum of 44-48 semester credits.

2. A maximum of nine graduate semester credits (with a grade of B or better) completed within seven years previous to admission, may be transferred from other regionally accredited colleges or universities with the consent of the student's supervisory committee.
3. 3.0 grade point average.
4. Thesis or Comprehensive study.

# M.S. Degree in Nursing

## Core Requirements (16-20 credits)

**Nurs 601 Theoretical Perspectives of the Discipline 2**

**Nurs 602 Ethics of Healthcare and Nursing 2**

**Nurs 604 Advanced Nursing Research 3**

**Nurs 606 Healthcare Delivery Systems, Policy, and Financing 2**

**Nurs 608 Transcultural and Social Perspectives 3**

**Nurs 620 Advanced Practice Roles 2**

**Nurs 797 Master's Comprehensive Study 2-4 or**
**Nurs 798 Master's Thesis 6**

## Clinical Nurse Specialist in Adult Health Requirements (28 credits)

**Nurs 612 Advanced Health Assessment 3**

**Nurs 614 Advanced Pathophysiology I: Concepts 2**

**Nurs 616 Advanced Pathophysiology II: Systems 2**

**Nurs 620 Advanced Practice Roles 2**

**Nurs 630 Advanced Community Assessment 3**

**Nurs 631 Advanced Pharmacology I 2**

**Nurs 632 Advanced Pharmacology II 2**

**Nurs 640 Adult Nursing I 3**

**Nurs 640P Advanced Nursing Practicum I 4**

**Nurs 641 Adult Nursing II 3**

**Nurs 641P Advanced Nursing Practicum II 4**

## Family Nurse Practitioner Requirements (MS: 38 credits)

Prior to beginning clinical courses, this track requires Advanced Cardiac Life Support (ACLS) certification.

**Nurs 612 Advanced Health Assessment 3**

**Nurs 612P Practicum I: Advanced Health Assessment 3**

**Nurs 614 Advanced Pathophysiology I: Concepts 2**

**Nurs 616 Advanced Pathophysiology II: Systems 2**

**Nurs 618 Family Nursing Theory and Health Promotion 3**

**Nurs 620 Advanced Practice Roles 2**

**Nurs 620P Practicum IV: FNP Role Integration 4**

**Nurs 630 Advanced Community Assessment 3**

**Nurs 631 Advanced Pharmacology I 2**

**Nurs 632 Advanced Pharmacology II 2**

**Nurs 633 Family Primary Care I: Assessment & Management 3**

**Nurs 633P Practicum II: Family Primary Care I 4**

**Nurs 634 Family Primary Care II: Assessment & Management 3**

**Nurs 634P Practicum III: Family Primary Care II 4**

**Nurs 797 Master's Paper 2 or**
**Nurs 798 Master's Thesis 6**

## Nurse Educator Requirements (28-29 credits)

**Nurs 612 Advanced Health Assessment 3**
**OR Nurs 630 Advanced Community Assessment 3**

**Nurs 614 Advanced Pathophysiology I 2**
**OR Nurs 616 Advanced Pathophysiology II 2**
**OR Nurs 621 Integrative Health Practices 3**

**Nurs 622 Teaching: Tech. Mgmt 3**

**Nurs 623 The Nurse as Educator 4**

**Nurs 627 Nurse Program / Curriculum Design & Evaluation 3**

**Nurs 640P Advanced Nursing Practicum I 3**

**Nurs 641P Advanced Nursing Practicum II 3**

**Nurs 793 Independent study in clinical specialty 4**

**Specialty Electives: approved cognate courses 3**

## Parish Nurse Specialist Requirements (24 credits)

Prior to beginning clinical courses, this track requires completion of a parish nurse preparation program based on the standardized core curriculum endorsed through the International Parish Nurse Resource Center.

**Nurs 620 Advanced Practice Roles 2**

**Nurs 621 Integrative Health Practices 3**

**Nurs 625 Advanced Parish Nursing 3**

**Nurs 626 Ethical Considerations of Parish Nursing 3**

**Nurs 630 Advanced Community Assessment 3**

**Nurs 640P Advanced Nursing Practicum I 3**

**Nurs 641P Advanced Nursing Practicum II 3**

**Specialty Electives: approved religion courses 6**

**Nurs 797 Master's Paper 2 or**
**Nurs 798 Master's Thesis 6**

## Transcultural Nurse Specialist Requirements (21-24 credits)

**Nurs 620 Advanced Practice Roles 2**

**Nurs 621 Integrative Health Practices 3**

**Nurs 624 Advanced Transcultural Nursing 3**

**Nurs 630 Advanced Community Assessment 3**

**Nurs 640P Advanced Nursing Practicum I 3**

**Nurs 641P Advanced Nursing Practicum II 3-6 [out of area]**

**Specialty Electives: approved transcultural courses 6**

**Nurs 797 Master's Paper 2 or**
**Nurs 798 Master's Thesis 6**

## Family Nurse Practitioner Requirements (DNP)

**601 Theoretical Perspectives/Discipline 2**

**606 Care Delivery/Policy/Financing 2**

**602 Ethics 2**

**604 Research 3**

**630 Advanced Community Assessment 3**

**685 Economic Outcomes Assessment 2**

**725 Applied Statistics 3**

**Communication Elective 3**

**Family Theory Elective 3**

**Life-span Development Elective 3**

**612 Advanced Health Assessment 3**

**712P Assessment Practicum 6**

**614 Advanced Pathophysiology I 2**

**616 Advanced Pathophysiology II 2**

**632 Pharmacology I 2**

**632 Pharmacology II 2**

**633 Family Primary Care I 3**

**710 Health Promotion/Disease Prevention 2**

**733P Family Primary Care: Residency I 8**

**634 Family Primary Care II 3**

**734P Family Primary Care: Residency II 8**

**720 Advanced Practice Roles 2**

**730 Clinical Applications 3**

**735P Role Integration Practicum 8**

**797S Comprehensive Study 4**

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## Courses Offered

**601 Theoretical Perspectives of the Discipline 2**
The course is designed to help the student analyze, critique, and apply a variety of nursing theories, models, and conceptual frameworks in advanced nursing practice.

**602 Ethics of Healthcare and Nursing 2**
The course provides the graduate nursing student with opportunities to analyze interactions among common clinical, organizational, societal, and policy decisions from ethical and legal perspectives.

**604 Advanced Nursing Research 3**
Research in Nursing includes an exploration of the research process and the methodologies appropriate to nursing.

**606 Healthcare Delivery Systems, Policy, and Financing 2**
Focus on healthcare delivery systems configuration, policy development, and how healthcare systems are financed.

**608 Transcultural and Social Perspectives 3**
Develop an understanding of diversities in races, cultures, individuals, families, communities, populations, lifestyles, gender, and age groups. Changing demographics will be analyzed, major health needs identified, and health promotion and disease prevention plans formulated.

**612 Advanced Health Assessment 3**
Performance of health histories, complete physical/psychosocial assessments, and developmental assessments of clients across the lifespan. A laboratory component is included.

**612P Practicum I: Advanced Health Assessment 3**
Clinical opportunities for application of recently learned skills and extended clinical experiences in advanced health assessment. Clinicals are supervised by a healthcare provider who has documented expertise in the area of specialization.

**614 Advanced Pathophysiology I 2**
General pathophysiological responses to selected body systems to disease processes are presented from both biological and behavioral perspectives. Emphasis on normal cellular function, developmental changes, and common physiological symptoms.

**616 Advanced Pathophysiology II 2**
Builds on the content from Nurs 614 with emphasis on normal cellular function,

developmental changes and common physiological symptoms. Synergistic clinical manifestations and total body-mind responses to system alterations. Prereq: Nurs 614.

**620 Advanced Practice Roles 2**
Focus on the advanced practice nurse's role expectations. Includes an understanding of the profession, regulations and rules of advanced practice, scope of practice, legal ramifications of scope of practice, interdisciplinary, collaborative practice. Prereq: Nurs 634P and 641P.

**620P Practicum IV: FNP Role Integration 4**
Clinical focus on the advanced practice nurse's role expectations in the primary care setting. Includes an understanding of the profession, regulations and rules of advanced practice, scope of practice, legal ramifications of scope of practice, and interdisciplinary, collaborative practice. Prereq: Nurs 634P and 641P.

**621 Integrative Health Practices 3**
Integrative therapies with a focus on selected systems of health and specific modalities widely used by healthcare consumers. Emphasis on assessing patients for use and developing a list of educational and provider resources.

**623 The Nurse as Educator 4**
Major study in a selected area with an emphasis in research. Prereq: Nurs 622P and 632.

**624 Advanced Transcultural Nursing 3**
Program planning to promote the health of diverse populations will be based on epidemiological data, theory, and research. Students will select a specific age group or health problem within a population/cultural group to study in depth. Prereq: Nurs 608.

**625 Advanced Parish Nursing 3**
Emphasis is placed on the mind-body-soul connection with health and healing. Strategies for designing, implementing, and evaluating a parish nursing program, along with administrative implications are explored. Prereq: Nurs 616, and 618.

**626 Ethical Considerations of Parish Nursing 3**
Ethical and legal considerations unique to an advanced parish nursing practice are evaluated and protocols recommended. Theoretical applications, research findings, and policy and legal principles are utilized. Parameters of advanced nursing practice in parish settings will be delineated. Prereq: Nurs 602.

**630 Advanced Community Assessment 3**
Epidemiologic techniques, reporting, and research will be presented. Emphasis is placed on disease prevention and control. Health problems of national and international significance will be examined, and strategies for solutions and/or management will be proposed. Prereq: Stat 330.

**631 Advanced Pharmacology I 2**
Information relative to therapeutic management guidelines for treatment of selected disease processes. Drug information by classification and basic principles of pharmacodynamic and pharmacokinetics, clinical uses, mechanisms of action, contraindications, adverse reactions, and client education implications.

**632 Advanced Pharmacology II 2**
Continuation of information relative to therapeutic management guidelines for treatment of selected disease processes. Drug information by classification and basic principles of pharmacodynamic and pharmacokinetics, clinical uses, mechanisms of action, contraindications, adverse reactions, and client education implications. Prereq: Nurs 631.

**633 Family Primary Care I: Assessment and Management 3**
Clinical decision-making skills are fostered in the diagnosis, management, monitoring, and evaluation of common acute, emergent, and chronic health conditions. Selected case studies of clients will be examined in relation to problems, diagnoses, plans, and evaluations. Prereq: Nurs 612, 612P, and 616.

**633P Practicum II: Family Primary Care I 4**
Clinical opportunities for application of recently learned skills and extended clinical experiences in advanced health assessment. Theory, research, and didactic learning experiences are incorporated and supervised by a healthcare provider with expertise in the area of specialization. Prereq: Nurs 631 and 633.

**634 Family Primary Care II: Assessment and Management 3**
Clinical decision-making skills are fostered in the diagnosis, management, monitoring, and evaluation of common acute, emergent, and chronic health conditions. Selected case studies of clients will be examined in relation to problems, diagnoses, plans, and evaluations. Prereq: Nurs 633.

**634P Practicum III: Family Primary Care II 4**
Clinical opportunities for application of clinical experiences in advanced health assessment. Theory, research, and didactic learning experiences are incorporated in the student practice and supervised by a healthcare provider with expertise in the area of specialization. Prereq: Nurs 632 and 634.

**640 Adult Nursing I 3**
Evaluation and synthesis of advanced pathophysiology concepts applied to nursing and health-related theories, and research related to client outcomes. Health and illness phenomena, symptom management, and nursing interventions will be reviewed. Prereq: Nursing 612 and 616.

**640P Advanced Nursing Practicum I 3-6**
Clinical opportunities for application of clinical experiences in a primary care setting. Theory, research, and didactic learning experiences are incorporated in the student's practice and supervised by a healthcare provider with expertise in the area of specialization. Prereq: Nurs 640.

**641 Adult Nursing II 3**
Continuation of Adult Nursing I. Emphasis on clinical decision making, teaching/learning theory, and formulation of researchable questions for advanced nursing practice as an adult CNS. Prereq: Nurs 640.

**641P Advanced Nursing Practicum II 3-6**
An extended practicum time allowing the student a chance to more fully integrate skills and knowledge learned through the graduate program. Emphasis will continue on consultation, program planning, education, health promotion, and prevention of disease/illness. Prereq: Nurs 641.

**696 Special Topics 1-5**
Special topics related to specific areas of study. May be interdisciplinary in nature and may be repeated under various topics. Prereq: Graduate Status.

**793 Independent Study 1-4**

**797 Master's Comprehensive Study 2-4**
A project is selected which will contribute to the student's preparation for advanced practice in nursing. A committee comprised of three faculty members is chosen: two from nursing (one who serves as adviser) and one faculty member from a related field. A final examination is required. Prereq: Nurs 601, 602, 604; Approval of advisory committee.

**798 Thesis in Nursing 6-10**
Major study in selected area with an emphasis in research. The thesis research is carried out under the supervision of a nursing faculty adviser. Three other faculty members serve as committee members, one from nursing and one from outside of the department in a related field. The final examination is an oral defense of the thesis. Prereq: Nurs 601, 602, and 604.

**710 Health Promotion/Disease Prevention 2**
Critically examines patterns of health behaviors, lifestyle, developmental stages and psychosocial, cultural and spiritual contributions to well being. Includes data-based

assessment and management of preventive health services.

**712P Assessment Practicum 6**
In this course the student integrates health history, physical examination and laboratory evaluations in a plan for management of client needs. Prerequisite:612.

**720 Advanced Practice Roles 2**
Scope of practice, legal parameters of advanced practice, collaborative and interdisciplinary practice in the advanced nursing role. Prerequisites: 601, 602, 606.

**730 Clinical Applications 3**
Student designs individualized study in an area of focus. Options include extension of a scholarly study, extended clinical practice, intensive study of specialized treatment modality and other appropriate foci. Prerequisite: 634.

**733P Family Primary Care: Residency I 8**
Student synthesizes skills acquired in previous didactic and clinical courses to provide diagnosis, treatment, and management of an increasingly varied group of clients. Prerequisite/Corequisite: 633.

**734P Family Primary Care: Residency II 8**
Student synthesizes skills acquired in previous didactic and clinical courses, in particular NURS 733P, to provide diagnosis, treatment, and management of an increasingly varied group of clients. Prerequisite/Corequisite: 733P, 633.

**735P Role Integration 8**
Focus is on the role of the advanced practice nurse in the primary care setting. Prerequisite: 733P.

**797S Comprehensive Study**
Demonstration of ability to produce independent scholarly work pertinent to advanced nursing practice. Prerequisite: 601, 604.



E-Mail: The Graduate School
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The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701-231-7661

**Stefan Balaz, Ph.D. , D.Sc.**
Slovak Technical University, Bratislava, Slovakia, 1986
Postdoctorals:
Institute for Experimental Biology and Medicine, Borstel, Germany, 1988-89; University of Minnesota, Minneapolis, 1996
Research Interests:
Subcellular, Pharmacokinetics and Quantitative Structure-Time-Activity Relationships

**Satadal ChatterjeePh.D. (Physics)**
Saha Institute of Nuclear Physics, University of Calcutta 1986
Post-Doctorals:
Department of Medicine, Case Western Reserve University, Cleveland, Ohio 1985-1989
Research Interests:
Developmental therapeutics pertaining to cancer and cancer chemoprevention

**Bin Guo, Ph.D.**
State University of New York at Buffalo, 1999.
Postdoctoral:
Burnham Institute, La Jolla, CA. 1999 - 2003
Research interests:
Molecular and cell biology of apoptosis; cancer pharmacology.

**Anne Hinderliter, Ph.D.**
Cornell University, 1994
Postdoctoral:
University of Virginia, Charlottesville, 1994-2000
Research Interests:
Role of Membrane Domains in Regulating Signal Transduction Events

# Pharmaceutical Sciences

## Program Description

The Department of Pharmaceutical Sciences offers graduate study leading to the Master of Science and Doctor of Philosophy degrees. Advanced work may be selected from pharmaceutics, pharmacokinetics, pharmacology, and medicinal chemistry.

The pharmaceutical sciences curriculum consists of a core of courses involving both basic and pharmaceutical sciences. In addition, students will select courses that will prepare them to be competent scientists in their fields.

## Admissions Requirements

The Department of Pharmaceutical Sciences graduate program is open to all qualified graduates of recognized universities and colleges. To be admitted to the program with full status, the applicant must

1. Hold a baccalaureate degree from an educational institution of recognized standing.
2. Have adequate preparation in pharmacy or a biological or physical science related to pharmaceutical sciences.
3. At the baccalaureate level, have earned a cumulative grade point average (GPA) of at least 3.0 or equivalent.
4. Have three letters of recommendation sent to The Graduate School. Personal reference report forms are available from The Graduate School. Action is taken only on complete applications.
5. GRE (Graduate Record Exam) test required.

International students are required to provide a financial report and provide official TOEFL and Graduate Record Examination general tests scores. Action is taken only on complete applications.

Applications should be submitted directly to The Graduate School before April 1 of the upcoming academic year. However, applications will be considered when they are received. Additional information concerning the program is available from the department chair and at our Web site: www.ndsu.edu/pharmsci.

Students who do not meet all admissions requirements, but show potential for successful

**Sanku Mallik, Ph.D.**
Case Western Reserve University, 1992
Postdoctoral:
California Institute of Technology, 1993-95
Research Interests:
Synthetic medicinal chemistry

**Stephen T. O'Rourke, Ph.D.**
University of Wisconsin, 1985
Postdoctoral:
Mayo Clinic and Foundation, 1985-87
Research Interests:
Vascular Pharmacology

**Steven Qian, Ph.D.**
The University of Iowa, 1999
Postdoctoral:
National Institute of Environmental Health Science (NIEHS, NIH) 2000-2004
Research Interests:
Roles of lipid-derived and protein-derived free radical metabolites in all kinds of health related problems

**R. Craig Schnell, Ph.D.**
Purdue University, 1969
Provost and Vice President for Academic Affairs

**Jonathan Sheng, Ph.D.**
State University of New York at Albany, 1998
Postdoctoral:
University of Iowa 1998-2003
Research Interests:
Molecular pharmacology/ toxicology; drug and xenobiotic metabolism

**Jagdish Singh, Ph.D.**
Banaras Hindu University, Varanasi, India, 1982
Postdoctoral:
University of Otago, New Zealand, 1985-88; University of California--San Francisco, 1992-94
Research Interests:
Novel Dosage and Drug Delivery Systems, Biopharmaceutics

graduate study, may be considered for admittance in a conditional status. Evidence must be provided showing that the applicant's potential is not adequately reflected by his/her record. After demonstrating adequate performance at North Dakota State University, the student, in consultation with the major adviser, may request a change to full graduate standing. The student may not earn more than 12 semester credits of graduate course work while in conditional status.

Official transcripts (transcripts having an appropriate seal or stamp) of all previous undergraduate and graduate records must be received by The Graduate School before the application is complete. When a transcript is submitted in advance of completion of either undergraduate or graduate studies, an updated transcript showing all course credits and grades must be provided prior to initial registration at NDSU.

## Financial Assistance

A limited number of assistantships is available. To be considered for an assistantship, the student must have completed a Graduate School application, be accepted by the department, and submit a formal letter to the department chair requesting an assistantship.

## Degree Requirements

The Master of Science program requires the completion of 17 semester credits of letter-graded course work with a GPA of 3.0 or better.

The department requires the following core courses:

**PSci 611 Pharmacodynamics and Applied Therapeutics I**

**PSci 670 Pharmacokinetics**

**PSci 790 Graduate Seminar**

**Bioc 701 Comprehensive Biochemistry I**

**Bioc 702 Comprehensive Biochemistry II**

**Stat 725 Applied Statistics**

For M.S. candidates, an oral defense of a research-based thesis and academic subject matter is required. Candidates for the Ph.D. will be required to take an examination directed at determining competency in the pharmaceutical sciences.

The Doctor of Philosophy program requires the completion of 30 semester credits of letter-graded course work with a GPA of 3.0 or better. Candidates defend their dissertations.

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# Courses Offered

**411/611 Pharmacodynamics and Applied Therapeutics I 3**
An introduction to basic physical, chemical, and pharmacological principles that are important in the study of various properties of drugs and drug-receptor interactions. Prereq: PSci 341 and Bioc 461/department approval.

**412/612 Pharmacodynamics and Applied Therapeutics II 3**
The pharmacological properties of therapeutic agents used in the treatment of cancer and infectious diseases. Aspects of the physiology, chemistry, pharmacology, and the

toxicology related to understanding the therapeutic use of these agents. Prereq: PSci 341 and Bioc 461/departmental approval.

**413/613 Pharmacodynanics and Applied Therapeutics III 3**
The pharmacological properties of therapeutic agents used in the treatment of disorders of the autonomic nervous system and endocrine system diseases. Aspects of the physiology, chemistry, pharmacology, and the toxicology related to understanding the therapeutic use of these agents. Prereq: PSci 411 or 611.

**414/614 Pharmacodynamics and Applied Therapeutics IV 3**
The pharmacological properties of therapeutic agents used in the treatment of disorders of physiology, chemistry, pharmacology, and the toxicology related to understanding the therapeutic use of these agents. Prereq: PSci 411/611.

**415/615 Pharmacodynamics and Applied Therapeutics V 3**
The pharmacological properties of therapeutic agents used in the treatment of disorders of the pulmonary and GI systems, and other miscellaneous agents. Aspects of the physiology, chemistry, pharmacology, and the toxicology related to understanding the therapeutic use of these agents. Prereq: PSci 411/611.

**416/616 Pharmacodynamics and Applied Therapeutics VI 3**
The pharmacological properties of therapeutic agents used in the treatment of disorders of the central nervous system. Aspects of the physiology, chemistry, pharmacology, and the toxicology related to understanding the therapeutic use of these agents. Prereq: PSci 411/611.

**643 Toxicology 2**
Poisons, their mode of action, detoxification, and treatment. Prereq: PSci 411/611.

**670 Pharmaceutics III: Pharmacokinetics 3**
Concepts and mathematical techniques for describing the time course of drugs in biological systems.

**701 Quantitative Drug Design 2**
Modeling of drug disposition and receptor binding with focus on rational development of new drugs and elucidation of action mechanisms.

**703 Drug Metabolism 2**
Drug biotransformations and their effects on drug properties such as duration of action, potency, toxicity, and specificity. Prereq: Bioc 701, 702.

**718 Techniques in Pharmaceutical Research 3**
Application of modern instrumental techniques in the pharmaceutical sciences; qualitative and quantitative determination of physiologically and pharmacologically important substances.

**741 Techniques of Pharmacological Research 3**
Techniques of long-term pharmacological investigation and experimentation.

**746 Neuropharmacology 3**
Study of action mechanisms of drugs affecting the central and peripheral nervous systems.

**747 Cardiovascular Pharmacology 3**
Study of action mechanisms of drugs affecting the circulatory systems, including their pathology.

**762 Advanced Biopharmaceutics 2**
Stability and kinetic factors involved in absorption, distribution, metabolism, and excretion of drug products. Prereq: PSci 470/670.

The following variable credit courses are also offered:

**790 Graduate Seminar 1-3**

**793 Individual Study/Tutorial 1-5**

**696/796 Special Topics 1-5**

**798 Master's Thesis 1-10**

**799 Doctoral Dissertation 1-15**



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Fax: (701) 231-6524

## Graduate Faculty

701-231-8974

**Alan R. Denton, Ph.D.**
Cornell University, 1991
Postdoctoral, University of Guelph, 1991-94; Technical University of Vienna, 1994-95, Research Center Julich, 1996-98
Research Interests: Soft Condensed Matter Theory, Computational Physics

**Ghazi Q. Hassoun, Ph.D. (emeritus)**
University of Minnesota, 1963
Postdoctoral, University of Michigan, 1963-65
Research Interests: Foundations of Quantum Mechanics

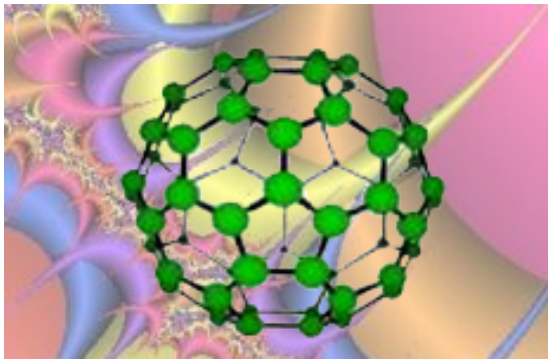
**Daniel M Kroll, Department Head.Ph.D.**
Chicago, 1973.
Research Interests: Theoretical and Computational Modeling of Complex Fluids and Biomembranes.

**Charles A. Sawicki, Ph.D.**
Cornell University, 1975
Postdoctoral, Cornell University, 1975-79
Research Interests: Acoustics, Biophysics, Geophysics

**Mahendra K. Sinha, Ph.D. (Emeritus)**
Pennsylvania State University, 1961
Postdoctoral, National Research Council (Ottawa), 1964-66
Research Interests: Field Emission and Field-Ion Microscopy

**Orven Swenson, Ph.D.**
Air Force Institute of Technology, 1982
Research Interests: Laser Ionization Detection, Optics

# Physics



## Program Description

The Department of Physics offers graduate study leading to the M.S. and Ph.D. degrees. Advanced work may involve specialized training in the following areas: biophysics, computational physics, condensed matter, laser applications, optics, particle physics, soft matter, and statistical mechanics.

Research and academic programs are tailored to meet individual needs and interests. Soon after their arrival, new students are strongly urged to visit faculty members to discuss research opportunities.

## Admissions Requirements

The Department of Physics graduate program is open to all qualified graduates of universities and colleges of recognized standing. To be admitted with full status to the program, the applicant must

1. Hold a baccalaureate degree from an educational institution of recognized standing.
2. Have adequate preparation in physics, showing potential to undertake advanced study and research as evidenced by academic performance and experience.
3. Have earned a cumulative grade point average (GPA) in all courses of at least 3.0 or equivalent at the baccalaureate level. The student with a GPA of 3.0 or equivalent in a previous graduate degree program may be admitted in full standing.

Students who do not meet all requirements for admission or have deficiencies in prerequisite course work, but show potential for successful graduate study, may be admitted under a conditional status. Evidence must be provided showing that the applicant's potential is not adequately reflected by his/her record. After meeting the specified standards of performance by the department, the student, in consultation with the major adviser, may request a change to full graduate standing. The student may not earn more than 12 semester credits of graduate credit in the conditional status. The request for change must be submitted to the Dean of The Graduate School by the major adviser after approval by the department chair.

Applications should be submitted directly to The Graduate School before March 1 for admission in Fall Semester, and before September 1 for admission in Spring Semester. Early applications are encouraged. However, late applications may receive consideration.

Official transcripts (transcripts having an appropriate seal or stamp) of all previous undergraduate and graduate records must be received by The Graduate School before the application is complete. When a transcript is submitted in advance of completion of

**Alexander J. Wagner, Ph.D.**
University of Oxford, 1997
Postdoctoral MIT, 1998-2000, Edinburgh, 2000-2002
Research Interests: Computational Soft Matter Physics

**Gary D. Withnell, Ph.D. (adjunct)**
North Dakota State University, 1980
Research Interests: Biophysics

**Thomas Ihle, Ph.D.**
Aachen, 1996.
Research Interests: Theory and Simulation of Complex Fluids (Colloids and Biopolymers).

**Sylvio May, Ph.D.**
Jena, 1997.
Research Interests: Theoretical and Computational Biophysics.

undergraduate or graduate studies, an updated transcript showing all course credits and grades must be provided prior to initial registration at NDSU.

Three letters of recommendation are required before action is taken on any application. Personal reference report forms are available from The Graduate School.

The TOEFL examination is required of international applicants. A minimum score of 550 (paper test) or 213 (computer test) is required.

The Graduate Record Examination (Subject and/or General Tests) is strongly recommended for all students.

## Financial Assistance

The student must apply to The Graduate School and be accepted in full or conditional status before being eligible for an assistantship in the Department of Physics.

Generally, graduate students are supported during the academic year by either teaching assistantships or research assistantships. The 2003-2004 academic year stipend was approximately $12,000 for 9 months, plus an additional enhancement of $3,600 is usually available. Additional support during the summer is also possible. Graduate tuition is fully waived for all teaching assistants and research assistants.

## Degree Requirements

### Master of Science

The M.S. program requires the completion of at least 30 graduate credits, numbered 601-798:

1. 18 or more must be in physics courses numbered 700-789.
2. Between 6 and 10 are in Phys 798.
3. No more than 6 credits are in courses numbered 601-689.
4. No more than 6 credits are in non-physics courses.

Each student selects an adviser by the end of the second semester. Soon after beginning M.S. research, a supervisory committee is selected. After the course work and research are completed (typically at the end of the second year), the student writes a thesis on the research performed. The candidate must then successfully defend the thesis before the supervisory committee.

### Doctor of Philosophy

The Ph.D. program requires the completion of at least 90 graduate credits, numbered 601-799. Credits used to satisfy the requirements for the M.S. degree may be included in the total:

1. 27 or more must be in letter-graded courses.
2. 21 are the required physics courses (752, 755, 758, 761, 771, 772, 781).
3. No more than 4 credits are in courses numbered 601-689.
4. No more than 12 credits are in non-physics courses.

Soon after beginning Ph.D. research under the direction of an adviser, an advisory committee is selected. The student must pass a comprehensive exam which tests proficiency as taught at the graduate level. This exam must be taken by the beginning of the third semester of Ph.D. study. After the course work and research are completed (typically three years after passing of the comprehensive exam), the student writes a dissertation on research work. The candidate must then successfully defend the dissertation before the advisory committee.

## Research Equipment

The following equipment is available for research: global positioning system, picotesla magnetometry equipment, work stations; Beowulf computer cluster; high power dye, Nd:YAG, titanium: sapphire lasers; immediate access to scanning electron microscope; low- and high-field NMR; and X-ray powder diffractometer.

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# Courses Offered

**611 Optics for Scientists and Engineers 3**
Introduction to modern optics. Geometric optics, electromagnetic nature of light, polarization, interference, diffraction, fiber optics. Corequisite laboratory with major related optics project. Prereq: Phys 252. Coreq: Phys 611L.

**611L Optics for Scientists/Engrs. Lab. 1**
Required laboratory for Physics 611. Ten optics experiments plus a major related project. Prereq: Phys 252. Coreq: Phys 611.

**615 Elements of Photonics 3**
Analysis of optical systems using the matrix formulation, wave propagation in anisotropic media, electro-optic effect and laser modulation, physical origin of optical nonlinearities, phase matching, optical second harmonic and parametric generation. Prereq: Phys 252.

**662 Heat and Thermodynamics 3**
Classical principles and laws of thermodynamics. Cyclic processes and entropy functions. Legendre differential transformations. Clausius equations, and principles of Maxwell's equations. Prereq: Phys 252.

**663 Statistical Mechanics 2**
The Maxwell-Boltzmann distribution function and its applications to thermodynamic problems. Introduction to Bose-Einstein and Fermi-Dirac statistics. Prereq: Phys 462.

**671 Advanced Laboratory 2**
Advanced laboratory in modern physics: experiments such as electron diffraction, nuclear spectroscopy, magnetic domains, and bubbles. Data analysis and fitting and solutions of differential equations using Math CAD software package.

**685 Modern Physics I 3**
Operators, one-dimensional wells and barriers, Schrodinger equation, uncertainty, duality, Born interpretation, unstable states, bosons and fermions, central force problems, angular momentum, spin. Prereq: Phys 252, Math 266.

**686 Modern Physics II 3**
Continuation of Physics 685. Perturbation theory, angular momentum addition, variational schemes, WKB method, scattering theory, time-dependent problems. Prereq: Phys 485/685.

**752, 753 Mathematical Methods in Physics I, II 3 each**
See Mathematics 782, 783 for description. Prereq for 753: Phys 752.

**755 Classical Mechanics 3**
Variational principles, Lagrange's equations, two body central force problem, rigid body motion, Hamilton's equations, canonical transformation, Hamilton-Jacobi theory. Prereq: Phys 352.

**758 Statistical Physics 3**
Review of the laws of thermodynamics, Bose-Einstein and Fermi-Dirac statistics, and applications. Prereq: Phys 463.

**761 Electromagnetism 3**
Review of Maxwell's Equations, radiation, collisions between charged particles, dynamics of relativistic particles and fields. Prereq: Phys 361.

**771, 772 Quantum Physics I, II3 each**
Schrodinger equation, wave packets, uncertainty, angular momentum, spin, second quantization, harmonic oscillator. Prereq for 771: Phys 486; Prereq for 772: Phys 771.

**775 Nuclear Physics 3**
Nuclear properties, nuclear force, nuclear models, nuclear decay, nuclear reactions, nuclear collisions, radioactivity, fission, fusion. Prereq: Phys 486.

**781, 782 Solid State Physics I, II3 each**
Crystal structure and binding, reciprocal lattices and x-ray diffraction, lattice vibrations, thermal properties, free electron model, band theory, magnetism, superconductivity. Prereq for 781: Phys 486; Prereq for 782: Phys 781.

The following variable credit courses are also offered:

**790 Seminar 1-3**

**793 Individual Study 1-5**

**696/796 Special Topics 1-5**

**797 Master's Paper 1-3**

**798 Master's Thesis 1-10**

**799 Doctoral Dissertation 1-15**



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## Graduate Faculty

701-231-7971

**James V. Anderson, Ph.D.**
Virginia Polytech Institute, 1990
Research Interests:
Plant Biochemistry

**James Beaver, Ph.D.**
University of Illinois, 1980
Research Interests:
Dry Bean Genetics

**Duane R. Berglund, Ph.D.**
North Dakota State University, 1971
Research Interests:
Row Crops, Specialty Crops

**William A. Berzonsky, Ph.D.**
University of Missouri, 1988
Research Interests:
Spring Wheat Breeding

**Bryan Brunner, Ph.D.**
Michigan State University, 1992
Research Interests:
Breeding Tropical/subtropical Crops

**Xiwen Cai, Ph.D.**
Washington State University, 1998
Research Interests:
Wheat Genetics

**Larry G. Campbell, Ph.D.**
Kansas State University, 1974
Research Interests:
Sugarbeet Genetics

**Marcelo J. Carena, Ph.D.**
Iowa State University, 1999
Research Interests:
Corn Breeding

**Patrick M. Carr, Ph.D.**
Montana State University, 1989
Research Interests:
Sustainable Agriculture

# Plant Sciences / Horticulture

## Program Description

The Department of Plant Sciences offers graduate studies leading to the M.S. degrees in Plant Sciences, Cereal Science, and Horticulture, and to a Ph.D. degree in Plant Sciences and Cereal Science. Specialized academic and research training in Plant Sciences is available in plant breeding and genetics, weed science, biotechnology, field and forage crop production and management, and crop physiology. Areas of specialization in Horticulture and Forestry include breeding and genetics, biotechnology, physiology, propagation, and production and management of horticultural crops such as woody plants, potatoes, vegetables, and turf and herbaceous ornamentals. Areas of specialization in cereal science may involve research in the areas of carbohydrates, enzymes, legumes, and other northern-grown crops; barley malting and brewing; wheat milling, baking, and pasta processing. Each study area is designed to provide students with a comprehension of the discipline and of relevant regional and global-community social issues.

The Department of Plant Sciences is located in Loftsgard Hall, completed in 1991, with modern and well-equipped research laboratories, offices for faculty and graduate students, and classrooms. Loftsgard Hall, which is part of the Plant Science Complex, provides a state-of-the-art facility for interdisciplinary research in plant sciences, ranging from basic studies and biotechnology to the more traditional applied areas. Facilities for cereal science research are located in Harris Hall. These facilities include analytical laboratories for grain quality research, baking, milling, malting and brewing, and pasta and noodle processing. Relatively new greenhouses and extensive growth chamber facilities are also available, as are 120 acres of field research land adjacent to the Plant Science Complex. An additional 500 acres of research land are located near the North Dakota State University campus. A horticultural farm only 35 miles west of campus has an extensive arboretum. Excellent supporting disciplines located nearby, or in the Plant Science Complex, include Soil Science, Botany, Cereal and Food Sciences, Biochemistry and Molecular Biology, Entomology, and Plant Pathology. The Plant Sciences Department encourages interdisciplinary research, and students frequently tailor their research program to meet their interests by working with faculty in one or more of the supporting disciplines.

The department has a policy of a limit of four graduate students assigned to each faculty adviser, so the student gets adequate personal attention and works closely with their adviser in research. Final selection of the adviser will be made on the basis of the student's interest, availability of space in the researcher's laboratory, and a common desire of the student and professor to work together. About one-third of the graduate students are Ph.D. candidates.

**Jack F. Carter, Ph.D.**
University of Wisconsin, 1950
Research Interests:
Flax Utilization

**Shiaoman Shaw Chao, Ph.D.**
North Carolina State University, 1984
Research Interests:
Small Grains Genomics

**Wun Shaw Chao, Ph.D.**
University of California-Davis, 1996
Research Interests:
Perennial Weeds

**Michael J. Christoffers, Ph.D.**
University of Missouri-Columbia, 1998
Research Interests:
Weed Science/Genetics

**David Wenhao Dai, Ph.D.**
North Dakota State University, 2001
Research Interests:
Woody Plant Physiology, Biotechnology

**Lynn S. Dahleen, Ph.D.**
University of Minnesota, 1989
Research Interests:
Barley Genetics, Biotechnology

**Edward L. Deckard, Ph.D.**
University of Illinois, 1970
Research Interests:
Crop Physiology

**Alan G. Dexter, Ph.D.**
University of Illinois, 1969
Research Interests:
Weed Science-Weed Control in Sugarbeet

**Douglas C. Doehlert, Ph.D.**
University of Wisconsin, 1982
Research Interests:
Oat Variety Development and Quality Production

**Elias M. Elias, Ph.D.**
North Dakota State University, 1987
Research Interests:
Durum Wheat Breeding, Genetics

**John Erpelding, Ph.D.**

## Admissions Requirements

The Department of Plant Sciences graduate programs are open to all qualified graduates of universities and colleges of recognized standing. To be admitted with full status to the program, the applicant must

1. Hold a baccalaureate degree from an educational institution of recognized standing.
2. Have adequate preparation in plant sciences and show potential to undertake advanced study and research as evidenced by academic performance and experience.
3. At the baccalaureate level, have earned a cumulative grade point average (GPA) in all courses of at least 3.0 (B or better) or equivalent. Students with a previous graduate degree with a GPA of 3.0 or equivalent may be admitted in full standing.

Students who do not meet all requirements for admission, but show potential for successful graduate study, may be admitted under a conditional status. Evidence must be provided, showing that the applicant's potential is not adequately reflected by his/her record.

Applications should be submitted directly to The Graduate School, and applications will be considered any time during the year.

Official transcripts (transcripts having an appropriate seal or stamp) of all previous undergraduate and graduate records must be received by The Graduate School before the application is complete. When a transcript is submitted in advance of completion of undergraduate or graduate studies, an updated transcript showing all course credits and grades must be provided prior to initial registration at NDSU. Three letters of recommendation are required before action is taken on any application. Personal reference report forms are available from The Graduate School. All students are also required to complete the GRE General Test.

The TOEFL exam is required of international applicants. A minimum TOEFL score of 525 (paper test) or 193 (computer test) is required of all international applicants whose native language is not English.

## Financial Assistance

Research assistantships (half-time) are provided on a competitive basis of scholarship and potential to undertake advanced study and research. As of the 2005-2006 academic year, the annual stipend is $15,600 for an M.S. candidate and $16,800 for a Ph.D. candidate. Graduate tuition is waived for all students with research assistantships. A limited number of graduate fellowships are available. The information provided for the application to The Graduate School is also used to assign available assistantships to applicants. The Plant Sciences Department also has numerous annual scholarships of $500 to $1000 each for outstanding Plant Sciences graduate students.

## Degree Requirements

Montana State University, 1996
Research Interests:
Geneticist Sorghum Germplasm

**Justin D. Faris, Ph.D.**
Kansas State University, 1999
Research Interests:
Wheat Molecular Genetics

**Michael E. Foley, Ph.D.**
University of Illinois, 1982
Research Interests:
Weed Biology

**Kenneth F. Grafton, Ph.D.**
University of Missouri, 1980
Research Interests:
Dry Bean Breeding, Genetics

**Elcio P. Guimaraes, Ph.D.**
Iowa State University, 1985
Research Interests:
Cereal Plant Breeding

**James J. Hammond, Ph.D.**
University of Nebraska, 1969
Research Interests:
Flax Breeding, Biometrics, Computer Programming

**Harlene Hatterman-Valenti, Ph.D.**
Iowa State University, 1993
Research Interests:
High-Value Crop Production

**Theodore C. Helms, Ph.D.**
Iowa State University, 1986
Research Interests:
Soybean Breeding, Genetics

**Robert A. Henson, Ph.D.**
University of Minnesota, 1983
Research Interests:
Crop Production

**Dale E. Herman, Ph.D.**
Purdue University, 1966
Research Interests:
Woody Plants, Propagation, Ornamentals

**Richard D. Horsley, Ph.D.**
North Dakota State University, 1988
Research Interests:
Barley Breeding, Genetics

**David P. Horvath, Ph.D.**
Michigan State University, 1993
Research Interests:

The M.S. program (Thesis Option) requires completion of at least 30 credits; this includes 10 credits of thesis research. The Ph.D. program requires completion of at least 90 credits; this includes 30 credits for an earned M.S. degree (Thesis Option) and 20 additional research credits. For each M.S. or Ph.D. candidate, a plan of study will be developed that meets the disciplinary requirements as well as the individual needs of the student. The faculty adviser and other members of the student's supervisory/advisory and examining committee assist in developing of the plan of study as well as the student's research plan. An M.S. Program (Comprehensive Study Option) is also offered in Plant Sciences. This option requires completion of at least 30 credits, including 3 credits of a Master's Paper.

Candidates for the M.S. degree normally satisfy all requirements within a two-year period, and Ph. D. candidates normally require three additional years. For M.S. candidates, an oral examination of academics related to the discipline and the research-based thesis is required. The Ph.D. candidates are required to pass a preliminary written and oral examination of academics related to the discipline and a final oral defense of a research-based dissertation. A B.S. to Ph.D. program is permitted for students who meet higher admission requirements.

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## Courses Offered

**611 Genomics 3**

This course will teach the principles of genomic science such as genome sequencing, comparative genomics, the transcriptomics, proteomics, and metabolomics. Offered fall. Prereq: Biol 150, Stat 330.

**631 Intermediate Genetics 3**

Expansion of classical and molecular concepts of genetics; basic concepts of Mendelian, quantitative, population, molecular, and evolutionary genetics. 2 one-and-one-half hour lectures. Offered fall. Prereq: PlSc 315. Cross-listed with Bot and Zoo.

**633 Weed Biology and Ecology 2**

Principles of weed biology and ecology including reproduction, dormancy, interference, competition, allelopathy, genetics, seedbanks, and herbicide resistance in crop communites. Offered even years; fall. Prereq: PLSC 323 or instructor permission.

**646 Genetics and Plant Improvement 3**

Genetic principles and their application to plant improvement. Crop evolution, chromosome structure, and population dynamics related to crop improvement methodology. Genetically modified plants, their impact on breeding technique, and the release of improved varieties. 3 one-hour lectures. Offered fall. Prereq: PlSc 315.

**653 Advanced Weed Science 2**

Integrated weed control programs for crops, pastures, non-cropland, and aquatic environments. Herbicide formulation and mixtures. Herbicide absorption, translocation, and action. 2 lectures. Offered fall. Prereq: PlSc 323.

**655 Cropping Systems: An Integrated Approach 3**

Integrative capstone focus on the scientific, professional, and ethical issues associated with crop production and management practices using decision case studies. 3 lectures. Offered spring.

**665 Advanced Landscape Plants 2**

Perennial Weed Physiology

**Khwaja Hossain, Ph.D.**
University of Wales, 1995
Research Interests:
Molecular Genetics and Genomics

**Kirk A. Howatt, Ph.D.**
Colorado State University, 1999
Research Interests:
Weed Science-Annual Weeds

**Jinguo Hu, Ph.D.**
University of California-Davis, 1975
Research Interests:
Sunflower Genomics

**Chao C. Jan, Ph.D.**
University of California, Davis, 1974
Research Interests:
Sunflower Cytogenetics

**Prem P. Jauhar, Ph.D.**
Indian Agricultural Research Institute, New Delhi, 1963
Research Interests:
Wheat Cytogenetics

**Burton L. Johnson, Ph.D.**
North Dakota State University, 1993
Research Interests:
Crop Production

**Shahryar F. Kianian, Ph.D.**
University of California-Davis, 1990
Research Interests:
Wheat Germplasm Enhancement

**Karen L. Klotz, Ph.D.**
Ohio State University, 1995
Research Interests:
Sugarbeet Physiology

**Chiwon W. Lee, Ph.D.**
Purdue University, 1977
Research Interests:
Vegetables, Floriculture, Biotechnology

**Deying M. Li, Ph.D.**
Iowa State University, 2001
Research Interests:
Sports Turf Management

**Edward C. Lulai, Ph.D.**

Nomenclature, identification, and landscape characteristics of native and introduced deciduous and evergreen woody plants grown in the Upper Midwest. Emphasis on cultivar introduction, trademarks/patents, adaptation, and diversity within species. Field trips required. 2 two-hour laboratories. Offered even years; fall. Prereq: PlSc 355.

**684 Plant Tissue Culture and Micropropagation 2**

Principles, techniques, and applications of plant tissue, organ, cell, protoplast, and embryo culture. Emphasis on micropropagation. 1 lecture and 1 two-hour laboratory. Offered fall. Prereq: PlSc 315.

**685 Arboriculture Science 3**

Tree, shrub, and vine care based on the physiology of the plant and the limitations of the environment. Includes pruning, fertilizing, bracing, planting, removal and selection of plant materials, and related subjects. 3 lectures. Offered even years; spring. Prereq: PlSc 355.

**686 Eco-Physiology of Horticultural Crops 2**

Influence of environmental factors, stress, and hardiness on plant growth and development, and their relationship to production practices. 2 lectures. Offered even years; fall. Prereq: PlSc 210 or 225.

**710 Professional Development I (non-didactic) 1**

Introduce students to professional society structure and function, manuscript review, resume preparation, lecture organization, grant writing, and research proposal preparation. Offered fall.

**711 Professional Development II (non-didactic) 1**

Manuscript preparation, manuscript review, and grantsmanship. Offered spring. Prereq: PLSC 724, PLSC 710, or enrolled as a Ph.D. student.

**721 Genomics Techniques 2**

The purpose of this is to teach the principles, techniques, and applications of the large-scale analysis of DNA organization and sequence, RNA expression, and protein sequence and structure. Offered spring. Cross-listed with BIOC. Prereq: PLSC 611.

**724 Field Design I 3**

Application of various field designs, factorial and split-plot arrangements, orthogonal and non-orthogonal comparisons, models, components of variance, correlation, and regression to biological problems. 3 lectures. Offered fall. Prereq: Stat 330 or 725.

**727 Crop Breeding Techniques 1**

Hybridization of North Dakota crops. Laboratory by arrangement. Offered odd years; summer. Prereq: PlSc 446/646.

**731 Plant Molecular Genetics 3**

Molecular aspects of plant genome organization and expression; basic and applied usages of molecular markers and gene transfer techniques. 3 lectures. Offered even years; spring. Prereq: PlSc 431/631.

**734 Field Design II 2**

Application of incomplete block designs, confounding and covariance analyses to biological problems. 2 lectures. Offered odd years; spring. Prereq: PlSc 724.

**741 Cytogenetics 4**

Chromosome behavior during mitosis and meiosis; chromosome structure, function, and

North Dakota State University, 1978
Research Interests:
Potato Physiology

**Rodney G. Lym, Ph.D**.
University of Wyoming, 1979
Research Interests:
Weed Science-Perennial Weeds

**Frank A. Manthey, Ph.D.**
North Dakota State University, 1985
Research Interests:
Durum and Pasta Quality

**Phillip E. McClean, Ph.D.**
Colorado State University, 1982
Research Interests:
Dry Bean Genetics, Biotechnology

**Michael S. McMullen, Ph.D.**
University of Minnesota, 1976
Research Interests:
Oat Breeding, Genetics

**Mohamed Mergoum, Ph.D.**
Colorado State University, 1991
Research Interests:
Hard Red Spring Wheat Breeding

**Calvin G. Messersmith, Ph. D.**
North Dakota State University, 1970
Research Interests:
Weed Science-Biological Control

**Dwain W. Meyer, Ph.D.**
Iowa State University, 1970
Research Interests:
Forage Management, Cropping Systems

**Jerry F. Miller, Ph.D.**
North Dakota State University, 1976
Research Interests:
Flax and Sunflower Genetics

**Carlos Ortiz, Ph.D.**
University of Arkansas, 1993
Research Interests:
Genetics- Starchy Crops and Turf

recombination; inheritance in aneuploids and polyploids; haploid formation and utilization. 3 lectures and 1 three-hour laboratory. Offered even years; fall. Prereq: PlSc 315.

**751 Advanced Genetics 3**

Classical and modern genetic concepts, nature and induction of mutations linkage, and application of chi-square. 3 lectures. Offered odd years; spring. Prereq: PlSc 315, 431/631.

**753 Action and Fate of Herbicides 2**

Herbicide mode of action and fate of herbicides in plants and soil, physiology of herbicide resistance, and herbicide antidotes. 2 lectures. Offered even years; spring. Prereq: PlSc 453/653, Bioc 460/660.

**755 Advanced Crop Management Decision Making 3**

Problem-based learning approach focusing on the scientific, professional, personal, and ethical issues associated with advanced crop management decision making. Offered even years, fall. Prereq: PlSc 455/655.

**763 Laboratory Methods--Weed Science 2**

Chemical, analytical, and physiological methods for determining pesticide residues in soil and ground water; and herbicide absorption, translocation, and metabolism in plants. 2 two-hour laboratories. Offered odd years; spring. Prereq: PlSc 453/653, Bioc 460/660.

**776 Advanced Plant Breeding 4**

Application of genetic principles to improvement of self- and cross-pollinated crops. 4 lectures. Offered odd years; spring. Prereq: PlSc 724, 446/646.

**780 Population Genetics 2**

Concepts and principles related to genetic properties governing random and non random mating populations. 2 lectures. Offered odd years; fall. Prereq: PLSC 315 and Stat 330.

**781 Quantitative Genetics 2**

Applied quantitative genetics and implications on plant breeding. 2 lectures. Offered even years; spring. Prereq: PLSC 315 and PLSC 724 or instructor approval, PLSC 446/646 recommended.

**785 Crop Breeding Programs Management 2**

Development of student ability to understand, examine, and evaluate crop breeding and improvement programs. Offered even years; fall. Prereq: PLSC 724, 446/646

**Timothy Porch, Ph.D.**
Cornell University, 2001
Research Interests:
Dry Bean Breeding and Genetics

**Joel K. Ransom, Ph.D.**
University of Minnesota, 1982
Research Interests:
Small Grains

**Albert A. Schneiter, Ph.D.**
The University of Arizona, 1973
Research Interests:
Crop Production

**Paul B. Schwarz, Ph.D.**
North Dakota State University, 1987
Research Interests:
Malting Barley Quality

**Gerald J. Seiler, Ph.D.**
North Dakota State University, 1980
Research Interests:
Sunflower and Sugarbeet Germplasm

**Ronald C. Smith, Ph.D.**
The Ohio State University, 1973
Research Interests:
Turfgrass Management

**Joseph R. Sowokinos, Ph.D.**
University of North Dakota, 1969
Research Interests:
Potato Physiology

**Jeffrey C. Suttle, Ph.D.**
Michigan State University, 1979
Research Interests:
Potato Physiology

**Asunta L. Thompson, Ph.D.**
University of Idaho, 1998
Research Interests:
Potato Breeding

**Linda Wessel-Beaver, Ph.D.**
University of Illinois, 1981
Research Interests:
Tropical Pumpkin and Squash Breeding

**M. Dale Williams, Ph.D.**
The University of Arizona, 1978

Research Interests:
Seedstocks, Crop Production

**Steven S. Xu, Ph.D.**
North Dakota State University, 1994
Research Interests:
HRSW Development

**Joseph D. Zeleznik, Ph.D.**
Michigan State University, 2001
Research Interests:
Urban/Rural Forestry

**Richard K. Zollinger, Ph.D.**
Michigan State University, 1989
Research Interests:
Weed Science-Applied Weed Control



E-Mail: The Graduate School

Prospective students may schedule a visit by calling 1-800-488-NDSU.

The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701-231-8567

**Thomas Ambrosio, Ph.D.**
University of Virginia, 2000
Research Interests:
Ethnic Conflicts, International Relations, Russian Foreign Policy

**Manjusha Gupte, Ph.D.**
Purdue University, 2003
Research Interests:
Public Policy and Public Administration (Environmental Policy), Comparative Politics, Methodology and Forestry and Natural Resources

**Kevin Thompson, Ph.D.**
**Department Chair**
University of Arizona, 1986
Research Interests:
Criminal Justice

**Robert A. Wood, Ph.D.**
University of Missouri, 1983
Research Interests:
Terrorism, Judicial Politics

# Political Science

## Program Description

The Department of Criminal Justice and Political Science offers both the M.A. and M.S. degrees in Social Sciences with a concentration in Political Science. The program serves students seeking to further their training in the scientific study of political activity for the purpose of pursuing careers in teaching, government service, interest group politics, or as preparation for doctoral studies. The program is designed to allow students to complete their substantive course work and exit requirement in two years.

## Admissions Requirements

The Department of Political Science graduate program is open to all qualified graduates of universities and colleges of recognized standing. To be admitted with full status to the program, the applicant must

1. Hold a baccalaureate degree from an educational institution of recognized standing.
2. Have adequate preparation in political science and show potential to undertake advanced study and research as evidenced by academic performance and experience.
3. Have earned an undergraduate cumulative grade point average (GPA) in all courses of at least 3.0 or equivalent in the last sixty (60) credit hours of undergraduate study.
4. Submit Graduate Record Examination (GRE) scores and receive a minimum cumulative score of 1500 on all three sections.
5. Take the TOEFL examination if an international applicant. A minimum score of 600 (paper test) or 247 (computer test) must be achieved.

Transcripts of all previous undergraduate and graduate records must be submitted with the application. When a transcript is submitted in advance of completion of a student's undergraduate or graduate study, an updated transcript showing all courses and grades must be provided prior to initial registration at NDSU.

Three letters of recommendation are required before action is taken on any application. Personal reference report forms are available from The Graduate School.

Applications should be submitted directly to The Graduate School before April 1 of the upcoming academic year.

## Financial Assistance

Both research and teaching assistantships are available. Applicants are considered on the basis

of scholarship, potential to undertake advanced study and research, and financial need. To be considered for an assistantship, a completed Graduate School application, official transcripts, three letters of reference, and GRE scores must be submitted to The Graduate School no later than April 1. If applicable, TOEFL scores must be submitted by that date.

### Degree Requirements

At least 30 semester credits of graduate work are required. Students must choose two of the department's four areas of specialization and, ultimately, will conduct original research culminating in a written master's thesis under the guidance of the major adviser.

Students must meet the following requirements:

6 credits of graduate methods courses (in consultation with advisor)
6 credits of 700-level science courses
6 credits of additional political science courses (600- or 700- level)
6 credits of additional 700-level courses (offered in political science or another discipline).
6 credits of Political Science 798 (Master's Thesis) plus a final oral defense.

Additional requirements are as follows:

12 credits of graduate courses completed must be within 2 of the 4 political science areas of expertise.
All political science graduate students must complete PolS 720 (counts toward the distribution above)

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## Courses Offered

**620 Political Behavior--Executive-Legislative Process 3**
Behavioral study of executives and legislators with emphasis on examination of empirical data.

**621 Political Behavior--Political Parties 3**
Behavioral study of political leaders with emphasis on examination of empirical data.

**630 Constitutional Law--Civil Liberties 3**
Examination of First Amendment rights, including freedom of speech, press, religion, association, and assembly. Due process and equal protection concerns are also addressed.

**631 Constitutional Law--Criminal Justice 3**
Study of Fourth, Fifth, and Sixth Amendment rights. Emphasis on the law of arrest, search and seizure, self-incrimination, and right to counsel.

**642 Global Policy Issues 3**
Analysis of the impact of planetary limits to growth, increasing globalization of the world economy, and changing control over resource systems on global politics.

**643 Politics of Development 3**
Introduction to topics of development and underdevelopment and to special circumstances facing the political systems of Third World countries.

**650 Politics of the Developing Countries 3**
Comparative examination of the government and politics of developing countries. Attention is given to special economics and cultural circumstances facing the political

systems of these countries.

**651 Politics of the Industrialized Countries 3**
Comparative study of government and politics in industrialized countries, including the analysis of legislative and executive branches, parties, bureaucracies, constitutions, policies, and voting behavior.

**652 Comparative Political Economy 3**
Comparative study of the relationship between politics and the economy in industrialized and developing countries. Topics include elections, trade, development, investment, redistribution, and the political business cycle.

**700 Qualitative Methods 3**
See Sociology for course description.

**701 Quantitative Methods 3**
See Sociology for course description.

**720 Theoretical Perspectives to the Study of Political Science 3**
Designed to guide beginning graduate students through the dominant paradigms and emerging subject areas of political science scholarship.

The following variable credit courses are also offered:

**790 Seminar 1-3**

**793 Individual Study 1-3**

**795 Field Experience 1-15**

**696/796 Special Topics 1-5**

**797 Master's Paper 1-3**

**798 Master's Thesis 1-10**



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Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701-231-8622

**Terence W. Barrett, Ph.D.**
University of North Dakota , 1989
Field:
Clinical; Issues in Therapy, Forensic Psychology

**Mark J. Brady, Ph.D.**
University of Minnesota , 1999
Field:
Visual and Cognitive Neuroscience; Object Recognition

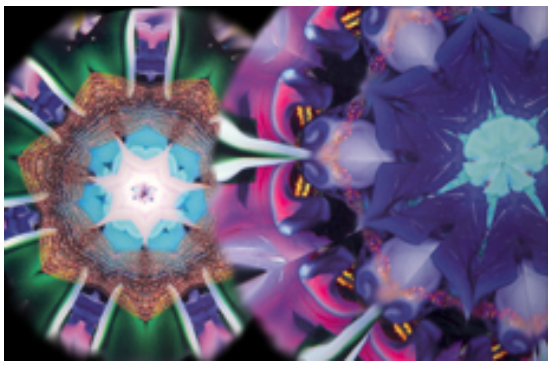
**James R. Council, Ph.D.**
University of Connecticut , 1984
Field:
Clinical; Personality, Assessment, Clinical and Experimental Hypnosis

**Scott G. Engel, Ph.D.**
North Dakota State University , 2003
Field:
Health and Social Psychology; Obesity and Eating Disorders

**Chris Kelland Friesen, Ph. D.**
University of Alberta , 2001
Field:
Cognitive Neuroscience, Visual Attention, Social Perception and Attention

**Robert D. Gordon, Ph.D.**
University of Illinois at Urbana-Champaign, 1999
Field:
Cognitive Neuroscience, Attention, Representation, Visual Information Processing

# Psychology



## Program Description

The Department of Psychology at North Dakota State University grants both M.S. and Ph.D. degrees. The doctoral program is in experimental psychology and is designed to prepare students for research and academic careers. There are two separate tracks within the Psychology master's degree program. Students may elect to pursue the experimental or clinical (behavior therapy) options.

**Doctoral Program.** Students enter the Ph.D. program with one of two emphases: Health and Social Psychology or Visual and Cognitive Neuroscience. These two areas represent the strengths of the department's faculty in experimental research, as well as two of the most active and cutting-edge areas of the field of psychology. The program accommodates 20 students, with approximately 4 new Ph.D. degrees awarded each year. Training in the program includes course work in the student's area of emphasis, as well as methods courses, breadth requirements, and research experience under the supervision of a faculty mentor. Training and experience in college-level teaching is an important part of the program. Student support is available through teaching assistantships, research assistantships, and teaching stipends.

**Master's Program.** Both master's tracks are designed to provide a broad background in general psychology and a firm grounding in research methodology. The clinical track of the program combines an emphasis on research with training and supervised practice in clinical behavior therapy skills. The program is suited for people who wish to pursue doctoral studies after receiving the M.S. or wish to work in a supervised practice setting immediately after graduation. The general cognitive-behavioral orientation integrates research and practice. Applied behavior analysis is an integral part of the program as are social learning and cognitive-behavioral approaches. Experiences and training are available in several subareas.

The general-experimental program stresses broad training in general psychology and involvement in research beginning early in graduate training. The program operates on a mentor system in which a student works closely with a primary faculty member in the student's chosen field of experimental psychology. The program is designed so that students satisfy a large amount of the general requirements the first year and acquire more specialized skills and training during the second year. The program prepares the student for doctoral studies in the experimental areas of psychology.

Students in both tracks have access to well-equipped research facilities and to faculty supervision time. (A favorable staff-to-student ratio is maintained.) The program requires 21 months of full-time study. Oral defense of a research-based thesis is required. The program is individualized, particularly in the second year, and students elect courses of special interest to them.

## Admissions Requirements

The Department of Psychology graduate programs are open to qualified graduates of universities and

**Wendy P. Gordon, Ph.D.**
University of Illinois at Urbana-Champaign, 2002
Field:
Child Development, Social Development and Peer Relations

**Clayton J. Hilmert, Ph.D.**
University of California , San Diego , 2003
Field:
Health and Social Psychology; Stress Psychophysiology, Cardiovascular Health, and Pregnancy

**Verlin B. Hinsz, Ph.D.**
University of Illinois , 1983
Field:
Social and Industrial/ Organizational; Small Group Performance, Group Decision Making

**Linda Langley , Ph.D.**
University of Minnesota , 1998
Field:
Cognitive Neuroscience, Age-Related Changes in Selective Attention and Visual Search Performance

**Kevin D. McCaul, Ph.D.**
University of Kansas , 1978
Field:
Social; Health Behavior, Applied Social Psychology

**Mark E. McCourt, Ph.D.**
University of California -- Santa Barbara , 1982
Field:
Biopsychology, Vision Science; Visual Psychophysics, Neuropsychology

**Raymond G. Miltenberger, Ph.D.**
Western Michigan University , 1985
Field:
Clinical; Applied Behavior Analysis, Developmental Disabilities

colleges of recognized standing. To be admitted with full status to the master's or doctoral programs, the applicant must

1. Hold a baccalaureate or graduate degree from an educational institution of recognized standing. Students may be admitted to the doctoral program at either the bachelor's or master's level.

2. Have adequate preparation in psychology and show potential to undertake advanced study and research as evidenced by academic performance and research experience.

3. At the baccalaureate level, have earned a cumulative grade point average (GPA) in all courses of at least 3.0 or equivalent. Students with a previous graduate degree with a GPA of 3.0 or equivalent may be admitted in full standing.

4. To be competitive for admission, students should have GRE scores above the 50th percentile on the general subtests.

Applications should be submitted directly to The Graduate School. Applications are due before March 1 for the upcoming academic year. Official transcripts (transcripts having an appropriate seal or stamp) of all previous undergraduate and graduate records must be received by The Graduate School before the application is complete. When a transcript is submitted in advance of completion of undergraduate or graduate studies, an updated transcript showing all course credits and grades must be provided prior to initial registration at North Dakota State University .

Three letters of recommendation are required before action is taken on any application. Personal reference report forms are available from The Graduate School.

Scores on the general Graduate Record Examination (GRE) are required prior to evaluation of applications by the Department of Psychology.

## Financial Assistance

Students are routinely supported through research and teaching assistantships. Applicants are considered on the basis of scholarship, potential to undertake advanced study and research, and financial need. All students who submit complete applications by the appropriate deadlines are considered for assistantships. Doctoral students are eligible for university fellowships that are awarded on a competitive basis.

## Requirements for the Master's of Science in Psychology

The program requires 21 months of full-time study, during which 40 semester hour credits must be completed with an overall GPA of 3.0 or better. An oral defense of a research-based thesis is required.

All students must:

1. Score 620 or above on the Advanced Psychology GRE test. Any student not scoring 620 or above on the GRE Psychology test before admission is required to retake the test and obtain at least a score of 620 prior to being awarded the master's degree. The intent of this requirement is to demonstrate competence in general psychology.

2. Complete an area paper in their field of specialization. The paper involves a literature review in a specific area and concludes with suggestions for future research. It should lead to a master's thesis proposal.

3. Complete a research-based thesis and pass an oral defense of the thesis administered by the

**Mark Nawrot, Ph.D.**
Vanderbilt University , 1991
Field:
Visual Neuroscience; Neural Mechanisms for Perception of Depth and Motion, Eye Movements, Alcohol

**H. Katherine O'Neill, Ph.D.**
University of North Dakota , 1991
Field:
Clinical; Psychopathology, Addiction, Anxiety

**Brian Ostafin, Ph.D.**
Boston University , 2004
Field:
Clinical; Implicit Cognition, Mindfulness, Addiction

**Stéphane Rainville, Ph.D.**
McGill University , 1999
Field:
Visual Neuroscience; Visual Synchrony, Multi-dimensional Optimization, Shape Perception, Form-Motion Interactions

**Michael D. Robinson, Ph. D.**
University of California , Davis , 1996
Field:
Social/Personality Affective Processes

**Paul D. Rokke, Ph.D.**
University of Houston , 1985
Field:
Clinical; Psychopathology, Behavioral Medicine

**Wolfgang Teder-Sälejärvi, Ph.D.**
University of Helsinki , 1994
Field:
Cognitive Neuroscience: Auditory & Somatosensory Attention, Crossmodal and Multisensory Interactions, Event-related Potentials (ERPs)

**David A. Wittrock, Ph.D.**
State University of New

student's supervisory committee.

4. Complete Psyc 640 Experimental Methods.

5. Successfully complete two Psyc core courses selected from two of the following three areas:

**(a) 660 Sensation and Perception, 665 Psychobiology, or 686 Neuropsychology;**

**(b) 661 Memory and Knowledge, or 464 Attention and Thinking;**

**(c) 668 Personality, or 670 Experimental Social Psychology.**

### Experimental track students must:

1. Pass a methodology exam on research design and statistics.

2. Demonstrate competence in a “skill” area related to their main interest area.

3. Complete one clinical course.

4. Complete a third core course so that one core course is taken from each core area.

### Behavior therapy track students must:

1. Complete a sequence in behavior therapy (Psyc 755-756).

2. Complete four required courses:

**Psyc 750 Introduction to Clinical Issues and Practices**

**Psyc 770 Advanced Psychological Assessment**

**Psyc 761 Applied Research Methods**

**Psyc 672 Advanced Psychopathology,**

**or Psyc 673 Child Psychopathology/Therapy**

3. Complete one approved elective.

4. Complete three semester credits of practicum during the first year and four semester credits of practicum during each semester of the second year.

## Suggested Curriculum for Behavior Therapy Track

### Year I-Fall

755 Behavior Therapy and Assessment I

770 Advanced Psychological Assessment or 761 Applied Research Methods Core Course

York at Albany , 1990
Field:
Clinical; Behavioral Medicine, Headache, Stress, Appraisal and Coping

More information on faculty background and interests is available on the department's homepage: www.ndsu.edu/ndsu/psychology

790 Graduate Seminar

750 Introduction to Clinical Issues and Practices

## Course or Elective

## Spring

640 Experimental Methods

756 Behavior Therapy and Assessment II

## Core Course or Elective

790 Graduate Seminar

795 Field Experience

## Summer

Area paper, outline thesis

## Year 2-Fall

770 Advanced Psychological Assessment

or 761 Applied Research Methods (both are required)

Practicum, thesis

672* Advanced Psychopathology or Elective**

GRE test

## Spring

673* Child Psychopathology/Therapy or Elective**

Practicum, thesis

*Only one of these two courses (672, 673) is required.

**Only one elective is needed and may be taken in any semester.

## Elective Options (must be 600 or 700 level)

681 Health Psychology
674 Behavior Analysis in Developmental Disabilities

672 Advanced Psychopathology
or 673 Child Psychopathology/Therapy; other core courses; courses in Department of Child Development and Family Science, and/or other departments

## Required Clinical Classes

Psyc 750, 755, 756, 761, 770, (672 or 673)

## Requirements for Doctor of Philosophy in Psychology:

1. Complete a master's degree in Psychology. This may be done at NDSU or elsewhere.

2. Complete at least 90 hours of graduate credit, including those completed for

the master's degree; 60 or more of these credits must be earned at NDSU. At least 30 credit hours must be in approved didactic courses, and at least 18 of these must be at the 700 level.

3. Complete quantitative and research methods courses (Psyc640 and 762, plus 761 for Health/Social track).

4. Complete core courses in specialty track:

- Health & Social Psychology - four courses: Psyc 733, 771, 782, 787

- Visual & Cognitive Neuroscience - three courses from Psyc 718, 720, 727, 731,760, 764).

5. Complete two (for Health/Social students) or one (for Visual/Cognitive students) breadth courses at the graduate level from area outside specialty track. (Can include approved courses from other departments).

6. Complete Psyc 790 (graduate seminar and colloquium series) each semester.

7. Participate in a continued program of research apprenticeship with at least one faculty member and, accordingly, enroll in Psyc 793 each semester for 1-5 credits.

8. Teach one undergraduate course under the supervision of a faculty member, after completion of Hum 702, Introduction to College Teaching in the Humanities and Social Sciences, or Biol 705/ Educ705, Teaching College Science.

9. Complete a major area paper to serve as the comprehensive exam for Ph.D. candidacy. The area paper will be a comprehensive literature review of the student's are of research and will include an oral defense.

10. Complete the dissertation. The student will defend a written proposal before a faculty committee, conduct an original research project, and complete a comprehensive written report on the project. The student will complete a final oral defense before the same committee.

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## Courses Offered

**640 Experimental Methods 3**

Intermediate experimental design and data analysis with emphasis on the analysis of variance. Laboratory includes data analysis on the computer. Prereq: Psyc 351, Stat 331.

**653 Organizational Psychology 3**
Survey of topics related to application of psychology to organizational settings. Emphasis on theoretical bases of the individual (motivation or satisfaction) and social (leadership or work group) factors involved in work behavior. Prereq or Coreq: Psyc 351.

**660 Sensation and Perception 3**
Explores physical, anatomical, and physiological bases of sensation and perception and their psychophysical measurement. Laboratory experiments complement lectures and demonstrate various experimental techniques and sensory phenomena. 2 lectures and equivalent of 2-hour laboratory. Prereq: Psyc 351.

**661 Memory and Knowledge 3**
Examination of current behavioral and neuropsychological research and theory in the area of memory and knowledge representation. Various cognitive phenomena are demonstrated and relevant design issues are highlighted via laboratory experiments. Prereq: Psyc 351.

**663 Experimental Development Psychology 3**
Examination of historical and contemporary theory and research in social and cognitive development. Topics include attachment, adolescent risk-taking, theories of intelligence, and meta-cognition. Laboratory experiences illustrate methods of investigating psychological development. Prereq: 351.

**664 Attention and Thinking 3**
Examines current behavioral and neuropsychological research and theory in the area of attention and thought processes. Laboratory experiments will demonstrate various attentional phenomena and highlight relevant design issues.

**665 Psychobiology 3**
Fundamental anatomy (structure) and physiology (function) of the nervous system. Physiological bases of behavior. 2 lectures and equivalent of 2-hour laboratory. Prereq: Psyc 351.

**668 Personality 3**
Study of complex human behavior with attention to historically significant theories and current empirical issues. Laboratory experiences illustrate methods of investigating individual differences. Prereq: Psyc 351.

**670 Experimental Social Psychology 3**
Examination of historical and contemporary theory and research in social psychology. Study of the relationship between the individual and social context. 2 lectures and equivalent of 2-hour laboratory. Prereq: Psyc 351.

**671 The Psychology of Aging 3**
Survey of cognitive and psychosocial development in adulthood and old age, including psychopathologies of old age. Contemporary research findings are emphasized. Prereq: Psyc 111.

**672 Advanced Psychopathology 3**
In-depth coverage of recent research on diagnosis, etiology, and maintenance of behavior disorders emphasizing the interaction of biological, behavioral, and social factors. Prereq: Psyc 270.

**673 Child Psychopathology and Therapy 3**
Overview of the etiology and treatment of behavior disorders in children and adolescents. Emphasis on recent research findings and behavioral intervention strategies. Prereq: Psyc 270 or 351.

**674 Behavior Analysis in Developmental Disabilities 3**

Overview of developmental disabilities with emphasis on mental retardation. Application of behavior analysis procedures for skills training, functional assessment and treatment of problem behaviors, and staff management. Students participate in assessment and treatment projects. Prereq: Psyc 211.

**680 History and Systems 3**
Historical development of scientific psychology. Emphasis on the development of various systems of psychology in America . Capstone experience. Prereq: Psyc 350 and two 400-level psychology courses.

**681 Health Psychology 3**
Application of behavioral procedures to the prevention, treatment, and rehabilitation of medical disorders. Emphasis on contemporary research findings. Prereq: Psyc 211 or 350.

**686 Neuropsychology 3**
Introduction to human neuropsychology with emphasis on the neural basis of motor, perceptual, cognitive, emotive, and language behavior. Topics include normal and pathological conditions from clinical and experimental perspectives. Prereq: Psyc 351.

**688 Human/Computer Interaction 3**
See Computer Science for description.

**718 Visual Neuroscience 3**
A detailed survey of current ideas, methods, and perspectives in visual neuroscience.

**720 Cognitive Neuroscience 3**
Examines prominent theories, research approaches, and experimental findings in the field of cognitive neuroscience.

**727 Advanced Topics in Visual Perception 3**
Integrated overview of the field of vision research. Addresses recent developments in the study of the phenomenology, psychophysics, and neural substrates of human visual sensation and perception.

**731 Fundamental Processes in Cognition 3**
Explores the underlying architecture of the human cognitive system: how it takes in, processes, stores, and retrieves information.

**732 Applied Cognitive Processes 3**
Explores the ways cognitive principles operate in ecologically valid (real-world) situations.

**733 Judgment and Decision Making 3**
Explores issues and topics related to judgment and decision making.

**735 Neural Networks 3**
See Computer Science for description.

**750 Introduction to Clinical Issues and Practices 1**
Instruction and practice in clinical interview techniques and discussion of clinical issues including ethics, laws, and crisis intervention.

**755 Behavior Therapy and Assessment I 4**
Introduction to the nature and characteristics of behavioral assessment and behavior therapy. Laboratory includes behavioral interviewing and training in assessment and treatment procedures.

**756 Behavior Therapy and Assessment II 4**
In-depth coverage of behavioral assessment and treatment approaches, emphasis on their empirical status. Laboratory includes instruction with practice in implementation of these procedures. Prereq:

Psyc 755.

**760 Research Methods in Visual and Cognitive Neuroscience 3**
This course provided both theoretical and practical training in methodological skills essential for the conduct of high-quality research in the field of visual cognitive neuroscience. May be repeated for credit with a change in topic given in subtitle.

**761 Applied Research Methods 3**
Experimental methodology and design skills useful in clinical research, including N=1 designs, experimental, and quasi-experimental designs. Laboratory includes reports on recent research articles, presentations on specific content areas, and development of a detailed research proposal.

**762 Advanced Research Methods and Analysis 3**
Advanced experimental design and data analysis. Emphasis on regression models as applied to psychological data and designs. Includes analysis on the computer. Lecture and laboratory. Prereq: Psyc 640.

**764 Advanced Topics in Attention 3**
Examines prominent theories of attention and empirical evidence in support of those theories. Included topics focus on the role of attention in thought, perception, and action.

**770 Advanced Psychological Assessment 3**
Comprehensive approach to assessment in clinical psychology. Includes administration, interpretation, and report writing. Primary focus on Wechsler intelligence scales and personality testing by objective and projectile methods.

**771 Social/Health Psychology Research 3**
Covers research designs frequently utilized in conducting social psychology related research with particular emphasis on health psychology.

**782 Emotions 3**
Focused on basic questions about defining emotions, differences in experiencing or expressing emotions, and relatedness to cognition. Includes emotions and psychotherapy, emotions in a social context, and the impact of emotional expressions versus repression on health. Prereq: Departmental approval.

**787 Advanced Social Psychology and Health 3**
Covers theory and research from social psychology that have implications for health behavior. Emphasizes theories of attitudes and behavior applied to such topics as regimen adherence, self-protective health behavior, and disease prevention. Prereq: Psyc 670 and 681 or departmental approval.

The following variable credit courses are also offered:

**790 Graduate Seminar 1-3**

**793 Individual Study/Tutorial 1-5**

**794 Practicum/Internship 1-8**

**795 Field Experience 1-15**

**696/796 Special Topics 1-3**

**797 Master's Paper 1-3**

**798 Master's Thesis 1-10**

**799 Doctoral Dissertation 1-15**



E-Mail: The Graduate School

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The Graduate School
201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701-231-8657

**Bill B. Brunton, Ph.D. (emeritus)**
Washington State University, 1974
Research Interests:
Cultural Anthropology, Shamanism, Religion, North American Indians, Intergroup Relations

**Jeffrey T. Clark, Ph.D.**
University of Illinois, 1987
Research Interests:
Archaeology, Paleoenvironmental Studies, Method/Theory; Oceania, Southeast Asia, North America

**Timothy J. Kloberdanz, Ph.D.**
Indiana University, 1986
Research Interests:
Expressive Culture and Folklore, Anthropological Theory, Indians of the Plains, Peoples of Europe, Ethnicity

**Arthur Oyola-Yemaiel, Ph.D.**
Florida International University
Research Interests:
Sociology of Disasters, Emergency Management, Complex Organizations

**Thomas J. Riley, Ph.D.**
University of Hawaii, 1973
Research Interests:
Archaeology, Archaeological Theory, Agricultural Systems, Polynesia, Micronesia, Eastern North America

**William Sherman, M.A. (emeritus)**
University of North Dakota, 1965
Research Interests:
Great Plains, Sociology of Religion, Regional Studies

**Kathleen Slobin, Ph.D.**
University of California--San Francisco, 1991
Research Interests:
Medical Sociology, Sociological

# Anthropology

## Program Description

The Department of Sociology and Anthropology offers the M.S. degree in Social Sciences with a concentration in Anthropology. This program is based on the principle that graduate level education in Anthropology is a desirable preparation for a growing number of career orientations. The precise plan of study for each student will be established in consultation with the academic advisor. Sample positions that our graduates have obtained include teaching, contract archaeology and research analysis as cultural experts.

The focus of graduate education in Anthropology is directed toward both the development of applied anthropologists and the advanced training of those seeking to pursue a doctoral degree. Students may elect to take courses in a specialty area, or they may pursue a background in general anthropology. Areas of specialization include cultural and biological anthropology and archeology.

The Anthropology graduate program provides students with the opportunity to expand their background and perspectives in research methods and theory. Consequently, the first year of the program is designed to expose students to theory and a variety of research methods.

Two program options are available for students. In the thesis option, students work on a research-based thesis. Students typically test theoretical assumptions using primary or secondary data. The comprehensive study option is designed for students who wish to combine their studies with some type of specialized field experience. Students electing this option are required to complete a comprehensive study paper related to their internship, such as evaluating a program.

Students in the Anthropology graduate program benefit from a favorable faculty-to-student ratio. A graduate minor in sociology is available to students in other programs.

## Admissions Requirements

The Department of Sociology/Anthropology graduate program is open to qualified graduates of universities and colleges of recognized standing. To be admitted with full status to the program, the applicant must

1. Hold a baccalaureate degree from an educational institution of recognized standing.
2. Have adequate preparation in anthropology, and show potential to undertake advanced study and research as evidenced by academic performance and experience.
3. At the baccalaureate level, have earned a cumulative grade point average in all courses of at least 3.0 or equivalent. Applications should be submitted directly to The

Theory, African Studies, Feminist Theory

Graduate School before April 1 of the upcoming academic year.

Official transcripts (transcripts having an appropriate seal or stamp) of all previous undergraduate and graduate records must be received by The Graduate School before the application is complete. When a transcript is submitted in advance of completion of undergraduate or graduate studies, an updated transcript showing all course credits and grades must be provided prior to initial registration at North Dakota State University.

Three letters of recommendation are required before action is taken on any application. Personal reference report forms are available from The Graduate School.

### Financial Assistance

Teaching assistantships are available to qualified applicants. Research assistantships may also be available, contingent on faculty research funds. Applicants for assistantships are considered on the basis of scholarship and potential to undertake advanced study and research. To be considered for an assistantship, a completed Graduate School application, official transcripts, and three letters of reference must be received by The Graduate School no later than April 1.

### Degree Requirements

Students must complete a minimum of 30 credits and a master's thesis for the thesis option, or a minimum of 35 credits and a paper for the comprehensive study option. An oral defense of the thesis or the paper is required.

Requirements for the M.S. degree in social science with a major field in anthropology or sociology are as follows:

All students must

1. Successfully complete a
   **Theory oriented Anthropology course.**
   **Methods Oriented Anthropology course**
2. Complete an additional 24 credits (including thesis) or 26 credits (including comprehensive study).
3. Complete a research-based thesis or comprehensive study paper, and pass an oral defense of the thesis or paper administered by the student's supervisory committee.

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## Courses Offered

## Anthropology

**632 Human Osteology 3**
The examination of human bones. Areas of study include identification of the relatively deceased or forsenic osteology; ancient and purely paleontological; and part of an archeological record.

**633 Apes and Human Evolution 3**
A laboratory-oriented survey of living primates describing and comparing the diverse behavioral and morphological adaptations of great apes in a human evolutionary context.

**644 Peoples of the Pacific Islands 3**
General survey of cultures, past and present, in Melanesia, Polynesia, and Micronesia.

**646 Current Problems in Paleoanthropology 3**
Critical inquiry and survey of biological anthropology. Allows students to construct our ancestors past using evidence from paleoanthropology, archaeology, geology, ecology, zoology, and comparative primate morphology.

**647 Science and Celebrity in Anthropology 3**
Explores the field of anthropology and its underlying mechanisms that shaped the theoretical basis of the discipline while allowing us to critically make inquiries of our biocultural existence.

**650 Cultural Anthropology 3**
Examination of the nature of culture, the dynamics of culture, cultural subsystems, and cultural data collection and analysis. Prereq: Anth 111 or departmental approval.

**651 Anthropological Linguistics 3**
Anthropological uses of linguistic data, methods, and theory. Includes phonetic transcription and phonemic, morphemic, and synthetic analysis.

**652 North American Indians 3**
General survey of native North American Indian cultures. Focuses on cultural systems as anthropologists have reconstructed them for the precontact period.

**653 Magic and Religion 3**
Comparative religion, religious concepts, practices, and practitioners. In-depth study of selected religious systems with a focus on shamanic religions. Prereq: Anth 111 or departmental approval. Cross-listed with RelS.

**658 Indians of the Plains 3**
Ethnographic/ethnohistorical survey of major Indian tribes in the Great American Plains region from ancient times to the present.

**661 Germans from Russia 3**
Study of the cultural and historical background of an important ethnic group in the Great American Plains region: German-speaking people from Russia.

**662 Cultural Ecology 3**
Analysis of the systematic relationship between human populations and their ecological surroundings. Prereq: Any Anth course.

**680 Development of Anthropological Theory 3**
Focus on major theoretical orientations in anthropology. Emphasis on the ways in which anthropological theories are used to generate explanations for multicultural phenomena. Prereq: Anth 111 or departmental approval.

## Sociology

**700 Qualitative Methods 3**
Advanced analysis of the methods used in qualitative research projects, such as intensive interviewing, focus groups, and participant observation. Prereq: Soc 340.

**701 Quantitative Methods 3**
Advanced analysis of the methods used in quantitative research projects, such as survey design, experimental design, and evaluation research. Prereq: Stat 330 or 725, Soc 340.

### The following variable credit courses are also offered:

**790 Graduate Seminar 1-3**

**793 Individual Study/Tutorial 1-3**

**795 Field Experience 1-15**

**696/796 Special Topics 1-5**

**797 Master's Paper 1-3**

**798 Master's Thesis 1-10**



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## Graduate Faculty

701-231-8657

**Gary A. Goreham, Ph.D.**
South Dakota State University, 1985
Research Interests: Rural Sociology, Community, Family, Research Methods, Sociology of Religion, Sociology of Agriculture

**Daniel J. Klenow, Ph.D.**
University of Notre Dame, 1977
Research Interests: Medical Sociology, Gerontology, Research Methods, Emergency Management

**H. Elaine Lindgren, Ph.D. (emeritus)**
University of Missouri, 1970
Research Interests: Social Change, Gender, Citizen Participation

**Joy M. Query, Ph.D. (emeritus)**
University of Kentucky, 1960
Research Interests: Medical Sociology, Theory, Mental Health

**Richard W. Rathge, Ph.D.**
Michigan State University, 1981
Research Interests: Demography, Applied Sociology, Rural Sociology, Research Methods

**William Sherman, M.A. (emeritus)**
University of North Dakota, 1965
Research Interests: Great Plains, Sociology of Religion, Regional Studies

# Sociology

## Program Description

The Department of Sociology and Anthropology offers the M.S. degree in Sociology. This program is based on the principle that graduate level education in Sociology is a desirable preparation for a growing number of career orientations. Sample positions that our graduates have obtained include research analyst, instructor and human service worker. The precise plan of study for each student will be established in consultation with the academic adviser with the student's career goal in mind.

The focus of graduate education in Sociology is directed toward both the development of applied sociologists and the advanced training of those seeking to pursue a doctoral degree. Students may elect to take courses in a specialty area, or they may pursue a background in general sociology. Areas of specialization include medical sociology (gerontology/mental health) and community development.

The Sociology graduate program provides students with the opportunity to expand their background and perspectives in research methods and theory. Consequently, the first year of the program is designed to expose students to theory and both quantitative and qualitative research methods.

Two program options are available for students. In the thesis option, students work on a research-based thesis. Students typically test theoretical assumptions using primary or secondary data. The comprehensive study option is designed for students who wish to combine their studies with some type of specialized field experience. Students electing this option are required to complete a comprehensive study paper related to their internship, such as evaluating a program.

Students in the Sociology graduate program benefit from a favorable faculty-to-student ratio. A graduate minor in sociology is available to students in other programs.

## Admissions Requirements

The Department of Sociology and Anthropology graduate program is open to qualified graduates of universities and colleges of recognized standing. To be admitted with full status to the program, the applicant must

1. Hold a baccalaureate degree from an educational institution of recognized standing.
2. Have adequate preparation in sociology and show potential to undertake advanced study and research as evidenced by academic performance and experience.
3. At the baccalaureate level, have earned a cumulative grade point average in all courses of

**Kathleen Slobin, Ph.D.**
University of California--San Francisco, 1991
Research Interests: Medical Sociology, Sociological Theory, African Studies, Feminist Theory

**Christina D. Weber, Ph.D.**
Suny-Buffalo, 2005
Research Interests: Social Theory, Feminist Theory, Sociology of Gender, Memory and Trauma Studies, Family

**George A. Youngs, Ph.D.**
University of Iowa, 1981
Research Interests: Social Psychology, Research Methods, Sociology of Disasters, Emergency Management

at least 3.0 or equivalent. Applications should be submitted directly to The Graduate School before April 1 of the upcoming academic year.

Official transcripts (transcripts having an appropriate seal or stamp) of all previous undergraduate and graduate records must be received by The Graduate School before the application is complete. When a transcript is submitted in advance of completion of undergraduate or graduate studies, an updated transcript showing all course credits and grades must be provided prior to initial registration at North Dakota State University.

Three letters of recommendation are required before action is taken on any application. Personal reference report forms are available from The Graduate School.

## Financial Assistance

Teaching assistantships are available to qualified applicants. Research assistantships may also be available, contingent on faculty research funds. Applicants for assistantships are considered on the basis of scholarship and potential to undertake advanced study and research. To be considered for an assistantship, a completed Graduate School application, official transcripts, and three letters of reference must be received by The Graduate School no later than April 1.

## Degree Requirements

Students must complete a minimum of 36 credits and a master's thesis for the thesis option, or a minimum of 35 credits and a paper for the comprehensive study option. An oral defense of the thesis or the paper is required.

Requirements for the M.S. degree in social science with a major field in sociology are as follows:

All students must

1. Successfully complete
   **Soc 723 Social Theory**
   **Soc 700 Qualitative Methods**
   **Soc 701 Quantitative Methods**
2. Complete an additional 21 credits (including thesis) or 26 credits (including comprehensive study).
3. Complete a research-based thesis or comprehensive study paper, and pass an oral defense of the thesis or paper administered by the student's supervisory committee.

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# Courses Offered

**601 Sociology of Religion 3**
Study of religion viewed as a social institution with a characteristic history, ecology, structure, behavior, and purpose. Cross-listed with RelS.

**603 Sociology of the Great Plains 3**
Social and cultural patterns, trends, and problems peculiar to life in the semi-arid Great Plains.

**605 Community Development 3**
Study of communities viewed as social systems. Includes political, economic, social, and economic factors affecting community growth and decline. Community development methods are addressed.

**607 Deviant Behavior 3**
Analysis of the sociological aspects of the antecedents, the social/human relations processes, and the consequences of deviance in Western society. Prereq: Soc 110.

**609 Social Policy 3**
Investigation of the socio-cultural conditions that affect social policy formation in the areas of medicine-mental health, criminal justice, social welfare, and community and social change.

**610 Social Inequality 3**
Analysis of social and economic inequities and investigation of the relationship between inequity and life changes.

**612 Sociology of Sex Roles 3**
The socialization of men and women; an analysis of institutional norms, values, and attitudes and their effects on gender role development. Prereq: Soc 110.

**613 Sociology of Work 3**
Analysis of contemporary work-related issues concerning changing organizational structures and cultural expectations. Prereq: Soc 110.

**617 Sociology of the Family 3**
Comparative family types, member relationships, family dynamics in relation to personality, social change, and social values.

**618 Social Psychology 3**
Examination of both historical and contemporary research and theory in social psychology. The study of the relationship between the individual and the social context. Prereq: Soc 110.

**622 Development of Social Theory 3**
Sociological theories and systems from Comte, Marx, Durkheim, and Weber through the 20th century. Prereq: Soc 110.

**624 Feminist Theory and Discourse 3**
Historical overview of feminist ideas and major writings from the 18th century to the present, which includes issues related to women's personal, social, and public lives.

**626 Sociology of Medicine 3**
Analysis of the social aspects of health and illness, the healthcare professions, organization of healthcare, and related issues.

**639 Social Change 3**
Analysis of the complex nature of social change. Prereq: Soc 110.

**640 Sociology of Aging 3**
Examination of sociological perspectives on aging. Topics include social theories of aging, retirement, long-term care, chronic illness, and death.

**641 Sociology of Death 3**
Examination of research on social psychological and social organizational dimensions of death and dying. Additional topics include hospice movement, grief and bereavement, and communicating death news.

**643 International Disasters 3**
Impacts of natural and human-made disasters on industrialized and developing societies; relief and reconstruction post-disaster programs.

**645 Special Populations in Disasters 3**
Identification of special populations and their needs that arise in emergency or disaster situations both in industrialized and developing countries.

**665 Applied Demographics 3**

Overview of demographic concepts and principles, and their application to business and planning decisions. Emphasis on using databases and information sources available on the Internet.

**700 Qualitative Methods 3**
Advanced analysis of the methods used in qualitative research projects, such as intensive interviewing, focus groups, and participant observation. Prereq: Soc 340.

**701 Quantitative Methods 3**
Advanced analysis of the methods used in quantitative research projects, such as survey design, experimental design, and evaluation research. Prereq: Stat 330 or 725, Soc 340.

**723 Social Theory 3**
Examination of contemporary social theories and theory construction. Prereq: Soc 422/622.

The following variable credit courses are also offered:

**790 Graduate Seminar 1-3**

**793 Individual Study/Tutorial 1-3**

**795 Field Experience 1-15**

**696/796 Special Topics 1-5**

**797 Master's Paper 1-3**

**798 Master's Thesis 1-10**



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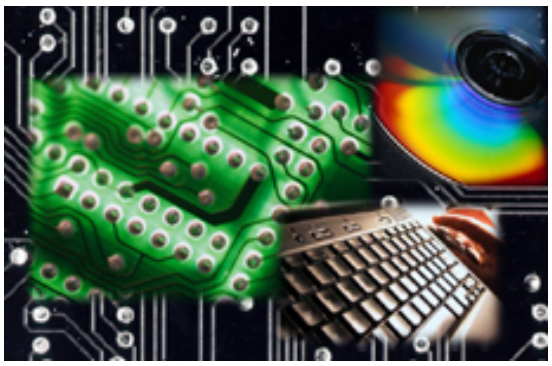
Fax: (701) 231-6524

## Graduate Faculty

701-231-8562

**see the computer science deparment for graduate faculty details**

# Software Engineering



## Program Description

Software Engineering is focused on the application of systematic, disciplined, and quantifiable approaches to the development, operation, and maintenance of software systems. Inclusive of computer programming but going well beyond, Software Engineering is concerned with methodologies, techniques, and tools to manage the entire software life cycle, including development of requirements, specifications, design, testing, maintenance, and project management. The advent of Software Engineering is a natural result of the continuous quest for software quality and reusability, and the maturing of the software development industry.

The Department of Computer Science offers a Graduate Certificate, M.S., and Ph.D. in Software Engineering. The programs are designed to appeal to both full-time students and software professionals who are employed and wish to pursue a program part time. Minimum qualifications for admission are the same as those specified for advanced degrees in Computer Science. For additional information, see www.cs.ndsu.nodak.edu or contact the Director of Software Engineering (701) 231-8189. For a complete listing of courses and faculty, please refer to the Computer Science section.

## Admissions Requirements

### Certificate

1. B.S. or equivalent degree from an accredited university;
2. Twelve semester hours or equivalent of Computer Science or Software Engineering courses from an accredited university, or at least one year full-time professional software engineering experience;
3. Programming skill in a modern higher level programming language, preferably C++, C#, or Java.

### Master of Science

1. B.S. or equivalent degree from an accredited university with at least a 3.0 grade point average on a 4.0 scale. Full-time professional experience may offset this GPA requirement at the rate of 0.1 in GPA for each eighteen months of such experience to a maximum of 0.4 in GPA;
2. Eighteen semester hours or equivalent in Computer Science from an accredited institution, or at least two years of full-time professional software engineering experience;
3. Programming skill with one modern higher level programming language, preferably C++,

C#, or Java.

## Doctor of Philosophy

1. B.S. or equivalent degree from an accredited university with at least a 3.25 grade point average on a 4.0 scale. Significant full-time software development professional experience may offset this GPA requirement at the rate of 0.1 in GPA for each two years of such experience to a maximum of 0.4 in GPA;
2. Eighteen semester hours or equivalent in Computer Science from an accredited institution, or at least three years of full-time professional software engineering experience;
3. Programming skill in at least one higher level programming language, preferably C++, C#, or Java.

## Degree Requirements

## Graduate Certificate

Requires 10 semester credit hours consisting of CSCI 713 Software Development Processes

**Any two of the following five courses:**

Computer Science 714, Software Project Planning and Estimation
CSCI 715 Software Requirements Definition and Analysis
CSCI 716 Software Design
CSCI 717 Software Construction
CSCI 718 Software Testing and Debugging

**One CSCI 790 seminar in an appropriate area as approved by the student's adviser. Examples include**

a. Database Systems
b. Extreme Programming
c. Formal Methods in Software Engineering
d. Intelligent Agents

An extensive project of approximately one third of a semester incorporated into whichever of the above courses the student and her (his) adviser selected. The project may be job related. This project serves as the capstone experience for the student.

## Sample Certificate Combinations:

Software Design: CSCI 713, 715, 716 + Seminar with project in 716
Software Testing: CSCI 713, 714, 718 + Seminar with project in 718.
Software Project Management: CSCI 713, 714, 715 + Seminar with project in 715.
Software Construction: CSCI 713, 716, 717 + Seminar with project in 716 or 717.
Other arrangements could be done as well.

## Master of Science in Software Engineering

## Program Requirements (33 semester hours)

1. The Software Engineering Core (12 credits):

Students must complete the core within five semesters of their entering the program.
   a. CSCI 713: Software Development Processes
   b. CSCI 765: Introduction to Database Systems
   c. CSCI 716: Software Design
   d. Either CSCI 715: Software Requirements Definition, or CSCI 718: Software Testing and Debugging. Each student selects one of these two courses.

2. The Software Engineering Comprehensive Examination. This examination shall include integrative questions on the four courses which make up the software engineering core (see 1 above). The exam must be passed within the first seven semesters of their program. Each student is allowed a maximum of two attempts to pass this examination. Students are encouraged to complete the comprehensive examination early in their program.

3. Six credits (not part of the core) from:
   a. CSCI 714 Software Project Planning and Estimation
   b. CSCI 715 Software Requirements Definition
   c. CSCI 717 Software Construction
   d. CSCI 718 Software Testing and Debugging
   e. CSCI 747 Software Complexity Metrics
   f. CSCI 745 Formal Methods for Software Development
   g. CSCI 746 Development of Distributed Applications

4. Nine credits of other Computer Science or Computer Engineering courses selected with and approved by the student's graduate advisory committee.

5. Three CSCI 790 graduate seminars in software engineering areas (1 credit each). These seminars must be approved in advance by the student's graduate adviser (a form is provided for this purpose).

6. A comprehensive study option (3 credits) paper based on a significant software development project undertaken by the student, perhaps as a member of a team, either at the University or as part of a job. This project will require design, implementation, and testing of a significant piece of computer software.

7. A Final Oral Examination on the paper and course work. This examination shall include questions on design choices, implementation methods, and testing choices for the student project.

## Ph.D. in Software Engineering

## Program Requirements (90 semester hours)

1. All M.S. course requirements (items 1,3,4, and 5 above) or their equivalent in transfer or examination credits.

2. CSCI 793 Software Development Project (6 semester hours). This course will require the design, implementation, and testing of a significant piece of computer software. This course must be completed successfully before the Qualifying Examination may be attempted. If a student successfully passed the M.S. in Software Engineering Comprehensive Examination at the Ph.D. qualifying level while earlier completing an M. S. at North Dakota State University, the student shall not need to take the Qualifying Examination, but this course must be completed successfully within the first two years of the Ph.D. program.

3. Satisfactory completion of the Ph.D. Qualifying Examination. This examination will consist of integrative questions on the four core courses described in (1) under the M.S. above. Students must complete this requirement within their first seven semesters of participation in the program.

4. Twelve hours of course work chosen from the courses listed below and not duplicating any items used to satisfy 1:
    a. CSCI 714 Software Project Planning and Estimation
    b. CSCI 715 Software Requirements Definition
    c. CSCI 716 Software Design
    d. CSCI 717 Software Construction
    e. CSCI 718 Software Testing and Debugging
    f. CSCI 747 Software Complexity Metrics
    g. CSCI 745 Formal Methods for Software Development
    h. CSCI 746 Development of Distributed Applications

5. Six hours of additional course work in Computer Science or Computer Engineering chosen by the student and his advisor and approved by the Student's Advisory Committee.

6. Thirty-six semester credit hours for research, preparation, and defense of a dissertation in Software Engineering. These hours will be graded on a Satisfactory/Unsatisfactory basis.

## Additional course work requirements:

1. Beyond the M.S. degree, a maximum of 9 credits of course work can be transferred.
2. The 90 credits may include a maximum of 15 credits of non-didactic courses (independent studies and seminar hours). Seminars are limited to four of those credits.
3. The student's advisory committee, the department chair, and the graduate dean all must approve the course work on the plan of study at least two semesters before graduation.



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201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701-231-8901

**Francis X.M. Casey, Ph.D.**
Iowa State University, 2000
Research Area/Activity:
Field Oriented Soil Physics, Measurement and Prediction of Water Transfer and Chemical Transport Through Soil

**Allan W. Cattanach, Ph.D. (adjunct)**
University of Minnesota, 1979
Research Area/Activity:
Soil Fertility, Sugarbeet Management

**Larry J. Cihacek, Ph.D.**
Iowa State University, 1979
Research Area/Activity:
Erosion and Cropping Systems/ Erosion and Productivity Relationships, Conventional and Alternative Crop Management, Sedimentation

**John W. Enz, Ph.D.**
University of Minnesota, 1976
Research Area/Activity:
Applied Climatology and Microclimatology/Climate Based Agricultural Management

**David W. Franzen, Ph.D.**
University of Illinois, 1993
Research Area/Activity:
Soil Fertility/State Soil Specialist

**David G. Hopkins, Ph.D.**
North Dakota State University, 1997
Research Area/Activity:
Interactions among landscape, soil morphology, soil properties and environmental aspects of land use.

**R. Jay Goos, Ph.D.**

# Soil Science

## Program Description

Graduate study leading to the M.S. and Ph.D. degrees is offered in the Department of Soil Science. The instructional and research programs emphasize an understanding of soil-plant-atmosphere interactions and their application to soil and water resource management. Students may pursue degrees with emphasis in agricultural climatology and meteorology, soil chemistry, soil fertility, soil genesis and morphology, soil management, soil physics, environmental modeling, water quality, soil salinity, plant nutrition, soil survey, soil conservation, soil reclamation, or soil mineralogy. M.S. and Ph.D. programs in Natural Resources Management and Environmental and Conservation Science with emphasis in soil science are also available.

A close working relationship exists between the department, and various state and federal agencies. Strong supporting course work is available from other departments at North Dakota State University. Programs of study are designed to meet student interests and needs.

North Dakota's diversity of soils and agricultural practices provides an exceptional field setting in which to study soil science. The department is well equipped for field and laboratory investigations.

## Admissions Requirements

The Department of Soil Science graduate program is open to all qualified graduates of universities and colleges of recognized standing. To be admitted with full status to the program, the applicant must

1. Hold a baccalaureate degree from an educational institution of recognized standing.
2. Have adequate preparation in soil science or related areas, and show potential to undertake advanced study and research as evidenced by academic performance and experience.
3. At the baccalaureate level, have earned a cumulative grade point average (GPA) in all courses of at least 3.0 or equivalent.

Preferably, applications should be submitted directly to The Graduate School before March 15 of the upcoming academic year. However, applications will be considered at any time they are submitted.

Official transcripts (transcripts having an appropriate seal or stamp) of all previous undergraduate and graduate records must be received by The Graduate School before the application is complete. When a transcript is submitted in advance of completion of undergraduate or graduate studies, an updated transcript showing all course credits and grades

Colorado State University, 1980
Research Area/Activity:
Soil Fertility and Management/ Fertilizer Management for Small Grains

**Mark Liebig, Ph.D. (adjunct)**
University of Nebraska, 1998
Northern Great Plains Research Station, Mandan, ND

**Stephen D. Merrill, Ph.D. (adjunct)**
University of California, Riverside, 1976
Northern Great Plains Research Station, Mandan, N.D.

**Kristine Nicholas, Ph.D.(adjunct)**
University of Maryland, 2003
Research Area/Activity:
Soil Microbiology and Aggregate Stability
Northern Great Plains Research Station, Mandan,ND

**Laura F. Overstreet, Ph.D.**
North Carolina State University, 2005
Research Area/Activity:
Soil Conservation and Management, Sugarbeet Research

**Lyle D. Prunty, Ph.D.**
Iowa State University, 1978
Research Area/Activity:
Soil Physics/Nutrient Management and Measurement Under Irrigation, Simulation of Water and Chemical Movement

**James A. Staricka, Ph.D. (adjunct)**
University of Minnesota, 1990
Williston Research Center, Williston, N.D.

**Donald L. Tanaka, Ph.D. (adjunct)**
University of Nebraska, 1980
Research Area/Activity:
Dryland integrated agricultural systems, Soil and crop ecological interactions

must be provided prior to the initial registration at NDSU.

Three letters of recommendation are required before action is taken on any application. Personal reference report forms are available from The Graduate School.

All applicants must complete the Graduate Record Examination with minimum scores of 450 in the quantitative and 4.0 in the analytical writing section.

The TOEFL examination is required of international applicants. A minimum score of 525 (paper test) or 193 (computer test) must be achieved.

### Financial Assistance

Research assistantships are available. Applicants are considered on the basis of scholarship, potential to undertake advanced study and research, and financial need. To be considered for an assistantship, a completed Graduate School application, official transcripts, three letters of reference, and general GRE scores (as well as a TOEFL score for international applicants) must be received by The Graduate School.

### Degree Requirements

The M.S. program normally requires 24 months of full-time study and research while the Ph.D. program normally requires a minimum of 36 months. An overall GPA of 3.0 or better must be maintained. An oral defense of thesis and academic subject matter is required of M.S. candidates. Ph.D. candidates are required to take a preliminary written and oral examination of academic subject matter and a final oral defense of a research-based dissertation.

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## Courses Offered

**610 Soil and the Environment 2**
Soil as part of the ecosystem, soil classification, land use, waste disposal, environmental quality. Not acceptable for graduate credit for Soil Science majors. 2 lectures. Offered spring. Prereq: 6 credits of physical or biological sciences.

**644 Soil Genesis and Survey 4**
Introduction to soil development, morphology, and survey. Soil classification, geography, and their interpretation will be highlighted by evaluating physical and chemical soil properties and their distribution at the landscape scale. 3 lectures, 1 three-hour laboratory (includes several field trips). Offered fall. Prereq: Soil 210.

**647 Microclimatology 3**
Characteristics and causes of the climate near the ground and its interaction with living organisms. Energy and mass transfer concepts. Lectures, discussions, demonstrations. Offered even years; spring. Prereq: Phys 211.

**655 Soil Chemistry 3**
Soil chemical reactions and equilibria, solubility relationships, mineral weathering, cation and anion adsorption, redox reactions, metal chelation, and fixation of nutrients in the soil. 3 lectures. Offered odd years; fall. Prereq: Soil 322; Chem 121, 122L.

**665 Soil and Plant Analysis 3**
Laboratory analytical techniques for chemical characterization of soils and determining elemental composition of soils and plant materials for plant nutrition and environmental purposes. 1 lecture, 2 laboratories. Offered odd years; spring. Prereq: Soil 210; Chem 121, 122.

**680 Soil and Waste Disposal 2**

Role of soil as a reactor and roles of chemical, physical, hydrological, and biological soil properties that influence waste transformation in soil. 2 lectures. Offered even years; spring. Prereq: 16 credits of physical sciences including one year of chemistry, senior or graduate standing, or departmental approval.

**763 Soil Physics 3**

Composition of soil in terms of solid, liquid, and gaseous phases. Theory of water, heat, and solute transport processes. Water availability for plant growth. 2 lectures and 1 laboratory. Offered even years; spring. Prereq: Soil 333, 339; Phys 211; Math 146 or 165.

**782 Advanced Soil Fertility 2**

Advanced study of soil-plant-nutrient relationships with emphasis on concepts of soil fertility, ion absorption, nutrient transformation, and interpretation of experimental data. 2 lectures. Offered even years; fall. Prereq: 455/655.

**784 Advanced Soil Genesis, Morphology, and Classification 2**

Advanced study of processes of soil development, soil morphology, and principles of soil classification. 2 lectures (field trip and laboratory by arrangement). Offered even years; fall. Prereq: Soil 444/644.

**785 Advanced Soil Chemistry 2**

Advanced study of chemical properties of soil. 2 lectures. Offered even years; spring. Prereq: Soil 455/655.

The following variable credit courses are also offered:

**790 Seminar 1**

**793 Individual Study 1-5**

**695/795 Field Experience 1-15**

**696/796 Special Topics 1-5**

**794 Practicum/Teaching 1**

**797 Master's Paper 1-3**

**798 Master's Thesis 1-10**

**799 Doctoral Dissertation 1-15**

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201 Old Main
North Dakota State University, Fargo, ND 58105
Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701-231-7532

**Rhonda Magel, Ph.D.**
University of Missouri-Rolla, 1982
Field:
Nonparametrics, Inference Under Order Restrictions, Regression

**Marepalli B. Rao, Ph.D.**
**Professor Emeritus**
Indian Statistical Institute, India, 1973

**Jeffrey Terpstra, Ph.D.**
Western Michigan University, 1997
Field:
Nonparametrics, Time Series, Robust Statistics

**Fu-Chih Cheng, Ph.D.**
North Dakota State University, 2003
Field:
Monte Carlo Simulations, Resampling Methods, and Design of Experiments

**Quing Kang, Ph.D.**
Kansas State University-Manhattan,2005

**Christoper Vahl, Ph.D.**
Kansas State University-Manhattan,2005

# Statistics

## Program Description

The Department of Statistics offers programs leading to a Ph.D. in statistics or a master's degree in applied statistics. The program is flexible enough to be individually planned around prior experience and in accord with professional goals.

During the first year of the program, students are strongly encouraged to meet with each faculty member to discuss possible research topics. The student should select an advisory and examining committee by the end of the first year.

A joint master's degree in computer science and statistics may also be obtained.

A graduate certificate in Applied Statistics for nonmajors is also offered. This includes Stat 725, Stat 726, and two other pre-approved graduate level courses in statistics.

## Admissions Requirements

### Master's Program in Applied Statistics

The Department of Statistics' graduate program is open to qualified graduates of universities of recognized standing. To be admitted with full status to the M.S. program, the applicant must

1. Hold a baccalaureate degree from an educational institution of recognized standing.
2. Have had at least one year of calculus.
3. Have had at least one course in statistics.
4. Have had at least one programming language.
5. Must have at least a 3.0 or equivalent cumulative grade point average (GPA) on all related courses at the baccalaureate level.

### Joint Master's Program in Computer Science and Statistics

To be admitted with full status into the M.S. program in computer science and statistics, the applicant must satisfy the admission requirements for both the M.S. program in computer science and the M.S. program in applied statistics.

### Ph.D. Program in Statistics

To be admitted with full status into the Ph.D. program, the applicant must

1. Hold a baccalaureate degree from an educational institution of recognized standing.
2. Have had four courses in math at the university calculus level or above.
3. Have had several courses in statistics.
4. Have had at least one programming language.
5. Must have at least a 3.0 or equivalent cumulative grade point average (GPA) on all related courses at the baccalaureate level.

Students not holding a master's degree in statistics or a closely related field will not be admitted to the Ph.D. program in statistics. These students must first apply to the M.S. program in applied statistics and complete the M.S. degree.

Preferably, applications should be submitted directly to The Graduate School before March 15 of the upcoming academic year.

Official transcripts (transcripts having an appropriate seal or stamp) of all previous undergraduate and graduate records must be received by The Graduate School before the application is complete. When a transcript is submitted in advance of completion of undergraduate or graduate studies, an updated transcript showing all course credits and grades must be provided prior to initial registration at NDSU.

Three letters of recommendation are required before action is taken on any application. Personal reference report forms are available from The Graduate School. The TOEFL examination is required of international applicants. A minimum score of 550 (paper test) or 213 (computer test) must be achieved.

## Financial Assistance

The student must first make application to The Graduate School and be accepted in full or conditional status before he/she is eligible for an assistantship in the Department of Statistics.

Teaching assistantships are available. To be considered for an assistantship, a completed Graduate School application, official transcripts, and three letters of reference must be submitted to The Graduate School no later than March 15. International students must also submit a TOEFL score.

## Degree Requirements

The program for the M.S. degree in applied statistics requires 32 semester credits with an overall GPA of 3.0 or higher. An oral defense of a research-based thesis or paper is required. The program for the M.S. degree in computer science and statistics requires 42 semester credits with an overall GPA of 3.0 or higher. An oral defense of a research-based thesis or paper is required.

The program for the Ph.D. degree requires an additional 30 credits of course work beyond the M.S. degree and 30 hours of research. An oral defense of a dissertation is required.

### M.S. Degree in Applied Statistics

All students must

1. Complete a set of core courses with a grade of B or better, including Stat 661, 662, 767, 768, 764 or 774.
2. Successfully complete 2 one-credit practicums in consulting. Each statistical practicum will be listed as Stat 794.

3. Complete an additional 9-12 hours (depends on number of research hours) of course work selected from the following courses: Stat 650, 651, 660, 663, 664, 665, 670, 730, 732, 750, 761, 762, 770, 777, 778, 780, 786, 796 (Special Topics in Statistics). At most, two of the following courses will count in the additional 9-12 hours: CSci 618, 654, 737; Math 650, 688, 728.
4. Pass two written comprehensive exams. Exam 1 covers Stat 767 and 768. Exam 2 covers Stat 661, 662, and 764 or 774. Exam 1 is two hours, and Exam 2 is three hours. These exams are offered approximately the fourth week of Fall and Spring Semesters. A maximum of two attempts will be allowed.
5. Successfully complete and defend a research-based thesis or paper.

### M.S. Degree in Computer Science and Statistics

All students must

1. Take a minimum of 42 semester credit hours, including at least 18 graduate course credits in computer science and at least 18 graduate course credits in statistics.
2. Take CSci 708, 713, 724, 737, 765, and one additional 600- or 700-level course in computer science.
3. Take Stat 661, 662, 767, 768, 764 or 774, and one additional 600- or 700-level course in statistics (does not include Stat 725).
4. Pass both the comprehensive exams for the M.S. degree in computer science and the M.S. degree in statistics.
5. Successfully complete a research-based thesis or paper. The supervisory committee must consist of at least one faculty member from computer science and at least one faculty member from statistics.

### Ph.D. Degree in Statistics*

All students must

1. Complete a set of core courses with a grade of B or better, including Stat 661, 662, 767, 768, 764 or 774.
2. Successfully complete 6 one-credit practicums in Consulting/Presentation Practicum. Each statistical practicum will be listed as Stat 794.
3. Complete an additional 30 semester credits of statistics courses at the 600- or 700-level (does not include Stat 725 or Stat 726). At least 15 credits must be at the 700-level. All Ph.D. students must complete Stat 786.
4. Complete 9 semester credits from the following: Math 650, 651, 688, 689, 728; CSci 654, 737. This requirement may be waived and additional courses in statistics substituted upon approval by the adviser and advisory committee.
5. Pass a written comprehensive exam. This exam consists of three sections that are each three hours in length. It is given once a year during approximately the fifth week of the Spring Semester. A maximum of two attempts is allowed.
6. Submit a research proposal and pass an oral exam on the proposal and related topics.
7. Complete and successfully defend the research dissertation.

*Some of these requirements may be satisfied upon admittance into the program with an already existing M.S. degree in Statistics.

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## Courses Offered

**650 Stochastic Processes 3**
Discrete time Markov chains, Poisson processes, continuous time Markov chains, birth

and death processes, renewal processes, branching processes, queuing systems, and applications. Prereq: Stat 368.

**651 Bayesian Statistical Decision Theory 3**
Bayesian approach to statistics, including utility and loss, prior and posterior densities, and Bayesian inference. Comparisons with classical statistical methods. Prereq: Stat 368 or 468.

**660 Applied Survey Sampling 3**
Simple random, stratified, systematic, and cluster sampling; two-stage sampling. Estimation of population means and variances. Ratio and regression estimators. Prereq: Stat 330 or 368.

**661 Applied Regression Models 3**
Simple linear regression, matrix approach to multiple regression, and introduction to various tests and confidence intervals. Includes discussion of multicollinearity and transformations. Prereq: Stat 330 or 368 and a knowledge of matrix algebra.

**662 Introduction to Experimental Design 3**
Fundamental principles of designing an experiment: randomized block, Latin square, and factorial. Also covers analysis of covariance and response surface methodology. Prereq: Stat 330 or 368.

**663 Nonparametric Statistics 3**
Various tests and confidence intervals that may be used when the underlying probability distributions are unknown. Includes the Wilcoxon, Kruskal-Wallis, and Friedman. Prereq: Stat 330 or 368.

**664 Discrete Data Analysis 3**
Application of binomial, hypergeometric, Poisson, mixed Poisson, and multinomial distributions in discrete data analysis. Log-linear models and contingency tables. Logistic regression. Discrete discriminant analysis. Prereq: Stat 368.

**665 Meta-Analysis Methods 3**
Statistical methods for meta-analysis with applications. Various parametric effect sizes from a series of experiments: fixed effect, random effect linear models; combining estimates of correlation coefficients; meta-analysis in the physical and biological sciences. Prereq: Stat 330 and 331, or 461/661 or 725.

**670 Statistical SAS Programming 3**
Focuses on statistical problem solving and writing SAS computer code. Data types, data management, data input/output, SAS as a programming language, data analysis, report writing, and graphing. Prereq: Stat 461/661 or 462/662, or Stat 726.

**725 Applied Statistics 3**
Data description, probability, inference on means, proportions, difference of means and proportions, categorical data, regression, analysis of variance, and multiple comparisons. Prereq: Knowledge of algebra. NOTE: This course is not intended for statistics or mathematics majors.

**726 Applied Regression & Analysis of Variance 3**
Simple and multiple regression, ANOVA tables, correlation, regression diagnostics, selection procedures, analysis of covariance, one-way ANOVA, two-way ANOVA. Prereq: Stat 725.

**730 Biostatistics 3**
Direct assays, parallel line assays, slope ratio assays, multiple assays, and quantal assays. Model, estimation, and testing. Probit and logit analysis. Prereq: Stat 461, 520 or 725.

**732 Introduction to Bioinformatics 3**
An introduction to the principles of bioinformatics including statistical techniques for the analysis of one or more gene sequences, and computational techniques for knowledge discovery from biological data. Prereq: Stat 461/661. Cross-listed with Math 732 and CSCI 732.

**750 Time Series 3**
Estimation of trend in time series data. Seasonal models. Stationary models. Moving average, autoregressive, and ARMA models. Model identification. Forecasting. Intervention analysis. Prereq: Stat 461/661, Stat 468/768, and a course in matrix algebra.

**761 Advanced Regression 3**
Multiple regression, analysis of residuals, model building, regression diagnostics, multicollinearity, robust regression, and nonlinear regression. Prereq: Stat 461/661, Stat 468/768, and a course in matrix algebra.

**762 Messy Data Analysis 3**
One-way classification models with heterogeneous errors. Two-way classification analysis in the unbalanced case. Analysis of mixed models. Split-plot, nested, and crossover designs. Prereq: Stat 461/661, Stat 462/662, and a course in matrix algebra.

**764 Multivariate Methods 3**
Sample geometry; correlation; multiple, partial, canonical correlation test of hypothesis on means; multivariate analysis of variance; principal components; factor analysis; and discriminate analysis. Prereq: Stat 461 or 462.

**767 Probability and Mathematical Statistics I 3**
Random variables, discrete probability distributions, density functions, joint and marginal density functions, transformations, limiting distributions, central limit theorem. Additional project required. Prereq: Math 265 or Stat 368.

**768 Probability and Mathematical Statistics II 3**
Properties of estimators, confidence intervals, hypotheses testing, Neyman-Pearson lemma, likelihood ratio tests, complete and sufficient statistics. Additional projects required. Prereq: Stat 767.

**770 Survival Analysis 3**
Basic methodology in the analysis of censored data, two basic types of censoring, parametric estimation, nonparametric estimation, and life table methods. Prereq: Stat 768.

**774 Linear Models I 3**
General linear models. Full rank models. Estimation, confidence ellipsoids, and tests of hypotheses. Not full rank models. Applications to regression and design of experiments. Prereq: Stat 768 and a course in matrix algebra.

**777 Multivariate Theory 3**
Wishart distribution, distribution of Hotelling's T-square and Lambda statistics, cluster analysis, correspondence analysis, principal components, factor analysis, discriminant analysis, multidimensional scaling. Prereq: Stat 764.

**778 Modern Probability Theory 3**
Probability theory presented from the measure theoretic perspective. Emphasis on various types of convergence and limit theorems. Discussion of random walks, conditional expectations, and martingales. Prereq: Stat 767 and Math 750. Cross-listed with Math.

**780 Asymptotics, Bootstrap, and Other Resampling Plans 3**
Development of large sample and small sample properties of a variety of estimators. Prereq: Stat 768.

**786 Advanced Inference 3**

Further discussion of properties of estimators, theory of estimation, and hypotheses testing. Prereq: Stat 768.

The following variable credit courses are also offered:

**690, 790 Seminar 1-3**

**696, 796 Special Topics 1-5**

**793 Individual Study 1-5**

**794 Consulting/Presentation Practicum 1**

**797 Master's Paper 1-3**

**797R Paper Continuing Registration 1**

**798 Master's Thesis 1-10**

**798R Thesis Continuing Registration 1**

**799 Doctoral Dissertation 1-15**

**799R Dissertation Continuing Registration 1**



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201 Old Main
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Phone: (701) 231-7033
Fax: (701) 231-6524

## Graduate Faculty

701-231-7190

**Magdy Abdelrahman, Ph.D.**
University of Illinois-Urbana, 1996
Research Interests: Characterization of Modified Asphalt Binders and Mixes; Pavement Maintenance and Rehabilitation Techniques; Performance-Related Specifications for Pavement Materials; Quality Control and Quality Assurance in Pavement Construction
Department: Civil Engineering

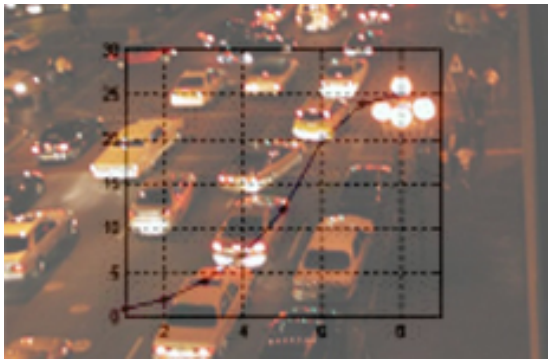
**Donald A. Andersen, EngD**
Texas A&M University, 1982
Research Interests: Transportation, Pavements, Traffic Engineering
Department: Civil Engineering

**Canan Bilen-Green, Ph.D.**
University of Wyoming, 1998
Research Interests: Quality and Reliability Engineering, Design and Auditing of Quality and Productivity Monitoring Systems, Statistical Modeling and Applications, Applied Operations Research
Department: Industrial and Manufacturing Engineering

**John Bitzan, Ph.D.**
University of Wisconsin-Milwaukee, 1997
Research Interests: Transportation Economics
Department: College of Business Administration

**Eric A. DeVuyst, Ph.D.**
Purdue University, 1993
Research Interests: Production and Resource Economics, Farm Management, Operations Research

# Transportation and Logistics



## Program Description

North Dakota State University offers an interdisciplinary program leading to the Ph.D. degree in Transportation and Logistics (TL). The Transportation and Logistics program is a joint effort of the Colleges of Agriculture, Food Systems, and Natural Resources; Business Administration; and Engineering and Architecture as well as the Upper Great Plains Transportation Institute. The following departments are participating in the program: Agribusiness and Applied Economics; Civil Engineering and Construction; Industrial and Manufacturing Engineering; and Management, Marketing, and Finance.

The TL doctoral program allows students to develop advanced knowledge and research skills in the rapidly growing fields of transportation and logistics. The Ph.D. program consists of three main components: a core curriculum of 25 credits, an area of concentration, and a dissertation. After completing the interdisciplinary core curriculum, students may enter one of three areas of concentration: 1) Logistics and Supply Chain Systems, 2) Transportation Economics and Regulation, and 3) Transportation Infrastructure and Capacity Planning.

## Admissions Requirements

The Transportation and Logistics Ph.D. program is open to qualified graduates of universities and colleges of recognized standing. To be admitted with full standing, the applicant must

1. Hold a baccalaureate degree from an educational institution of recognized learning.
2. Have adequate preparation in one or more of the disciplines comprising Transportation and Logistics.
3. Have shown the potential to undertake advanced study and research as evidenced by prior academic performance.
4. Have earned a cumulative grade point average of at least 3.0 or equivalent in all courses completed at the baccalaureate level.Students entering from a master's degree program must have earned a cumulative grade point average of at least 3.0 or equivalent in their graduate program.

Students who do not meet all requirements for admission or have deficiencies in prerequisite course work, but show satisfactory potential for graduate study, may be admitted conditionally. The conditional status may be changed to full graduate standing after the first or second semester of study, based on the student's academic performance.

The Transportation Infrastructure and Capacity Planning option is restricted to students with undergraduate degrees in Civil or Construction Engineering. A student wishing to pursue an

Department: Agribusiness and Applied Economics

**Robert Hearne, Ph.D.**
University of Minnesota, 1995
Research Interests:
Natural Resource and Environmental Economics
Department: Agribusiness and Applied Economics

**Joseph M. Jones, Ph.D.**
University of Missouri, 1994
Field:
Marketing
Department: Management, Marketing, and Finance

**Won Koo, Ph.D.**
Iowa State University, 1974
Research Interests:
International Trade
Department: Agribusiness and Applied Economics

**David K. Lambert, Ph.D.**
Oregon State University, 1985
Research Interests:
Production Economics, Natural Resources
Department: Agribusiness and Applied Economics

**Reza A. Maleki, Ph.D., PE, CMfgE**
North Dakota State University, 1989
Research Interests:
Plant-wide Assessment, Manufacturing and Productivity Improvements, Rapid Product Development, Production Systems Design
Department: Industrial and Manufacturing Engineering

**Peter O'dour, Ph.D.**
University of Missouri-Rolla, 2004
Research Interests:
GIS, Groundwater contamination, Remote sensing
Department: Geosciences

**G. Padmanabhan, Ph.D.**
Purdue University, 1980
Research Interests:
Hydrology, Water Resources, Hydraulic Engineering

area of concentration in Transportation Economics and Regulation must have completed intermediate-level microeconomics and taken at least one course in macroeconomics. In order to pursue an area of concentration in Logistics and Supply Chain Systems, a student must have earned a baccalaureate degree in Agribusiness, Business, Economics, Finance, Industrial Engineering, Management, Marketing, or a related field. All applicants must meet the general program prerequisites of at least one year of calculus and one course in statistics and economics.

Preferably, applications for admission should be submitted directly to The Graduate School before May 1 of the upcoming academic year. However, applications will be considered at any time they are submitted. The Graduate School must receive official transcripts of all previous undergraduate and graduate records before the application is complete. Three letters of recommendation are required before action is taken on any application.

The TOEFL examination is required of international applicants. A minimum score of 550 (paper test) or 213 (computer test) must be achieved. The Graduate Record Examination (GRE) is required for all students without a master's degree from an institution of recognized learning and any student without a qualifying degree from an institution of recognized learning in the United States.

## Financial Assistance

The number of assistantships varies from year to year, depending on grants and the number of students in residence. Applicants are considered on the basis of scholarship, academic performance, and financial need. The application to The Graduate School, including the three letters of reference and official transcripts, is required to be considered for an assistantship. International students must also submit a TOEFL score. Graduate tuition is waived for students with assistantships.

## Degree Requirements

The Ph.D. program requires the completion of a minimum of 90 credits of graduate study beyond the baccalaureate degree with an overall GPA of 3.0 or higher. Each student must develop a plan of study under the guidance of a faculty adviser and a supervisory committee. Twenty-five of the graduate credit hours must consist of core Transportation and Logistics courses or suitable substitutes. A minimum of 30 credit hours must consist of research-based dissertation credits. In addition, a minimum number of credit hours must be taken in the student's area of concentration, including quantitative methods courses related to the concentration. The remaining credits may be comprised of technical electives and additional dissertation credits.

Students must take a qualifying examination at the end of the first year of studies, or as soon as possible thereafter. The qualifying exam will include two components: 1) core transportation and logistics knowledge and 2) competency in quantitative methods. After passing of the qualifying examination and successful completion of the courses designated in the plan of study, the student may schedule a comprehensive examination. The comprehensive exam includes written and oral components related to the student's area of concentration. The comprehensive exam also includes a dissertation prospectus examination in which the student must present and defend a plan for undertaking and completing a dissertation. After passing of the comprehensive exam and completion of the dissertation, the doctoral candidate must pass a final examination in which the completed dissertation is presented and defended.

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# Courses Offered

**AgEc 771 Economics of Transportation Systems 3**
This course will provide an understanding of transportation economics and policy

Department: Civil Engineering

**Ayman Smadi, Ph.D.**
Iowa State University, 1994
Research Interests:
Transportation Systems, Intelligent Transportation Systems, Freight Planning
Department: Upper Great Plains Transportation Institute

**Gary R. Smith, Ph.D.**
Purdue University, 1986
Research Interests:
Quality Control and Systems Applications, Decision Analysis and Modeling Techniques, Safety Performance Measurement and Improvements, Labor Productivity
Department: Civil Engineering

**Joseph Szmerekovsky, Ph.D.**
Case Western Reserve University/ Weatherhead School of Management
Research Interests:
Project management and scheduling, Complex systems and flexible manufacturing and using linear and nonlinear dynamic and integer programming and network flows
Department: Management, Marketing and Finance

**Denver D. Tolliver, Ph.D.**
Virginia Polytechnic University, 1989
Research Interests:
Transportation Systems Planning, Freight Transportation, Economic Analysis
Department: Upper Great Plains Transportation Institute

**Rodney D. Traub, Ph.D.**
Purdue University, 1994
Field: Operations Management
Department:
Management, Marketing, and Finance

**Amiy Varma, Ph.D.**
Purdue University, 1993
Research Interests:
Transportation Systems and Planning, Traffic Engineering, Airports, and Infrastructure Management

issues facing society. Topics include transport demand, modal costs, transportation competition and market power, transportation regulation, transportation investment, and the economics of transportation safety.

**Engr 770 Quantitative Modeling 3**
Applications modeling and optimization methods. Domains: transportation, logistics, manufacturing, service systems scheduling, and supply-chain management. Decision models: linear programming and sensitivity analysis, transportation and assignment, network models and algorithms, and integer, dynamic and nonlinear programming.

**Engr 771 Probabilistic and Deterministic Methods 3**
Applications modeling. Domains include transportation, logistics, manufacturing, service systems scheduling, and supply-chain management. Quantitative models and tools include Markov chains, stochastic processes, queuing, deterministic and stochastic decision analysis, time series, forecasting, and regression modeling.

**TL 782 Transportation Systems I 3**
Interdisciplinary concepts and models, including relationships among transportation, the economy, environment, and land use; freight transportation demand; logistics planning; railroad technology, capacity, and infrastructure; barge, pipeline, ports, and cargo-handling; highway and maritime transportation.

**TL 783 Transportation Systems II 3**
Railroad, highway and motor carrier transportation; highway capacity and finance, truck size and weight policies, and highway planning models.

**TL 784 Intermodal Freight Transportation 3**
Intermodal freight transportation modes. Container handling and logistics. Rail, highway, and ocean vessel equipment. Terminals and cargo-handling procedures. Landside and port issues. Documentation and liability. Intermodal information systems. Policy, regulatory, and financial issues.

**TL 785 Spatial Analysis of Transportation Systems 4**
Theories and models of spatial interaction between transportation and land use, including transportation and spatial organization of production and cities, networks and transportation costs, location theories, interaction and optimization models, GIS concepts and applications.

**TL 786 Public Transportation 3**
History and development of transit. Transit modes. Transit facilities. Services planning. Routing and scheduling. Demand forecasting. Intelligent Transportation Systems. Transit and urban land use. Rural transit systems. Intercity rail passenger service. Policy and management.

**TL 788 Research in Transportation and Logistics 3**
Strategic research issues in Transportation and Logistics. Foundations of research philosophies and methodologies. Research design, problem and objective statements. Research methods in Applied Economics, Supply Chain Management, and Transportation Infrastructure Planning. Interdisciplinary synthesis.

The following variable credit courses also are offered:

**TL 790 Seminar 1-3**

**TL 793 Individual Study 1-5**

**TL 796 Special Topics 1-5**

**TL 799 Dissertation (credits determined by advisory committee)**

In addition to these courses, technical electives may be selected from graduate courses offered by participating departments, subject to the approval of the student's advisory committee. For a

Department: Civil Engineering

**David L. Wells, Ph.D.**
University of Missouri-Rolla, 1996
Research Interests: International Studies in Manufacturing Technology, Strategic Management, Economic Development Strategies
Department: Industrial and Manufacturing Engineering

**William W. Wilson, Ph.D.**
University of Manitoba, 1980
Research Interests: Commodity Marketing, Agribusiness, Industrial Organization
Department: Agribusiness and Applied Economics

**Frank Yazdani, Ph.D., PE**
University of New Mexico, 1987
Research Interests: Structural Engineering/Mechanics, Constitutive Modeling of Materials, Damage Mechanics, Plasticity, Computational Plasticity, Finite Elements, Concrete and Masonry Materials
Department: Civil Engineering

description of potential electives, see the graduate program descriptions for Agribusiness and Applied Economics, Business Administration, Civil Engineering and Construction, and Industrial and Manufacturing Engineering.



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