

Microbiology

Department Information

- **Department Head:**
John McEvoy, Ph.D.
- **Graduate Coordinator:**
Danielle Condry, Ph.D.
- **Department Location:**
Van Es Hall
- **Department Phone:**
(701) 231-7512
- **Department Web Site:**
www.ndsu.edu/microbiology/ (<http://www.ndsu.edu/microbiology/>)
- **Application Deadline:**
January 15 for fall
- **Credential Offered:**
Ph.D., M.S.
- **English Proficiency Requirements:**
TOEFL iBT 71, IELTS 6; Duolingo 105

Program Description

The Department of Microbiological Sciences offers graduate study leading to Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees in Microbiology. Faculty in the department have expertise in microbiomes, microbial genomics, biotechnology, synthetic biology, molecular biology, virology, immunology, microbial physiology, and discipline-based education research. The M.S. in Microbiology emphasizes research methodology and laboratory techniques. The Ph.D. in Microbiology is an outcomes-based program focused on developing research project leaders.

M.S. in Microbiology

The master's program in Microbiology emphasizes research methodology and laboratory techniques. Student research and academic programs support a strong foundation of knowledge in microbiology and are individually tailored to meet the needs and interests of each student. Graduates are prepared for positions in research or commercial laboratories or for further graduate study. Students select a major adviser by the end of the first semester in residence. By the end of the first year in residence, the student and major adviser will select a supervisory committee. Students can earn a M.S. in Microbiology by completing a research thesis under the advisement of a research faculty member or by completing a comprehensive research paper in the program.

Graduating master's students will be able to:

1. Adhere to ethical and professional standards in Microbiology.
2. Demonstrate foundational knowledge in Microbiology, including proficiency in a range of techniques.
3. Participates in scholarly inquiry relevant the field of study.
4. Collect and document reproducible and publishable quality data through completion of experiments using at least one technique.
5. Critically analyze, write high-quality technical documents, and communicate scientific content to a chosen audience. Contribute significantly (co-authorship) to scientific journal articles.
6. Participates in collaboration in ways that enhance the output of the project.
7. Display professional skills in personal effectiveness, including managing individual projects and being ready for the workplace.
8. Participate in activities that promote civic responsibility, citizenship, and inclusiveness.

Ph.D. in Microbiology

The Ph.D. program in Microbiology encompasses many sub-disciplines, including plant-microbe and animal-microbe interactions, microbiome research, virology, vaccine development, soil microbiology, biofilm research, immunology, and discipline-based education research. The program trains students in the foundation of knowledge, process of inquiry, and philosophy of microbiology. It breaks with traditional programs by focusing training

on seven well-defined learning outcomes that can be attained with or without supporting coursework. This includes outcomes for professional, ethical, and civic development. Doctoral graduates are prepared for a variety of career paths including academic or industry research and academic teaching.

Graduating doctoral students will be able to:

1. Demonstrate professional and ethical behavior consistent with the expectations of the discipline.
2. Use and apply appropriate discipline knowledge, concepts, and theoretical frameworks.
3. Conduct scholarly inquiry relevant to societal challenges and the field of study.
4. Demonstrate proficiency with a variety of classical and modern techniques by collecting and documenting reproducible and publish quality data through completion of experiments.
5. Critically analyze, write high-quality technical documents, and communicate scientific content and research results to diverse audiences. Contribute significantly (first-authorship) to scientific journal articles.
6. Initiate and manage collaboration in ways that enhance the output of the project.
7. Display professional skills in personal effectiveness to be competitive in the job market.
8. Engage and initiate activities that display civic responsibility, citizenship and inclusiveness.

The program of study is customizable to each student's training needs. In the absence of didactic course requirements, the program holds students accountable for year-over-year progress toward the learning goals via annual assessments of student progress by the mentor and research advisory committee.

In addition to the Graduate School requirements (<https://bulletin.ndsu.edu/graduate/admission-information/>), applicants must have evidence of a strong academic record in the biological sciences.

The statement of purpose should address each of the following:

1. The degree you are seeking (Comprehensive study-based M.S., Thesis-based M.S., or PhD).
2. An explanation of how obtaining a graduate degree in our program fits your career goals.
3. A description of the qualities you possess that will contribute to your success.
4. A description of any relevant experiences you have had. If you have had research experience, it is important to include a letter of recommendation from your research adviser. (Particularly important for Thesis-based M.S. and Ph.D. applicants)
5. A list of the areas of research in the department that interest you and identifying specific researchers is helpful. (Particularly important for Thesis-based M.S. and Ph.D. applicants)
6. The Department of Microbiological Sciences and North Dakota State University value and support individuals with diverse backgrounds, and experiences. Valuing our differences opens learning opportunities beyond the traditional classroom, resulting in a more rewarding education, research, and enhanced perspectives. Please write a statement that identifies the distinctive characteristics and/or life experiences, such as successfully overcoming obstacles or hardships, that you would bring to your graduate studies.

Note to Reference Letter Writers

Please indicate how you know and how well you know the applicant. Be specific about the applicant's relevant academic skills, research skills, and personal traits, using illustrative examples whenever possible. Please put into perspective how the applicant compares to other students you have interacted with.

Admission Standards

Applicants are evaluated in each of five dimensions that are expected to impact performance as a graduate student:

1. Academic preparation
 - a. Prior courses/degrees
 - b. Communication
 - c. English Proficiency - if applicable
2. Scholarly Potential
 - a. Motivation for graduate study
 - b. Prior Experience
3. Socio-Emotional Competencies
 - a. Self-Appraisal
 - b. Long term Goals/Accomplishments

4. Alignment with Program
 - a. Alignment with Faculty research
 - b. Alignment with program training
5. Alignment with Diversity Values of the department

Admission Process

The two admission pathways to our graduate programs – sponsored admission and general admission – differ primarily in the timing of mentor selection relative to graduate program admission. For sponsored admission, a mentor is identified before application for admission to one of our graduate programs. For general admission, mentor selection occurs after admission and completion of rotations. Please see the Microbiology website (<https://www.ndsu.edu/agriculture/academics/academic-units/microbiological-sciences/>) for more details on the process and Frequently Asked Questions.

Financial Assistance

Students must first apply to the Graduate College and be accepted to one of our programs before they are eligible to receive an assistantship. Research assistantships are available to students enrolled in the thesis-based M.S. and Ph.D. programs. Teaching assistantships are available to students enrolled in thesis-based M.S., and Ph.D. programs. Research and teaching assistantships are limited, contingent upon the availability of funds, and awarded competitively.

In addition to the stipend, graduate assistants receive a graduate tuition waiver. Tuition waivers cover base tuition for NDSU graduate credits only. Students are responsible for differential tuition, student fees, and tuition for non-graduate level credits taken or Cooperative Education credits.

Please refer to the department website for more information on the requirements for this program.

M.S. in Microbiology

The master's program requires completing a minimum of 30 semester credits with an overall GPA of 3.0 or better. Students are required to select from a list of core courses for eight to nine didactic credits toward their degree, as well as enroll in 1 credit of the following: Intro to Graduate Research, Scientific Integrity, and Journal Club (first year) and Seminar and Annual Review (second year).

Plan A Thesis-based M.S.: Of the 30 credits, 16 credits must be in didactic graduate courses. Thesis-based master's students can apply 6 to 10 credits MICR 798 Master's Thesis research towards the degree. This degree in microbiology requires a research-based thesis, a public seminar of the thesis research, and a final oral defense of the thesis.

Plan B Comprehensive Paper-based M.S.: Of the 30 credits, 21 credits must be in didactic graduate courses. Plan B (Paper-based) M.S. students can apply 2 to 4 MICR 797 Master's Paper based research credits towards the degree. This degree in microbiology requires the writing and presentation of a thoroughly researched paper to the student's committee.

Students with inadequate undergraduate training in microbiology will be required to complete undergraduate courses in microbiology in addition to the required minimum 30 semester credits.

Examinations

Thesis-based Examination: The final examination will be an oral defense of the student's research results. The student's research supervisory (thesis) committee will administer the exam after a public presentation of the work.

Comprehensive Paper-based Examination: M.S. students in this option will produce an in-depth research paper on a specific topic in Microbiology and present a summary of their paper. The paper will be reviewed by the student's supervisory committee and approved when completed.

Ph.D. in Microbiology

The Ph.D. program is based on defined training outcomes. Degree requirements are in agreement with NDSU Graduate School requirements. The student and major adviser will prepare a plan of study by the end of the first year in residence. The Graduate School requires the plan of study for the Ph.D. degree to include no less than 90 semester graduate credits (60 credits for students matriculating with a master's degree). An overall GPA of 3.0 or higher must be maintained. An annual review of the student's progress is required. Students must complete the following: Intro to Graduate Research, Scientific Integrity, and Journal Club in the first year and Journal Club, Seminar, and Annual Review in all subsequent years of the program.

Examinations

Qualifying Exam: The first exam in the PhD Program examines fundamental areas of knowledge in microbiology that will be essential for success as a doctoral candidate. Successful completion of the qualifying exam allows the student to move on to the preliminary exam. This exam can be completed in years 1 or 2 of the program.

Preliminary Exam: The second exam requires the student to write a research proposal in alignment with a program administered by NIH, NSF, or NIFA and defend the proposal in an oral examination. After successfully completing the written and oral preliminary examination, the student will be formally admitted to candidacy for the Doctor of Philosophy Degree. This exam is typically completed in years 2-3 of the program.

Final Exam: The final examination will be an oral defense of the student's research results. The student's research supervisory committee will administer the exam after a public presentation of the work.

Samat Amat, Ph.D. (<https://www.ndsu.edu/agriculture/academics/academic-units/microbiological-sciences/research/amat-lab/>).
University of Calgary, 2019

Research Interests: Leveraging Livestock Microbiomes to Improve Nutrition and Animal Health and Reduce Antimicrobial Resistance.

Samiran Banerjee, Ph.D. (<https://www.ndsu.edu/agriculture/academics/academic-units/microbiological-sciences/research/banerjee-lab/>)
University of Saskatchewan, 2012

Research Interests: Soil and Plant Microbiome, Agricultural Intensification, Climate Change

Danielle Condry, Ph.D.

University of North Dakota, 2013

Research Interests: Discipline-Based Education Research; Equitable Grading Strategies in Large Enrollment Classes, Utilizing Concept Inventories to Inform Curricula Change, How Science Communication Impacts Decision-Making, and Community Engaged Learning and Its Impacts on Student Success in the Classroom

Glenn Dorsam, Ph.D.

Virginia Commonwealth University, 1998

Research Interests: Signaling by the Gut Hormone Vasoactive Intestinal Peptide and Its Role in Gut Microbiome Development, Abnormal Inflammation, and Fat Deposition

Barney Geddes, Ph.D.

University of Manitoba, 2014

Research Interests: Using Molecular Genetics, Functional Genomics, and Synthetic Biology Approaches to Understand Mechanisms of Beneficial Plant- Microbe Interactions

John McEvoy, Ph.D.

Ulster University, 2002

Research Interests: *Cryptosporidium* Ecology, Evolution and Host-Parasite Interactions; Environmental Microbiology

Birgit Pruess, Ph.D. (<https://www.ndsu.edu/agriculture/academics/academic-units/microbiological-sciences/research/pruess-lab/>)
Ruhr-Universität Bochum, 1991

Research Interests: Global Gene Regulation in Enteric Bacteria; Complex Regulatory Networks

Sheela Ramamoorthy, Ph.D.

Virginia Polytechnic Institute and State University, 2006

Research Interests: Virology and Vaccinology