



Overview – NDSU Life Sciences Research

North Dakota State University (NDSU), Fargo, has core competencies in such areas as biotechnology, chemistry, biocidal/antimicrobial polymers and coatings, anti-corrosion coatings, electrochemical impedance spectroscopy, bioinformatics software and databases (proteomics, genomics). NDSU has developed extensive expertise, experience, and facilities in robotics and robot-assisted, high-throughput combinatorial experimentation and research. This has led to initial research and development of similar capabilities in high-throughput biotechnology which can be used by NDSU and certain life sciences industry partners to accelerate the design, development, and testing of new prophylactic and therapeutic vaccines, bio-catalytic enzymes, high-valued proteins, etc.

NDSU is also involved in the engineering, design, development, prototype manufacture, and testing of biomedical device technologies. NDSU has created antimicrobial/biocidal polymers and coatings that prevent bacterial and fungal infections associated with the use of endotracheal tubes or urinary catheters. Utilizing high-throughput combinatorial chemistry research tools, new and novel polymers and coatings are being tested on medical devices like catheters.

Likewise, NDSU can design, produce, and test micro-miniaturized electronic components which are pivotal to the development and manufacture of medical devices such as cochlear implants, advanced pacemakers, intelligent micropumps, etc. *This document provides a snapshot of some of the life sciences research interests and expertise, previous research or current research at NDSU.*

Asthma

Asthma affects 17 million people in the U.S. at an annual cost of \$14 billion, according to the American Lung Association. Microbiology researchers at NDSU study the effects of asthma on mice in order to develop an improved model to determine how mold triggers asthma and the long-term effect on airways. The research is an important step in understanding the airway remodeling process that occurs in chronic asthma.

Bioengineering

Tissue engineering involves developing effective techniques to repair, replace, or regenerate damaged or diseased tissues by manipulating cells, creating artificial implants, or synthesizing laboratory-grown substitutes. This research group in NDSU's College of Engineering seeks to establish the materials, processing and biomedical science base for a novel and innovative approach to design and fabricate multi-functional, biomimetic composite scaffolds which are predictable and controllable for tissue engineering. "Biomaterials in total joint replacement," an article by Dr. Kalpana Katti, was a top cited article in colloids journals published by Elsevier, a leading scientific publisher.

Bioinformatics

This group of investigators in Computer Science researches various aspects of bioinformatics, the computational side of biology. This includes genomics, proteomics, metabolomics, etc. High throughput techniques have been developed in biology which produce vast quantities of raw data to be analyzed. Computational techniques are being developed to analyze these data.

Biotechnology

This Pharmaceutical Sciences research is directed toward mechanistic studies for developing and testing novel delivery technologies to deliver biotechnologically derived molecules (e.g., peptide, protein, and gene).

Cancer Prevention and Control

NDSU Psychology Department research involves behavioral science applied to prevention (behavioral changes that can prevent the occurrence of cancer) and control (behavioral changes that can facilitate coping with the disease).

Cancer Research

Pharmaceutical Sciences and Chemistry researchers work to identify molecular genetic components that can be utilized as potential targets to enhance the efficacy of cancer chemotherapy, prevention of carcinogenesis, and apoptosis (cell death).

Cardiovascular Coupling

The focus of this interdisciplinary research group is to elucidate mechanisms at the systems and molecular levels involved in ventricular and vascular function. Cardiovascular coupling involves the strategy employed by the body's cardiovascular control system to deliver adequate oxygenated bloodflow to the body, as efficiently as possible, while maintaining optimal flight/fight reserves.

Computer-aided Drug Design

Computational methods are being applied to the design of drug molecules with the goal of increasing design efficiency. The computational methods facilitate prediction of (a) how a potential drug molecule would be distributed in the body, (b) whether potential drug molecules might interact with biomolecules involved in a particular disease, and (c) whether those interactions might be of therapeutic value.

DNA Lab

NDSU received a \$1.48 million grant from the U.S. Department of Justice to develop the forensics lab. NDSU had previously received \$1.97 million in funding for the lab. When completed, the NDSU laboratory will provide nuclear and mitochondrial DNA (mitDNA) analysis, as well as research to improve current analytical procedures.

Food Safety

Annually, 76 million Americans suffer foodborne illness; of these, 5,000 die (Mead et al., 1999). The Great Plains Institute of Food Safety (GPIFS) was developed at NDSU to combat such threats to the public health. 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.

Health, Nutrition, & Exercise Sciences

One research area is focused on investigation of effects of functional foods and trace minerals on prevention of chronic diseases and on immune responses. Additional research has focused on nutrition in the elderly.

North Dakota Telepharmacy Project

Through this federally-funded telepharmacy program, a licensed pharmacist at a central pharmacy site supervises a registered pharmacy technician at a remote telepharmacy site through the use of audio and video computer links to offer prescription services to medically underserved areas of rural North Dakota. The North Dakota Telepharmacy Project is a collaboration of the NDSU College of Pharmacy, the North Dakota Board of Pharmacy, and the North Dakota Pharmacists Association.

Novel Drug Delivery Systems

The development of a whole new generation of potent therapeutic agents based on biotechnology and genetic engineering has brought the limitations of conventional drug delivery into sharp focus. Drug delivery research efforts are directed toward the mechanistic studies for developing novel delivery technologies to deliver biotechnologically derived molecules (e.g., peptide, protein, and plasmid DNA).

Protease Research

The Center for Protease Research (CPR), funded by the National Institutes of Health (NIH) as a Center for Biomedical Research Excellence (COBRE), focuses on the development of therapeutic inhibitors for matrix metalloproteinases and serine proteases. In 2007, researchers received a \$10.5 million, five-year research grant from the National Institutes of Health (NIH) for new strategies for targeting protease (pro' tee aze) in disease. The research team is led by Mukund Sibi, who will receive a 2008 Arthur S. Cope Scholar Award from the American Chemical Society, considered to be a top honor in organic chemistry. In 2001, NDSU was awarded a five-year, \$8.25 million research grant from the NIH to establish the Center.

RFID Applications in Health Care

Medical facilities have many items to keep track of—from equipment to pharmaceuticals to patients. Dakota Medical Foundation, Fargo, awarded NDSU a \$75,000 grant to study establishing a consortium for radio frequency identification (RFID) in healthcare.

Visual and Cognitive Neuroscience

This program was awarded \$8.9 million by the National Institutes of Health (NIH) to create The Center for Visual Neuroscience. This group of investigators in the Psychology Department conducts research on various aspects of the neural mechanisms and functional significance of visual perception, visual cognition, and action.

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