

Cellular and Molecular Biology

Program and Application Information

Program Director:	Dr. Jane Shuh
Email:	jane.schuh@ndsu.edu
Department Phone:	(701) 231-6456
Department Web Site:	www.ndsu.edu/cellularmolecularbiology/
Application Deadline:	February 15 is the deadline for applicants seeking consideration of financial assistance (fellowship, assistantships) for fall semester and July 1 for spring semester.
Degrees Offered:	Ph.D.
Test Requirement:	GRE
English Proficiency Requirements:	TOEFL iBT 71; IELTS 6

Program Description

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.

Nearly 40 faculty members in many different departments and representing a variety of colleges participate as faculty mentors. The program is led by the CMB Director, who receives guidance on policy, procedure, and program administration from a multidisciplinary group of faculty who serve on the CMB Steering Committee.

Admission 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. International applicants are required to have proficiency in English as shown by a TOEFL iBT of 71 or higher or an IELTS of 6.0 or higher, unless they satisfy the requirements listed here (https://www.ndsu.edu/gradschool/prospective_students/countries_exempt_from_english_language_test_score_requirement) .

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.

Applicant Selection

Applications for the CMB program are accepted on a rolling basis throughout the year; however, for full consideration for a CMB program stipend, application must be made by the deadlines listed for fall admission (July 1). Acceptance into the program is based upon both the quality of the application and the capacity of the program.

As a program that encompasses many departments and core areas of research, as well as being an interdisciplinary training program, it is helpful to potential advisers to know what aspects of research the student is interested in. Students are encouraged to explore potential advisers' work and identify areas of interest that align with one or more CMB faculty research program(s). These areas should be addressed in the applicant's statement of purpose. If an applicant is open to a broad range of research, it is helpful to identify that as well (for example, working with plant genetics, any aspect of infectious disease, aspects of either cancer biology or therapeutics, etc). Students are only admitted to the program if a successful match with a CMB faculty member can be made, so this is a critical aspect of the application demonstrating what the student will bring to the research endeavor.

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.

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 or the CMB Director to inquire which investigators are accepting students so that a successful research mentorship can be arranged.

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 identify them in their statement of purpose. Students are encouraged to contact those with whom they would like to work regarding availability of positions and funding. In instances where specific investigators are not identified in the Statement of Purpose, the Director will contact faculty members who are accepting new students for their appraisal of the application.

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.

BIOC 701	Comprehensive Biochemistry I (required)
BIOC 702	Comprehensive Biochemistry II (required)
BOT 820	Advanced Cell Biology
BIOC 673	Methods of Biochemical Research
BIOC 674	Methods of Recombinant DNA Technology (required)
Select one of the following:	
BIOC 719	Molecular Biology of Gene Expression and Regulation
MICR 783	Advanced Bacterial Genetics and Phage
PLSC 731	Plant Molecular Genetics
PLSC 684	Plant Tissue Culture and Biotechnology

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
ANSC 774	Nitrogen Metabolism
ANSC 875	Vitamins and Minerals
BIOC 716	Protein and Enzyme Biochemistry
BIOC 723	Structural Basis of Membrane Transport and Signaling
BIOL 679	Biomedical Genetics and Genomics
PSCI 746	Neuropharmacology
PSCI 747	Cardiovascular Pharmacology
PSCI 762	Advanced Biopharmaceutics
PPTH 759	Host-Parasite Genetics
PPTH 759	Host-Parasite Genetics
Cellular Biology	
ANSC 813	Domestic Animal Endocrinology
ANSC 828	Advanced Reproductive Biology
ANSC 830	Growth Biology
BIOC 683	Cellular Signal Transduction Processes and Metabolic Regulation
MICR 775	Molecular Virology
MICR 781	Advanced Bacterial Physiology
PSCI 765	Cancer Cell Biology
PPTH 760	Advanced Mycology
ZOO 682	Developmental Biology
Techniques	
ANSC 758	Molecular Biological Techniques in Animal Sciences
BIOC 675	Computer Applications in Biochemistry and Molecular Biology
CHEM 728	Physical Methods for Chemical and Biomolecular Research
CHEM 729	X-Ray Structure Determination
CPM 771	Modern Methods of Polymer Characterization
ECE 713	Introduction to Lab-on-a-Chip Technology
PLSC 721	Genomics Techniques

Research

In addition to didactic credits, students take research credits to fulfill their dissertation studies on a topic of significant and original work. They must pass an oral and written preliminary examination which signifies their matriculation to doctoral candidacy. They also present a public presentation of their work in conjunction with a final dissertation examination on their research to attain the doctoral degree.

Laura Aldrich-Wolfe

Biological Sciences

Cornell University, 2006

Field: Community Ecology, Mycorrhizas, Plant-Fungal Interactions

Teresa Bergholz

Microbiological Sciences

Michigan State University, 2007

Field: Functional Genomics of Foodborne Pathogens

Eugene Berry

Microbiological Sciences

Northeastern University, 1983

Animal Virology (Ss (+) RNA Viruses), Genetic Variation,

Field: Mechanisms of Pathogenesis and Virulence

Julia Bowsheer

Biological Sciences

Duke University, 2007

Field: Evolutionary Development and Biology

Amanda Brooks

Pharmaceutical Sciences

University of Wyoming, 2006

Field: Molecular Biology, Spider Silk as a Drug Delivery System

Yongki Choi

Physics

City University of New York, 2010

Field: Early Detection of Cancer Cells, Single Molecule Enzymology, Biotechnology

Chris Colbert

Chemistry and Biochemistry

Purdue University, 2000

Field: Structure Biology with a Focus on the Biochemistry of Proteins Involved In Iron Import and Utilization

Glenn Dorsam

Microbiological Sciences

Virginia Commonwealth University, 1998

Field: Epigenetic Regulation

Anna Grazul-Bilska

Animal Sciences

University of Agriculture and Technology, 1983

Field: Animal Embryology and Reproductive Physiology and Endocrinology, Assisted Reproductive Technology

Kendra Greenlee

Biological Sciences

Arizona State University, 2004

Field: Developmental Physiology and Immunology

Tim Greives

Biological Sciences

Indiana University, 2009

Endocrine Regulation of Seasonality, Reproductive Neuroendocrinology, Hormones and Behavior

Jill Hamilton

Biological Sciences

University of British Columbia - 2012

Field: Plant Evolutionary Genomics

Lauren Hanna

Animal Sciences

Texas A&M University, 2013

Field: Quantitative Genetics, Animal Breeding, Whole System Approaches To Genomic Associations of Quantitative Traits

Stuart Haring

Chemistry and Biochemistry

Texas A&M University, 2013

Field: Cellular DNA Duplication (Replication) and Mutation Prevention (Repair)

Britt Heidinger

Biological Sciences

University of Iowa, 2004

Field: Physiological Ecology

Yagna Jarajapu

Pharmaceutical Sciences

Indiana University, 2007

Field: Bone Marrow Dysfunction and Vascular Repair in Diabetes, ACE2-Angiotensin-(1-7)/Mas Receptor Pathway in Bone Marrow Cells, Regulation of Bone Marrow Mobilization by Leptin

Jiha Kim

Biological Sciences
University of Georgia, 2006
Field: Cancer Cell Biology

Estelle Leclerc

Pharmaceutical Sciences
Glasgow Caledonian University, 2002
Field: Melanoma, Pancreatic Cancer; Monoclonal Antibodies as Diagnostic and Therapeutic Agents; Mechanism of RAGE Signaling

Guodong Liu

Chemistry and Biochemistry
Hunan University, 2001
Field: Development of Nano-Bioprobes for Biosensors and Bioassays for Detection of Nucleic Acids and Proteins

Phil Mcclean

Plant Sciences
University of Paris XI, 1994
Field: Dry Bean Genetics and Biotechnology

Dharmakeerthi "Karthik" Nawarathna

Electrical and Computer Engineering
Colorado State University, 2002
Field: Biomedical Engineering

Stephen O'Rourke

Pharmaceutical Sciences
University of Wisconsin-Madison, 1995
Field: Cerebral Vascular Function in Health and Disease

Birgit Pruess

Microbiological Sciences
Ruhr-Universität Bochum, 1991
Field: Bacterial Physiology, Biofilm Biology, and Food Safety

Steven Qian

Pharmaceutical Sciences
University of Iowa, 1999
Field: Chemistry and Biology of Free Radical and COX-Catalyzed Fatty Acid Peroxidation as Related to Human Health and Disease

Mohi Quadir

Coatings and Polymeric Materials
Freie Universität Berlin, 2010
Field: Polymeric Materials for Drug Delivery

Sheela Ramamoorthy

Microbiological Sciences
Virginia Tech, 2006
Field: Virology, Immunology, and Vaccinology

Jiajia Rao

Plant Sciences
University of Massachusetts-Amherst, 2013
Field: Food Chemistry and Ingredient Technology

Katie Reindl

Biological Sciences
North Dakota State University, 2006
Field: Cancer Cell Biology, Cancer Prevention and Treatment, Evaluating Bioactive Food Components

Larry Reynolds

Animal Sciences

Iowa State University, 1983
Field: Nutrition and Pregnancy in Ruminants

Kenton Rodgers

Chemistry and Biochemistry
University of Iowa, 1988
Field: Inorganic and Bioinorganic Chemistry

Jane Schuh

Microbiological Sciences
North Dakota State University, 2002
Field: Environmental Allergic Asthma Triggered By Mold

Sangita Sinha

Chemistry and Biochemistry
Purdue University, 2000
Field: Biochemistry and Structural Biology of Host-Pathogen Interactions

Kristine Steffen

Pharmaceutical Sciences
North Dakota State University, 2007
Field: Biology of Obesity and Post-Bariatric Outcomes, Gastrointestinal Microbiome Research

Chengwen Sun

Pharmaceutical Sciences
Jilin University, 2000
Field: Blood Pressure Regulation, Cell Signaling

Kendall Swanson

Animal Sciences
University of Kentucky, 2000
Field: Ruminant Nutrition, Energy Metabolism, Protein Metabolism, Pancreatic Function, Beef Cattle Production

Sathish Venkatachalem

Pharmaceutical Sciences
University of Madras
Field: Pulmonary Physiology and Pharmacology

Danling Wang

Electrical and Computer Engineering
Peking University, 2003; University Of Washington, 2014
Field: Sensor Design, Fabrication, and Application of Early-State Human Disease Monitoring and Diagnosis

Alison Ward

Animal Sciences
University of Saskatchewan, 2011
Field: Livestock Epigenetics, Nutrient-Gene Interactions, and Developmental Programming

John Wilkinson

Chemistry and Biochemistry
Vanderbilt University, 2001
Field: Cancer Cell Metabolism, Cell Death Pathways, Mitochondrial Gene Expression, Animal Models of Tumorigenesis

Qifeng Zhang

Electrical and Computer Engineering
Peking University, 2001
Field: Nanomaterials for Sensor and Biomedical Applications, Nanotechnology