

# Cellular and Molecular Biology

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**Telephone Number:** (701) 231-6456

**Degree Offered:** Ph.D.

**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.

**Test Requirements:** GRE

**English Proficiency TOEFL iBT 71**

**Requirements:** IELTS 6

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## Program Description

The CMB Program offers interdisciplinary research education and training opportunities that lead to a Ph.D. In this setting, students learn to integrate across concepts and to use multiple approaches to study contemporary biological problems. Students have access to state-of-the-art facilities and equipment in faculty laboratories and core facilities around campus. 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.

The CMB degree requirements include 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 under the direction of a CMB faculty member; and an oral defense of the dissertation.

CMB faculty members are recognized and respected nationally and internationally for contributions to their fields of study. They are drawn from 10 academic departments, including Animal Sciences, Chemistry and Molecular Biology, Biological Sciences, Cereal and Food Sciences, Entomology, Health, Nutrition, and Exercise Sciences, Pharmaceutical Sciences, Plant Pathology, Plant Sciences, and Veterinary and Microbiological Sciences. With the interdisciplinary nature of the program, you can look forward to working closely with not just one but many faculty members at NDSU.

Students may engage in basic and applied aspects of cellular and molecular biology research in various systems, including animals, plants, and microorganisms. Examples of current research by CMB faculty include the following:

- Adaptation to environmental stress
- Assistive reproductive technology
- Apoptosis
- Cancer
- Cell-cell communication
- Cell cycle regulation
- Cell metabolism
- Cytogenetics

- Drug action and metabolism
- Enzymology and metabolic regulation
- Extracellular matrix
- Gene regulation and expression
- Hormone biosynthesis, metabolism, and evolution
- Immunology
- Molecular pathogenesis
- Protein structure and function
- Signal transduction
- Stem cells and developmental processes

## Admissions Requirements

The Cellular and Molecular Biology Ph.D. program is open to qualified graduates of universities and colleges of recognized standing. If possible, applicants should identify at least one cellular and molecular biology faculty member with whom they wish to study.

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.

## 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.

## 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.

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.

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.

## Courses Offered

### Biochemistry and Molecular Biology

BIOC 701	Comprehensive Biochemistry I (required)	4
BIOC 702	Comprehensive Biochemistry II (required)	4
BIOC 673	Methods of Biochemical Research (required)	3

### Cellular Biology

ZOO 820	Advanced Cell Biology	3
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### Molecular Biology

BIOC 674	Methods of Recombinant DNA Technology (required)	3
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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	

### Technique Courses

Select one of the following:

MICR 645	Animal Cell Culture Techniques	
PLSC 684	Plant Tissue Culture and Biotechnology	

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 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

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.

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.

### Teresa Bergholz, Ph.D.

Michigan State University, 2007  
Field: Functional Genomics of Foodborne Pathogens  
Department: Chemistry and Biochemistry

### Eugene S. Berry, Ph.D.

Northeastern University, 1983  
Field: Animal Virology (ss(+) RNA Viruses), Genetic Variation, Mechanisms of Pathogenesis and Virulence  
Department: Veterinary and Microbiological Sciences

### Julia Bowsher, Ph.D.

Duke University, 2007  
Field: Evolutionary Developmental Biology; Molecular Basis of Pattern Formation  
Department: Biological Sciences

### Chris Colbert, Ph.D.

Purdue University, 2000  
Field: Structure Biology with a Focus on the Biochemistry of Proteins Involved in Iron Import and Utilization  
Department: Chemistry and Biochemistry

### Glenn Dorsam, Ph.D.

Virginia Commonwealth University, 1998  
Field: Epigenetic Regulation  
Department: Chemistry and Biochemistry

### Nathan Fisher, Ph.D.

University of Michigan, 2006  
Field: Ecology and Evolution of Non-Commensal Bacterial Pathogens  
Department: Veterinary and Microbiological Sciences

### Anna T. Grazul-Bilska, Ph.D.

University of Agriculture and Technology, 1983

Field: Animal Embryology and Reproductive Physiology & Endocrinology,  
Assisted Reproduction Technology  
Department: Animal and Range Sciences

**Kendra Greenlee, Ph.D.**

Arizona State University, 2004  
Field: Developmental Physiology and Immunology  
Department: Biological Sciences

**Tim Greives, Ph.D.**

Indiana University, 2009  
Field: Endocrine Regulation of Seasonality, Reproductive  
Neuroendocrinology, Hormones and Behavior  
Department: Biological Sciences

**Bin Guo, Ph.D.**

State University of New York at Buffalo, 1999  
Field: Cancer Cell Biology, Apoptosis, Molecular Pharmacology  
Department: Pharmaceutical Sciences

**Lauren Hanna, Ph.D.**

Texas A&M University, 2013  
Field: Quantitative Genetics, Animal Breeding, Whole System  
Approaches to Genomic Associations of Quantitative Traits  
Department: Animal Sciences

**Stuart Haring, Ph.D.**

University of Iowa, 2004  
Field: DNA Metabolism and Cell Cycle Regulation  
Department: Chemistry and Biochemistry

**Britt Heidinger, Ph.D.**

Indiana University, 2007  
Field: Physiological Ecology  
Department: Biological Sciences

**Yagna Jarajapu, Ph.D.**

Glasgow Caledonian University, 2002  
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  
Department: Pharmaceutical Sciences

**Estelle Leclerc, Ph.D.**

University of Paris XI, 1994  
Field: Melanoma, Pancreatic Cancer; Monoclonal Antibodies as  
Diagnostic and Therapeutic Agents; Mechanism of RAGE Signaling  
Department: Pharmaceutical Sciences

**Phillip E. McClean, Ph.D.**

Colorado State University, 1982  
Field: Plant Molecular Genetics  
Department: Plant Sciences

**Stephen O'Rourke, Ph.D.**

University of Wisconsin, 1995  
Field: Vascular Pharmacology/physiology, Regulation of Vasomotor  
Tone, Smooth Muscle-Endothelial Cell Interactions  
Department: Pharmaceutical Sciences

**Birgit Pruess, Ph.D.**

Ruhr-Universität Bochum, 1991  
Field: Bacterial Physiology and Global Gene Expression  
Department: Veterinary and Microbiological Sciences

**Steven Qian, Ph.D.**

University of Iowa, 1999  
Field: Free Radical Metabolism  
Department: Pharmaceutical Sciences

**Sheela Ramamoorthy, Ph.D.**

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

**Dale A. Redmer, Ph.D.**

University of Missouri - Columbia, 1983  
Field: Animal Physiology, Reproductive Physiology, Fetal Growth,  
Placental Function, Ovarian Function, Vascular Growth  
Department: Animal Sciences

**Katie Reindl, Ph.D.**

North Dakota State University, 2006  
Field: Cancer Cell Biology, Cell Migration and Metastasis, Cell Cycle  
Control, Extracellular Matrix Interactions  
Department: Biological Sciences

**Lawrence P. Reynolds, Ph.D.**

Iowa State University, 1983  
Field: Factors Influencing Fetal and Placental Growth and Development  
in Compromised Pregnancies  
Department: Animal Sciences & Center for Nutrition and Pregnancy

**Kenton Rodgers, Ph.D.**

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

**Jane Schuh, Ph.D.**

North Dakota State University, 2002  
Field: Immunology of Chronic Airway Remodeling, Cellular Differentiation  
in Pulmonary Disease, Animal Modeling of Allergic Airway Disease  
(Asthma)  
Department: Veterinary and Microbiological Sciences

**Sangita Sinha, Ph.D.**

Purdue University, 2000  
Field: Structure Biology and Biochemistry of host pathogen interactions  
Department: Chemistry and Biochemistry

**Chengwen Sun, Ph.D.**

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

**Kendall Swanson, Ph.D.**

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

**Stefan Vetter, Ph.D.**

Swiss Federal Institute of Technology, 1998  
Field: Development of Small Molecules and Peptides for the Modulation  
of Receptor for Advanced Glycation Endproducts (RAGE) in Disease  
States  
Department: Pharmaceutical Sciences

**John Wilkinson, Ph.D.**

Vanderbilt University, 2001

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

**Erxi Wu, Ph.D.**

Sheffield University, UK, 1998

Field: Pharmacogenomics; Tumor Therapeutic Targets; Drug Discovery; Anticancer Natural Products

Department: Pharmaceutical Sciences