



Cellular and Molecular Biology Interdisciplinary Graduate Program

Graduate Handbook
North Dakota State University

2017 - 2018

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1. PROGRAM OVERVIEW

The CMB program was formed in 1988 and was the first interdisciplinary graduate program at NDSU. The program was designed to respond to the evolving nature of research in the life sciences in which it was recognized that biological phenomena emerge from molecular and cellular events and that the elucidation of such processes increasingly relies on multidisciplinary approaches.

The CMB program provides cross training of graduate students in the areas of biochemistry and cellular and molecular biology. In this setting, students learn the most up-to-date approaches from a variety of fields. Integration across concepts as well as the application of various approaches to addressing biological problems is developed through their preliminary exam, in which students are required to write a research proposal in the format of a national granting agency different from their dissertation research, and to defend it orally. The students also develop and conduct an original line of research under the supervision of their major adviser. The program also brings together faculty with common interests and who use common approaches and equipment. Such a community of scientists fosters collaboration and engenders a sense of cooperation that leads to shared use of common equipment.

The CMB program prepares students for careers in academia and private industry. All graduates of the program have obtained permanent positions in their field or are engaged in postdoctoral training.

"NDSU afforded me the opportunity to receive a broader, interdepartmental education. This was appealing because I wanted to be able to keep my options open when it came time to head out into the workforce. To this day, the broad education has continued to be a benefit." -- Barton Slagter, Ph.D. 2004, senior research scientist at Novartis Animal Health

"The flexibility of the CMB program at NDSU was instrumental in allowing me to study my desired field—immunology—while gaining a wealth of perspectives and technical applications for research. I didn't realize how many tools were in that toolbox until I did my postdoctoral training at the University of Michigan Medical School and saw how my foundational knowledge in microbiology, immunology, biochemistry, and hands-on lab work allowed me to bring new techniques and opportunities to one of the best research universities in the country." – Jane Schuh Ph.D. 2000, Professor and Associate Director of the ND Agricultural Experiment Station and current Director of the NDSU Cellular and Molecular Biology program

1.1 Meet the Director – Dr. Jane Schuh

Welcome to the Cellular and Molecular Biology program at North Dakota State University. The CMB program provides cross training of graduate students in the areas of biochemistry and cellular and molecular biology. In this setting, students learn the most up-to-date approaches from a variety of fields. Integration across concepts as well as the application of various approaches to addressing biological problems is developed through their preliminary exam, in which students are required to write a research proposal in the format of a national granting agency different from their dissertation research, and to defend it orally. The students also develop and conduct an original line of research under the supervision of their major adviser. The program also brings together faculty with common interests and who use common approaches and equipment. Such a community of scientists fosters collaboration and engenders a sense of cooperation that leads to shared use of common equipment. Active participation in your coursework will make it a richer experience for both you and your colleagues.



Good luck with your studies at NDSU. I hope you strive for excellence and academic success throughout your time here. Once you've completed your program of study, you will be well prepared to join our graduates who go on to careers in academic research, government, and industry.

Dr. Jane Schuh is the director of the NDSU Cellular and Molecular Biology Interdisciplinary Graduate Program, as well as a Professor of Immunology in the Microbiological Sciences Department. She graduated with a Ph.D. in Cellular and Molecular Biology from NDSU and participated in a postdoctoral fellowship at the University of Michigan Medical School in the Department of Pathology. Schuh joined the faculty at NDSU in 2004 as a researcher studying allergic asthma and teaching immunology. While still an active researcher, she has also served in a number of administrative roles across the campus. Throughout her career, Schuh has been awarded more than \$13 million in grant funding and has authored and co-authored more than 30 research papers.

1.2 Mission

The mission of the Cellular and Molecular Biology program is to provide an interdisciplinary education so that students may incorporate innovative approaches to address biological problems of the state, nation, and world.

1.3 Prerequisite 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:

- Hold a baccalaureate degree from an educational institution of recognized standing.
- Have earned a cumulative grade point average (GPA) in all courses of at least 3.0 or equivalent at the baccalaureate level. Applications may be submitted directly to The Graduate School at any time.
- Have adequate preparation and show potential to undertake advanced study and research as evidenced by academic performance and experience.
- If possible, applicants should identify at least one Cellular and Molecular Biology faculty member with whom they wish to study.

A recent score (within 12 months) for the general Graduate Record Examination or successful completion of a relevant M.S. degree is required. No minimum GRE score is required, but investigators may use this as a piece of evidence in consideration of the student's application. Foreign students are required to have proficiency in English as shown by a TOEFL iBT of 71 or higher or an IELTS of 5.5 or higher, unless they have matriculated from an institution in which instruction is conducted in English.

The following undergraduate courses are 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.
- **Recommended** - introductory courses in computer science, statistics, and technical writing.
- With program approval, up to 3 courses may be attempted within the first year of resident study to correct deficiencies in required courses. Graduate credit will not be earned for these courses.

1.4 Program Administration

This interdisciplinary graduate program is administered by the Director with guidance from the CMB Steering Committee. The committee is composed of CMB faculty members representing a variety of participating academic departments. The duties of the Steering Committee include: 1) review of CMB students' plans of study, proposed research topic, and general progress, as needed; 2) review of applications for membership in the CMB faculty; and 3) implementation of policy and procedures of the CMB program.

1.5 Participating Departments/Programs

North Dakota State University offers an interdisciplinary program leading to the doctoral degree in Cellular and Molecular Biology. The CMB program is a joint effort of the Colleges of Agriculture, Food Systems, Natural Resources; Science and Math; Health Professions; and Engineering and includes the Departments of Animal Sciences, Biological Sciences, Chemistry and Biochemistry, Coatings and Polymeric Materials, Electrical & Computer Engineering (Bioengineering), Microbiological Sciences, Pharmaceutical Sciences, Physics, and Plant Sciences.

1.6 Financial Assistance

Self-funded students who provide their own support through sponsored funding sources (governmental or grant funding only) may contact CMB faculty members with whom they wish to work.

While the CMB program offers a limited number of competitive graduate assistantships that includes a full tuition waiver, financial support, is usually provided by the department or laboratory in which the student will carry out research. Therefore, applicants are encouraged to research participating faculty members' areas of expertise and contact those with whom they would like to work regarding availability of positions and funding. If specific investigators are identified in the Statement of Purpose, the Steering Committee or Director will contact the faculty members identified by the applicant to determine if financial support is available.

1.7 Conference Policy and Travel Support

Students are encouraged to submit papers and posters, which represent CMB and NDSU, for conference presentations within the United States. When funding is available, student scholarships will be supported to help cover travel costs. Students must submit their acceptance email and a note of support from PI stating how the remainder of the financial support would be covered along with the request for travel support at least two months prior to the event.

1.8 Facilities

NDSU possesses top-quality facilities and equipment, including confocal and fluorescence microscopy, DNA sequencing, laser capture microdissection, flow cytometry, microarray analysis, proteomic analysis, micro-CT imaging, real-time PCR, as well as scanning and transmission electron microscopy.

1.9 For More Information

For additional information or clarification on any information addressed in the handbook please contact the program Director or the Graduate School or visit the NDSU CMB website at <https://www.ndsu.edu/cellularmolecularbiology>.

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2. DOCTORATE IN CELLULAR AND MOLECULAR BIOLOGY

2.1 Program Objectives

The CMB program has been designed to respond to the evolving nature of research in the life sciences in which it was recognized that biological phenomena emerge from molecular and cellular events and that the elucidation of such processes increasingly relies on multidisciplinary approaches. In addition, new applications of sensor technology, disease diagnosis and treatment, and other emerging technologies require that scientists work across historical boundaries of their disciplines.

This is a research-oriented degree that requires advanced skills areas of biochemistry, cellular biology, molecular biology, and contemporary research techniques. Prospective students must have a high quantitative aptitude and be prepared to undertake rigorous graduate-level training in research including quantitative methods.

2.2 Academic Advising

As part of the acceptance process, students will identify an appropriate major advisor. This process should consist of finding a CMB-associated graduate faculty member who fits the student's personality, area of concentration, and who has a funded project on which the student can work. The adviser will assist in recommending graduate committee members to ensure a well-rounded group of faculty who will assist in formulating the dissertation. This supervisory committee should be formed within the first year of residence, and members must be identified before the plan of study is formulated so that all committee members have a chance to contribute to the plan of study. All committee members must approve the plan of study.

2.3 Supervisory Committee

The supervisory committee will have at least four members. The committee consists of:

1. The major adviser, who must be a full or associate member of the graduate faculty and affiliated with the CMB program. The 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 assist in compiling 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 director accompanied by rationale and *curriculum vitae*.
4. The Graduate School appointee, who must be a full member of the NDSU graduate faculty from outside the student's program. This appointment is officially made by the graduate dean, but suggestions are very welcome. The role of this member is to ensure that the student's plan of study follows Graduate School guidelines and that other Graduate School policies are observed. This member 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 upon recommendation by the program director accompanied by rationale and *curriculum vitae* and subsequent approval by the graduate dean. At least one of the individuals identified in points 2 or 3 above must be from the CMB graduate faculty.

The supervisory committee, agreed upon by the major adviser and student, 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/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.

2.4 Plan of Study

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, and the Graduate School dean. The plan of study must be filed in the Graduate School prior to scheduling the comprehensive written examination.

Bachelor's to Doctoral Degree

- Minimum 90 credits
- 27 of the 90 must be didactic credits. Fourteen credits of the total 27 are required courses prescribed by the CMB curriculum.
- 15 of the 27 must be 700- or 800-level course work. Fourteen of these credits are required courses for the CMB program. The rest may come from the list of elective courses that are approved for CMB.
- An overall GPA of 3.0 or better must be maintained.

Master's to Doctoral Degree

- Minimum 60 credits completed at NDSU. Twenty credits of the total 60 are required courses prescribed by the CMB curriculum.
- 15 of the 60 credits must be 700- or 800-level didactic courses. Fourteen of these credits are covered under the required courses for the CMB program. The other course may come from the list of elective courses that are approved for CMB.
- An overall GPA of 3.0 or better must be maintained.

Course Requirements

The program requires two courses in molecular biology, cell biology, and techniques courses as the core of the curriculum. Required courses are typically completed by the end of the second year in residence. They are:

MOLECULAR BIOLOGY

- **BIOC 701. Comprehensive Biochemistry I. 4 Credits. (Required)** Comprehensive treatment of the chemistry and biochemistry of proteins, nucleic acids, carbohydrates, lipids, vitamins, hormones, and the specific metabolism of these substances. 4 lectures.
- **BIOC 702. Comprehensive Biochemistry II. 4 Credits. (Required)** Comprehensive treatment of the chemistry and biochemistry of proteins, nucleic acids, carbohydrates, lipids, vitamins, hormones, and the specific metabolism of these substances. 4 lectures. Recommended: [BIOC 701](#).

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- **BOT 820. Advanced Cell Biology. 3 Credits. (Required)** In-depth survey of cell biology, including studies of membranes, secretion cytoskeleton, cellular movement organelles, and gene regulation. Prereq: [BIOC 702](#). Cross-listed with [ZOO 820](#).

- **One of the following is required:**
 - **BIOC 719. Molecular Biology of Gene Expression and Regulation. 3 Credits.** Advanced topics in molecular biology and regulation in prokaryotes, eukaryotes, and archaea; early events in developmental gene expression. 3 lectures. Prereq: [BIOC 702](#). F (alternate years).
 - **MICR 783. Advanced Bacterial Genetics and Phage. 3 Credits.** Mechanisms of genetic rearrangement and regulation in bacteria and phage. Recombinant DNA. Prereq: [MICR 682](#).
 - **PLSC 731. Plant Molecular Genetics. 3 Credits.** Molecular aspects of plant genome organization and expression; basic and applied usages of molecular markers and gene transfer techniques. 3 lectures. Prereq: [PLSC 631](#). S (even years).

TECHNIQUES COURSES

- **BIOC 673. Methods of Biochemical Research. 3 Credits. (Required)** Advanced separation, characterization, and enzymological techniques for research in the biological sciences are emphasized. 1 lecture, 2 three-hour laboratories. Prereq: [BIOC 661](#). Coreq: [BIOC 701](#). {Also offered for undergraduate credit - see [BIOC 473](#).}.
- **BIOC 674. Methods of Recombinant DNA Technology. 3 Credits. (Required)** Principles and techniques of recombinant DNA construction, gene cloning, and analysis of gene structure. 1 lecture, 2 three-hour laboratories. Recommended co-req: [BIOC 702](#). {Also offered for undergraduate credit - see [BIOC 474](#).}.

Each student is expected to seek out professional development by attending regular seminars in their home department or in conjunction with their research interests (for example, a seminar series or COBRE science series). Students are **required to present at least one scientific seminar per year** throughout the program. In addition, students will supplement their knowledge of molecular biology, cell biology, and research techniques by fulfilling the remaining credits in their plan of study with a selection from the following list of electives. Other appropriate electives may be used if approved by the student's advisory committee, as well as the program Director with input from the Steering Committee:

MOLECULAR BIOLOGY

- **ANSC 773. Energy Metabolism. 3 Credits.** Methods of measuring energy values and the metabolic processes involved in the production of useful biological energy from organic compounds. 3 lectures. Prereq: [BIOC 701](#). F (odd years).
- **ANSC 774. Nitrogen Metabolism. 3 Credits.** Detailed overview of nitrogenous compounds including metabolism and function. Considerable emphasis on current research from the literature. 3 lectures. Prereq: [BIOC 701](#). S (even years).
- **ANSC 875. Vitamins and Minerals. 3 Credits.** Metabolism of vitamins and minerals and their application in animal nutrition and the feed industry. 3 lectures. Prereq: [BIOC 701](#). F (even years).
- **BIOC 716. Protein and Enzyme Biochemistry. 3 Credits.** Advanced topics in protein properties and structure, and the influence of these factors on enzyme kinetics and mechanism. 3 lectures. Prereq: [BIOC 702](#). S (alternate years).
- **BIOC 723. Structural Basis of Membrane Transport and Signaling. 3 Credits.** Advanced topics discussing how three-dimensional structures of membrane proteins dictate their function in coordinating the extracellular environment with intracellular processes. Prereq: [BIOC 660](#) or [BIOC 701](#).

- **BIOL 679. Biomedical Genetics and Genomics. 3 Credits.** This course will cover the diagnoses, clinical presentations, prevention and treatments of hereditary diseases (Mendelian and complex); the ever-increasing roles that genetics and genomics have in advancing medicine (including personalized medicine). {Also available for undergraduate credit - see [BIOL 479](#).}.
- **PSCI 746. Neuropharmacology. 3 Credits.** Study of action mechanisms of drugs affecting the central and peripheral nervous systems.
- **PSCI 747. Cardiovascular Pharmacology. 3 Credits.** Study of action mechanisms of drugs affecting the circulatory systems, including their pathology.
- **PSCI 762. Advanced Biopharmaceutics. 2 Credits.** Stability and kinetic factors involved in absorption, distribution, metabolism, and excretion of drug products.
- **PPTH 759. Host-Parasite Genetics. 3 Credits.** Host-parasite genetics including genetics of plant and pathogens and gene-for-gene relationships. 3 lectures. S (even years).
- **PLSC 741. Cytogenetics. 4 Credits.** Chromosome behavior during mitosis and meiosis; chromosome structure, function, and recombination; inheritance in aneuploids and polyploids; haploid formation and utilization. 3 lectures, 1 three-hour laboratory. F (even years).

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- **ANSC 813. Domestic Animal Endocrinology. 3 Credits.** Detailed overview of the function of hormones and their effects on physiological systems. Considerable emphasis will be placed on experimental approaches, approaches to manipulate endocrine status, and current literature.
- **ANSC 828. Advanced Reproductive Biology. 3 Credits.** Discussion of reproductive physiology research with emphasis on current topics in cellular and molecular biology. 3 lectures. S (odd years).
- **ANSC 830. Growth Biology. 3 Credits.** Regulation of growth at the cell/tissue, organ systems, and whole animal levels. 3 lectures. S (even years).
- **BIOC 683. Cellular Signal Transduction Processes and Metabolic Regulation. 3 Credits.** 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 702](#). F (alternate years) {Also offered for undergraduate credit - see [BIOC 483](#).}.
- **MICR 775. Molecular Virology. 3 Credits.** 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 660](#), [MICR 670](#), [MICR 675](#).
- **MICR 781. Advanced Bacterial Physiology. 3 Credits.** 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 680](#).
- **PSCI 765. Cancer Cell Biology. 2 Credits.** This course covers the principles of modern cancer cell biology, including topics on oncogenes, tumor suppressor genes, growth factors, signal transduction, cell cycle, apoptosis, angiogenesis, and mechanism of tumor metastasis.

- **PPTH 760. Advanced Mycology. 4 Credits.** Biology and classification of fungi. Emphasis on identification, growth and development, physiology, and etiology of fungi. 2 lectures, 2 laboratories. F (odd years).
- **ZOO 682. Developmental Biology. 3 Credits.** 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. F/2 (even years) {Also offered for undergraduate credit - see [ZOO 482](#).}.

TECHNIQUES COURSES

- **ANSC 855. Molecular Biological Techniques in Animal Sciences. 3 Credits.** The theory and application of molecular biology laboratory techniques to the field of animal sciences. Prereq: [BIOC 660](#) or [BIOC 701](#). [There is a fee for non-An Sci students]
- **BIOC 675. Computer Applications in Biochemistry and Molecular Biology. 3 Credits.** 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.
- **CHEM 728. Physical Methods for Chemical and Biomolecular Research. 2 Credits.** Fundamentals and applications of physical methodologies, with emphasis on spectroscopic methods, used to probe molecular structure and the structural basis of reactivity. Covers optical, chiroptical, vibrational, paramagnetic resonance, and nuclear spectroscopic methods along with their applications to the study of molecular and biomolecular systems. Prereq: [CHEM 625](#) or BIOC 665.
- **CHEM 729. X-Ray Structure Determination. 2 Credits.** Use of single crystal X-ray diffraction data to determine molecular and crystal structures. Half semester.
- **CPM 771. Modern Methods of Polymer Characterization. 3 Credits.** Understanding the physical properties of polymers and methods for their characterization. Focusing on the significance and interplay of physical parameters and the underlying physics of the characterization methods.
- **ECE 713. Introduction to Lab-on-a-Chip Technology. 3 Credits.** This course introduces the fundamentals of Lab-on-a-chip technology. It also provides a comprehensive picture of instruments, tools and techniques used in various aspects of Lab-on-a-chip technology. Finally, some applications in biomedical engineering will be discussed.
- **MICR 465. Animal Cell Culture Techniques. 2 credits.** Methods of animal cell culture propagation and uses for cell culture systems.
- **PLSC 721. Genomics Techniques. 2 Credits.** Principles, techniques, and applications of the large-scale analysis of DNA organization and sequence, RNA expression, protein sequence, and structure. Prereq: [PLSC 611](#). Cross-listed with [BIOC 721](#). S.

2.5 Transfer of Credit

Bachelor's to Doctoral students: the doctorate requires 27 credits of course work, and of these, no more than 12 may be transferred by the petition process.

All transfer credits:

- College-level course work from regionally accredited colleges or universities (or equivalent for international institutions) is eligible for acceptance in transfer (credits from international institutions can be transferred only if approved by a committee from the student's program);

- must carry only grades of A or B on a 4-point scale;
- must have been earned within a 10-year period at the time of the final examination;
- must be clearly graduate level (a course listed as both graduate and/or undergraduate level will not be transferred);
- must not be a continuing education, correspondence, extension, or workshop course;
- must not be internship, individual study, special problem, or research (disquisition) courses, or courses graded Pass/Fail or Satisfactory/Unsatisfactory;
- must not have been used to fulfill the requirements of a baccalaureate or master's degree;
- must be verified by an official transcript; and
- 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 College.

Master's to Doctoral students: A total of 30 credits will automatically be attributed from the completion of a master's degree in an aligned discipline, reducing the total number of required disquisition credits from 90 to 60. The remaining 60 credits must be completed at NDSU.

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 graduate credits are subject to the minimums of transfer credits and to the policies given in the text.

All transfer 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.

2.6 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 is valid for one year. Should a student not have his/her disquisition approved by the Graduate College or fail to meet other degree requirements, the final examination must be retaken.

If a period of time two years or greater lapses before the disquisition is approved by the Graduate School, the student must reapply, re-defend the dissertation, and must register for a minimum of two (2) credits. The student's degree will post at the end of the semester in which the disquisition is approved by the Graduate School.

2.7 Preliminary Examinations

The exams for candidacy qualification consist of a written examination, which is an independent research proposal written by the student, and an oral examination based on the same proposal. These exams are to be taken directly following the completion of their core didactic courses, typically at the end of the second year and no later than the end of the third year in residence. Annual renewal of stipends, research assistantships, and teaching assistantships will require the student to complete the exams at the designated time for their program. Students can request scheduling modifications from their advisory committee for extenuating circumstances. The written portion of the preliminary examination must be prepared, evaluated by the committee, and found to be satisfactory ("passed") before the comprehensive oral examination can be scheduled. Scheduling paperwork ("Notification of Scheduled Examination" form) must be submitted to the Graduate School at least two weeks before the oral examination. This is the student's responsibility.

The supervisory committee shall serve as the examining committee of which the major adviser shall serve as chair.

Written exam

To fulfill the written portion of the preliminary examination, the student will develop a concept for a research proposal in consultation with their mentor. The advisory committee will be notified in writing of the proposal topic before the student begins writing the proposal in earnest to provide time for consultation with the committee and mentor. The committee's approval of the proposal topic should be treated as highly desirable. Committee members are encouraged to share concerns with the student and/or advisor as soon as possible, but no later than five business days after receiving the proposal topic. The targeted program for the proposal may vary, but should be approved by the advisory committee along with the concept. The targeted program should be administered by the NIH, NSF, or NIFA and may include predoctoral, postdoctoral, or the main research programs of the chosen institute.

The proposal may be developed in consultation with the research mentor, colleagues, and collaborators; however, the student must have complete editorial and intellectual authority over the proposal. The written proposal should be the product of the student's own work. The mentor may provide guidance on the requirements of the targeted program including helping the student decipher formatting requirements, preliminary data requirements, etc.

At a minimum, the proposal should contain information in the following areas:

- Project summary and impact statement
- Background and justification/significance of the proposed work
- Preliminary data
- Specific hypotheses or objectives
- Approach: experimental design and technical methods (6-10 pg)
- Expected outcomes
- Project timeline
- Biographic sketch
- Draft budget

The student must pass the written portion of the exam before the oral portion may be scheduled. The student will submit the written proposal to the advisory committee and will allow at least 10 business days for their deliberation. The committee will meet to discuss and to determine the result of the written exam. Committee members are expected to spend considerable time in evaluation of the written proposal and to provide their written comments to the student at the time conclusion of the examination.

Evaluation criteria:

- Background and justification/significance of the proposed work: does the work present relevant background and is the significance of the work demonstrated?
- Preliminary data: does the preliminary findings (whether the student's, the home lab's, or from the literature) support the hypothesis?
- Specific hypotheses or objectives: are the objectives of the proposal defined and achievable?
- Approach: are the experimental design and technical methods appropriate to answer the questions set forth and to test the hypothesis?
- Expected outcomes: can the student explain what their expected results will be and how the data will be interpreted?
- Project timeline: is the time allotted for the work realistic?
- Biographic sketch: per agency guidelines
- Draft budget: is the funding complete and appropriate for the work proposed?

Although a 'fundable' score is not required for successful completion of the written portion of the examination, each advisory committee member will vote on whether to proceed with the oral portion of the examination. A negative vote by more than one member of the student's committee will signify failure of the preliminary examination. Upon permission of a majority of the supervisory committee members, a candidate may repeat the written examination (for a total of 2 attempts).

Oral exam

To fulfill the oral portion of the preliminary examination, students will provide an oral defense of their written proposal. This should be scheduled with the Graduate School (Notification of Scheduled Examination form) and the advisory committee immediately after the written exam has been successfully passed.

The student will present the background, rationale, objectives, approach, and impact of the proposed work to their advisory committee. Evaluation of the student will proceed in a question and answer format until all advisory committee members are satisfied that they can determine the student's suitability to proceed to candidacy.

Evaluation criteria:

- Background knowledge in topic area and in the broader context of cellular and molecular biology: does the student have sufficient depth and breadth of knowledge in the topic area?
- Experimental design and hypothesis testing: is the hypothesis sound and is the student able to articulate rational experiments to test it?
- Critical thinking in scientific analysis: does the student think like a scientist in the analysis of expected outcomes and how the information will fit into the broader scheme of the topic area?

Each advisory committee member will vote on whether to advance the student to candidacy. A negative vote by more than one member of the student's committee will signify failure of the preliminary examination. Upon permission of a majority of the supervisory committee members, a candidate may repeat the oral examination (for a total of 2 attempts).

A positive vote by the advisory committee will be recorded on the Report of Preliminary Exam form and submitted to the Graduate School, and the student will advance to candidacy. Students are encouraged to submit their grant proposal for funding to the appropriate funding agency with the assistance of their supervising PI.

2.8 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 advisory committee for review and approval after the successful completion of the preliminary exams. In most instances this will be the topic from the preliminary exam proposal application and the written proposal may serve as the dissertation description. However, if the dissertation topic is different than the preliminary exam proposal, a separate description must be submitted. 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. Guidelines and writing help are available through the Graduate School.

2.9 Dissertation Defense

The final examination will be taken after the candidate has completed course work, passed the written and oral preliminary exams, and finished the dissertation research and writing. 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.

The student must file paperwork with the Graduate School using the Notification of Scheduled Examination form at least 2 weeks prior to the examination. 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 seven days prior to the final examination.

At the conclusion of the 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 form 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 seven days.

A negative vote by more than one member of the student's committee will signify failure of the final examination. Upon permission of a majority of the supervisory committee members, a candidate is allowed to take the examination a second time. The supervisory committee will set a date at least one month after the failed examination. 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 academic dean 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, including submitting final copies.

2.10 Submission of Final Dissertation

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

After the final examination, the student will incorporate corrections into the dissertation suggested at the oral examination. Once the corrections are made, the student submits the signed approval page and the IRB/IACUC/IBC Compliance Notification to the Graduate School. The student also makes payment at this time. The disquisition will then be submitted to the Graduate School electronically. After a review process to check for formatting, approval of the final version of the disquisition will be granted by the graduate writing coordinator.

The student will have one year from the date of the final examination to submit the final electronic version of the disquisition 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 and request an extension. If a period of two years or greater lapses before the final copies are submitted, the student must reapply to the Graduate School, request an extension, retake the final examination, and register for a minimum of two credits. Degree date is based on the date when the final copy is submitted to the Graduate School.

2.11 Graduate Research Assistantship Policies

Funding Sources

GRAs are funded from a variety of sources. Quite often, funds tied to specific projects are used to fund assistantships. Other times, they are tied to CMB or Graduate School funds. The source of graduate funding determines who will be the student's supervisor.

Work Load

The stipend that most students receive is based upon 20 hours per week of active research work. This is in addition to your normal course and dissertation work. During all semesters, Graduate Assistants are required to contribute at this level, regardless of academic activities. Exceptions to this work load may be given at the discretion of the GRA supervisor.

Stipend Review/Probation/Termination

Students who do not meet the expectations of the GRA position will undergo a stipend review. If, for whatever reason, the student is unable to meet the required workload, weekly hours may be reduced, and the stipend reduced accordingly. Students may also be placed on probation if the GRA duties are not fulfilled. The length of probation is one month. If the student meets expectations during this time period, probation may be lifted. If graduate assistant duties are not met during this period, the GRA position will be terminated, at which point the student will no longer receive a stipend, which may also impact tuition waivers.

North Dakota State University Graduate Assistant Contract

Effective Fall 2015, all graduate students on an assistantship are required to complete the North Dakota State University Graduate Assistant Contract to be eligible for this position. This form will be completed prior to the hiring process or any changes in stipend level or assistantship type.

Appointment details include:

- Your assistantship includes a tuition waiver covering base tuition.
- If you accept this appointment you must also complete W4 and I-9 forms in the Payroll Office, located in SGC 102, on or before your first day of work.
- Teaching and service assistants must consent to a criminal background check.
- Graduate assistantships at NDSU shall not exceed an average of twenty (20) working hours per week, and your hours must be documented using an appropriate method approved by your supervisor.
- Specific responsibilities will be determined by the supervising advisor.

3.0 GENERAL GRADUATE STUDENT POLICIES

3.1 Code of Academic Responsibility and Conduct [\(NDSU Policy 335\)](#)

3.2 Academic Misconduct [\(NDSU Policy 326\)](#)

3.3 Enrollment Status

Nine credits are considered a full-time graduate load. To receive financial aid, students must be enrolled at least half-time (e.g., 5 credits). Loan deferment may also require full- or half-time status. Eligibility varies with financial aid programs; students should contact their lender for requirements.

Graduate assistants working 20 hours per week are considered full time if registered for five or more graduate credits. Federal law requires all international students with a 20-hour per week assistantship to carry at least six graduate credits for full-time status. Graduate students wishing to register for more than 15 credits in a regular semester shall secure the approval of their program director and the dean of the Graduate School.

3.4 Scholastic Standards

To be in good academic standing and to receive a graduate degree, a student must have a cumulative GPA of at least 3.0.

All courses taken by a graduate student for which grades are given will be used in calculating the grade point average, except in the instance that 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.

In fulfilling graduate course requirements on any plan of study, only grades of A, B, or C are acceptable. For doctoral dissertation (799/899), only the grade of satisfactory (S) is acceptable. For seminar (790/890), case studies (792/892), individual study/tutorial (793/893), practicum/internship (794/894), or field experience (795/895), only grades of A, B, C, or S are acceptable for graduate credit.

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, courses with grades of D, F, and U may not be used for graduate credit. Acquisition of more than two grades of C, D, F, and U may be grounds for dismissal upon recommendation of the program director.

3.5 Academic Warning

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. A student on academic warning cannot register for the following semester until the grades for the current semester post.

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.

3.6 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.

3.7 Continuous Enrollment

Students are required to register for at least one credit each semester (fall and spring) until all degree requirements are completed, including submitting final copies of the dissertation. The graduate dean will not approve the degree until the student has registered for the number of credits of research for any semesters not covered by either registration or leave of absence, but no more than four credits total.

A student who has not registered for longer than a continuous two-year period must also re-apply for admission and is subject to the degree requirements at the time of readmission.

3.8 Leave of Absence

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, using the Request for Leave of Absence form on the Graduate Studies webpage. Leaves of absences do not amend in any way the seven- and ten-year time limitation.

3.9 Dismissal from the Graduate School

Graduate students may be suspended or dismissed from NDSU as a result of failure to meet NDSU's scholastic standards, academic or professional misconduct, insufficient progress toward a degree, or failure to meet professional expectations or standards. Students suspended or dismissed from the Graduate School are not eligible for admission into any degree-granting or certificate program or into non-degree status for a period of at least one calendar year from the date of their suspension or dismissal. Suspension or dismissal does not become complete until the completion of any appeal process.

3.10 IRB, IBC, and/or IACUC Approval

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.

Disquisitions that 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 IRB, IACUC, or IBC as appropriate. Every effort should be made by advisers to see that students are aware of these University requirements.

3.11 Intellectual Property Policy

The NDSU policy 190 establishes guidelines to support faculty, staff, and students, in identifying, protecting and

administering Intellectual Property and defining the rights and responsibilities of all involved. See [NDSU Policy 190](#)

3.12 Drug- and Alcohol-Free Campus Policy

NDSU maintains an alcohol/drug free campus, subject to minor exceptions noted below. Section 155 of the NDSU Policy Manual: Alcohol and Other Drugs applies to students, campus organizations and employees, regardless of the individual's age. See Section 155: Unlawful and Unauthorized Use by Students and Employees at [NDSU Policy 155](#)

3.13 Out-of-Country Travel

NDSU international students are not allowed to work outside the United States. Student employees must be in the United States in order to work and be paid from NDSU. This means that any students returning to their home country during breaks, holidays, or on vacation cannot conduct any business or work on projects for which they are being paid. NDSU does not have the tax withholding and filing capabilities in countries other than the United States.

Any student who travels outside of the United States will be terminated from their stipend. Upon the students return to the United States, the student may be rehired and their stipend can be reinstated after completing the proper paperwork.

Appendix A: North Dakota State University Graduate Assistant Contract Form

North Dakota State University Graduate Assistant Contract

Graduate Student Name: _____

Hiring Department: _____

Appointment Details

Assistantship Type (select all that apply): _____ Research _____ Teaching _____ Service

You are expected to work _____ hours/week and/or teach _____ credits during the academic year.

Stipend amount: _____
Start Date: _____ End Date: _____

- Your assistantship includes a tuition waiver covering base tuition. (Please note: Special programs that have differential tuition beyond University base tuition are not included in this tuition waiver).
- If you choose to accept this appointment you must also complete W4 and I-9 forms in the Payroll Office, located in SGC 102, on or before your first day of work.
- Teaching and Service assistants must consent to a criminal background check.
- Graduate assistantships at NDSU shall not exceed an average of twenty (20) working hours per week and your hours must be documented using an appropriate method approved by your supervisor.
- Your responsibilities as a Graduate Assistant include completing required trainings annually
- (Baseline Safety Training, Sexual Harassment Prevention Training, Title IX Training) within 30 days of accepting this appointment. **Failure to complete training can lead to sanctions, including revocation of your tuition waiver and/or termination of the assistantship.**

Your specific responsibilities include:

This appointment and terms of appointment are subject to and governed by the laws of the State of North Dakota and the policies, rules, and regulations of the State Board of Higher Education and the University, as may be amended. This offer is contingent on:

- acceptance and continued enrollment in the University's graduate program, as applicable;
- the University's verification of credentials and other information required by law and/or University policies including, but not limited to, a criminal background check prior to beginning duties; and
- signing and returning one copy of this contract to the Graduate School by _____.

Expectations

Your performance will be reviewed by _____. Your first performance review will occur on or around _____. Continuation of this assistantship is contingent upon you receiving satisfactory performance reviews by your supervisor.

- To maintain this appointment you must continue to meet the academic standards established for Graduate Assistants by the University and remain in good standing at NDSU and in the graduate program.
- You will be expected to complete all graduate degree requirements, including thesis and dissertation research, with time outside of the paid assistantship work hours.
- This Graduate Assistantship is subject to the policies and procedures described in the Graduate Assistant Policy that can be found in the [Graduate Bulletin](#).
- You are expected to fulfill your responsibilities adhering to the professional and academic expectations of your discipline and in compliance with NDUS and NDSU policies. Violations of these policies and expectations may result in sanctions including termination of your assistantship and/or dismissal from the Graduate School. Adjudication of these violations will occur in accord with NDSU Policy 335.1, or other appropriate policy.
- Your appointment may be renewed depending upon performance and the availability of funding. You must remain in good standing with NDSU, the Graduate School, and the graduate program to continue receiving an appointment.

This notice is effective only when approved by the University. No other official or employee of the University has authority to extend any offer of employment or re-employment or to modify or to adjust the terms thereof. Upon receipt of your acceptance of this offer, your appointment will be processed for action by the University administration.

Although this letter is necessarily focused on NDSU's policies and procedures and carries a somewhat legalistic tone, I do want to say that I'm excited that you may join our department at NDSU. You will find we have a very collegial atmosphere here; we will strive to help you meet your educational goals. If you have any questions please do not hesitate to contact: _____

(supervisor name)

I accept this job offer as described above.

Prospective Employee: _____ Date: _____

Department Head (Program Director): _____ Date: _____

cc: Dean of the Graduate School Human Resources

This contract letter represents our complete agreement and replaces all prior written or oral agreements for assistantships. If there is any term or provision that you feel should be a part of this contract, you need to have this contract revised so that it is included or it will not be part of your contract [please discuss its inclusion with your supervisor before signing and returning this letter as its addition must be agreed to by the University]. The reason for this is to avoid any misunderstanding in the future about what was promised and accepted between us.