

# MICROBIOLOGY

## Undergraduate Microbiology Major

Interested in the study of small things that have a big impact? Then Microbiology may be the place for you.

Our mission in the Microbiology Program is to instill a comprehensive understanding of microbiology and its relevance to human society and global health, and to cultivate the concepts and skills necessary to succeed in microbiology-related careers.

Iowa State University offers:

- Extensive hands-on laboratory experiences that develop problem solving & technical skills used in a variety of professional careers
- Application of science to issues in the modern world
- Excellent preparation for human medicine and veterinary medicine
- Preparation for employment in a variety of professional settings
- Research opportunities and interaction with professors from across Iowa State University Departments of Animal Science, Plant Pathology and Microbiology, Biochemistry & Molecular Biology, Biology, Veterinary Microbiology, Veterinary Pathology, Food Science, Entomology, and Geology
- Degrees in microbiology at both the undergraduate (B.S.) level and graduate (M.S., PhD., see Graduate Major (<http://catalog.iastate.edu/previouscatalogs/2020-2021/collegeofagricultureandlifesciences/microbiology/#graduatetext>)) level

### Career opportunities:

Opportunities after graduation include the following:

- Biomedical research scientist
- Biotechnology firms
- Biorenewables industry
- Forensic scientist
- Pharmaceutical and vaccine development companies
- Immunologist
- Agricultural microbiology and plant pathology
- International agricultural research centers
- Government laboratories (CDC, NADC, USDA)
- Infectious disease
- Food safety and food technology
- Water quality
- Ecology and environmental microbiology
- Botanical gardens & nurseries
- Technical brewer

- Science writer
- Public health agencies
- Public policy organizations

Interested in Human medicine or Veterinary medicine? A microbiology degree prepares students for advanced study in Dentistry, Medical Laboratory Science, Optometry, Pharmacy, Physician Assistant Programs, and Physician or Veterinary education. Go to [micro.iastate.edu](http://micro.iastate.edu) (<https://www.micro.iastate.edu/>) to find more information about the Microbiology Program.

## Curriculum in Microbiology

[www.micro.iastate.edu](http://www.micro.iastate.edu) (<http://www.micro.iastate.edu>)

Administered by an interdepartmental committee.

### Total Degree Requirement: 128 cr.

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

### International Perspective: 3 cr.

International Perspectives Courses (<https://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current/>)

### U.S. Diversity: 3 cr.

U.S. Diversity Courses (<https://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses/>)

### Electives: 7-12

#### Communications Proficiency:

English composition - with a C or better	6
Speech fundamentals - with a C or better	3

#### Communication/Library:

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
SP CM 212	Fundamentals of Public Speaking	3
One course from the following:		3
ENGL 302	Business Communication	
ENGL 309	Proposal and Report Writing	
ENGL 312	Biological Communication	
ENGL 314	Technical Communication	
LIB 160	Information Literacy	1

**Total Credits** **13**

### Humanities and Social Sciences:

Approved Humanities list <sup>1</sup>	3
Approved Social Science list <sup>2</sup>	3

<sup>1</sup> Humanities Course list (<https://www.cals.iastate.edu/student-services/humanities/>)

<sup>2</sup> Social Sciences Course list (<https://www.cals.iastate.edu/student-services/social-sciences/>)

**Ethics: 3 cr.**

3 cr. from approved Ethics Course list (<https://www.cals.iastate.edu/student-services/ethics/>)

**Mathematical Sciences:**

One of the following: 7-8

MATH 143 & MATH 160	Preparation for Calculus and Survey of Calculus	
MATH 165 & MATH 166	Calculus I and Calculus II	
MATH 160 & STAT 301	Survey of Calculus and Intermediate Statistical Concepts and Methods	

One of the following: 3-4

STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	

**Total Credits** 10-12

**Physical Sciences:**

CHEM 177	General Chemistry I	4
CHEM 177L	Laboratory in General Chemistry I	1
CHEM 178	General Chemistry II	3

One of the following: 5-10

PHYS 111 & PHYS 112	General Physics and General Physics	
PHYS 115 & 115L	Physics for the Life Sciences and Laboratory in Physics for the Life Sciences	

CHEM 331 Organic Chemistry I 3

CHEM 331L Laboratory in Organic Chemistry I 1

CHEM 332 Organic Chemistry II 3

One of the following: 3-6

BBMB 404 & BBMB 405	Biochemistry I and Biochemistry II	
	or BBMB 301 Survey of Biochemistry	
	or BBMB 316 Principles of Biochemistry	

**Total Credits** 23-31

**Biological Sciences:**

BIOL 211 Principles of Biology I 3

BIOL 211L Principles of Biology Laboratory I 1

BIOL 212 Principles of Biology II 3

BIOL 212L Principles of Biology Laboratory II 1

BIOL 313 Principles of Genetics 3

BIOL 313L Genetics Laboratory 1

BIOL 314 Principles of Molecular Cell Biology 3

**Total Credits** 15

**Microbiology:**

Core courses:

MICRO 110 Professional and Educational Preparation in Microbiology 1

MICRO 302 Biology of Microorganisms 3

MICRO 302L Microbiology Laboratory 1

MICRO 310 Medical Microbiology 3

One of the following: 1

MICRO 310L Medical Microbiology Laboratory

MICRO 475L Immunology Laboratory

MICRO 320 Molecular and Cellular Bacteriology 4

MICRO 440 Laboratory in Microbial Physiology, Diversity, and Genetics 4

MICRO 450 Undergraduate Capstone Colloquium 2

MICRO 451 Survey in Microbiology R

One of the following: 3

MICRO 430 Prokaryotic Diversity and Ecology

MICRO 456 Principles of Mycology

MICRO 477 Bacterial-Plant Interactions

Additional nine credit hours from the following: 9

MICRO 353 Introductory Parasitology

MICRO 374 Insects and Our Health

MICRO 374L Insects and Our Health Laboratory

MICRO 402 Microbial Genetics and Genomics

MICRO 407 Microbiological Safety of Foods of Animal Origins

MICRO 408 Virology

MICRO 420 Food Microbiology

MICRO 421 Food Microbiology Laboratory

MICRO 430 Prokaryotic Diversity and Ecology

MICRO 456 Principles of Mycology

MICRO 475 Immunology

MICRO 475L Immunology Laboratory

MICRO 477 Bacterial-Plant Interactions

MICRO 485 Soil and Environmental Microbiology

MICRO 487 Microbial Ecology

MICRO 490 Independent Study

Microbiology elective - only 3 cr. lab courses allowed

**Total Credits** 31

Microbiology, B.S.

**First Year**

Fall	Credits Spring	Credits
ENGL 150 or 250	3 MICRO 302	3
MICRO 110	1 MICRO 302L	1
MICRO 101	3 BIOL 212	3
BIOL 211	3 BIOL 212L	1
BIOL 211L	1 CHEM 178	3
CHEM 177	4 STAT 104	3
CHEM 177L	1 Social Science choice	3
LIB 160	1	
	<b>17</b>	<b>17</b>

**Second Year**

Fall	Credits Spring	Credits
MICRO 310	3 MICRO Environmental or Elective	3
MICRO 310L	1 BIOL 313	3
CHEM 331	3 BIOL 313L	1
CHEM 331L	1 CHEM 332	3
MATH 143, 160, or 165	4 MATH 160, STAT 301, or MATH 166	4
ENGL 250	3 Humanities choice	3
	<b>15</b>	<b>17</b>

**Third Year**

Fall	Credits Spring	Credits
MICRO Environmental or Elective	3 MICRO 320	4
PHYS 111	5 PHYS 112	5
BIOL 314 or 328	3 Advanced English	3
SP CM 212	3 International Perspectives	3
Gen Elective	3	
	<b>17</b>	<b>15</b>

**Fourth Year**

Fall	Credits Spring	Credits
MICRO 440	4 MICRO elective	3
MICRO elective	3 MICRO 450	2
MICRO 451	R BBMB 405	3
ETHICS choice	3 Social Science choice	3
BBMB 404	3 Gen Electives	5
US Diversity	3	
	<b>16</b>	<b>16</b>

**Minor**

The program offers a minor in microbiology which may be earned by accumulating a minimum of 15 credits of microbiology courses.

Students requesting a minor in Microbiology must take the following:

- 1) Micro 201 (Introduction to Microbiology, and the accompanying lab, Micro 201L) **or** Micro 302 (Biology of Microorganisms, and the accompanying lab, Micro 302L)
- 2) Additional lecture credits and no more than 3 additional lab credits to reach 15 credits. For a list of acceptable courses see [https://www.micro.iastate.edu/files/page/files/minor\\_in\\_microbiology\\_4.pdf](https://www.micro.iastate.edu/files/page/files/minor_in_microbiology_4.pdf)
- 3) At least 6 credits at the 300+ level and must include at least 9 credits that are not used to meet any other department, college, or university requirement.

**Graduate Study**

The program offers work for the degrees master of science and doctor of philosophy in microbiology and for a minor for students majoring in other programs. The interdepartmental microbiology major is offered through faculty housed in twelve departments, including Agronomy; Animal Science; Biochemistry, Biophysics and Molecular Biology; Civil, Construction and Environmental Engineering; Entomology; Food Science and Human Nutrition; Genetics, Developmental and Cell Biology; Geological and Atmospheric Sciences; Plant Pathology and Microbiology; Veterinary Diagnostic and Production Animal Medicine; Veterinary Microbiology and Preventive Medicine; and Veterinary Pathology. Faculty coordinate graduate education and research in a wide range of topics fundamental to the discipline of microbiology. Specific information about individual faculty and their research areas is available at [www.micrograd.iastate.edu](http://www.micrograd.iastate.edu/). (<http://www.micrograd.iastate.edu/>)

Prerequisites to graduate study include a sound undergraduate background in chemistry, mathematics and biology, including microbiology and genetics.

Graduates in the Microbiology Graduate program have a broad-based knowledge in the fundamentals of microbiology as well as advanced knowledge in specific areas as determined by their areas of research focus. Students completing the thesis have the technical, research, critical-thinking, problem-solving, and computer skills to design, implement, and conduct research using a variety of current techniques and equipment. They are also able to communicate research results effectively with scientific peer groups in both oral and written formats.

**Courses primarily for undergraduates:**

**MICRO 101: Microbial World**

(3-0) Cr. 3. F.

*Prereq: High school biology or equivalent*

Introduction to the importance of viruses, bacteria, fungi, archaea and parasites both to humans and to the biosphere. Topics include past and present microbial impact on humans and society, ecology and diversity of microbes, biotechnology and microbial impact on the biosphere.

**MICRO 110: Professional and Educational Preparation in Microbiology**

(1-0) Cr. 1. F.

An introduction to curriculum and research opportunities in microbiology at Iowa State. Topics include: easing the transition to life as a university student, development of specific goals, strengthening interpersonal communication, professional portfolio creation and resume building. Offered on a satisfactory-fail basis only.

**MICRO 115: Phage Discovery Lab**

(0-4) Cr. 2. F.

An exploratory laboratory where students will purify phage from soil, visualize phage using electron microscopy and isolate genomic material for nucleic acid sequencing.

**MICRO 116: Phage Genome Annotation Lab**

(0-4) Cr. 2. S.

*Prereq: Recommended: MICRO 115*

An experiential microbiology laboratory where students learn to annotate and submit a complete phage genome.

**MICRO 201: Introduction to Microbiology**

(2-0) Cr. 2. F.S.

*Prereq: One semester of college-level biology*

Selected topics in microbiology with emphasis on the relationship of microorganisms to human and animal health, agricultural technology, and the environment. With written petition to the chair of the supervisory committee, students who obtain a grade of B or better may substitute 201 for Micro 302 in advanced courses.

**MICRO 201L: Introductory Microbiology Laboratory**

(0-3) Cr. 1. F.S.

*Prereq: Credit or enrollment in MICRO 201 or MICRO 302*

Basic microbiology laboratory techniques for non-microbiology majors. Credit for either Micro 201L or 302L, but not both, may be applied toward graduation.

**MICRO 302: Biology of Microorganisms**

(3-0) Cr. 3. F.S.SS.

*Prereq: BIOL 211, credit or enrollment in BIOL 212; 1 semester of chemistry*

Basic cell biology, physiology, metabolism, genetics and ecology of microorganisms, with an emphasis on prokaryotes and viruses, as well as the roles of microorganisms in the environment, disease, agriculture, and industry.

**MICRO 302L: Microbiology Laboratory**

(0-3) Cr. 1. F.S.

*Prereq: Credit or enrollment in MICRO 302*

Basic microbiology laboratory techniques for majors in microbiology, biological sciences and related fields. Credit for either Micro 201L or 302L, but not both, may be applied toward graduation.

**MICRO 310: Medical Microbiology**

(3-0) Cr. 3. F.

*Prereq: MICRO 302 (or MICRO 201 if a B or better was obtained)*

Study of infection by bacterial and viral pathogenic agents of humans with an overview of immune responses in controlling disease.

**MICRO 310L: Medical Microbiology Laboratory**

(0-3) Cr. 1. F.

*Prereq: MICRO 201 or MICRO 302; MICRO 201L or MICRO 302L; credit or enrollment in MICRO 310*

Microbiological tools and techniques to isolate, identify, and characterize medically significant microorganisms in relation to human diseases. Emphasis on the virulence factors of pathogenic organisms as compared to the normal flora.

**MICRO 320: Molecular and Cellular Bacteriology**

(4-0) Cr. 4. S.

*Prereq: MICRO 302, BIOL 313, credit or enrollment in CHEM 332*

A systems perspective of bacterial growth, survival, and cellular differentiation by integrating physiological and genetic principles. Emphasis is on prokaryotes although unicellular eukaryotes are also discussed. Topics include the structure, function, and assembly of cell components, molecular and genomic techniques, bioenergetics and metabolism, regulation of gene expression, genetic adaptation, stress tolerance, biofilms, and cell-cell interactions and communications.

**MICRO 353: Introductory Parasitology**

(Cross-listed with BIOL, V PTH). (3-0) Cr. 3. S.

*Prereq: BIOL 212*

Biology and host-parasite relationships of major groups of animal parasites, and techniques of diagnosing and studying parasites.

**MICRO 374: Insects and Our Health**

(Cross-listed with ENT). (3-0) Cr. 3. S.

*Prereq: 3 credits in biological sciences*

Identification, biology, and significance of insects and arthropods that affect the health of humans and animals, particularly those that are vectors of disease.

Meets International Perspectives Requirement.

**MICRO 374L: Insects and Our Health Laboratory**

(Cross-listed with ENT). (0-3) Cr. 1. Alt. S., offered even-numbered years.

*Prereq: Credit or enrollment in ENT 374*

Laboratory and field techniques for studying medical or public health entomology, including: collection, identification and maintenance of medically significant arthropods and experimental design and execution related to the biology of arthropods or arthropod-pathogen interactions.

**MICRO 402: Microbial Genetics and Genomics**

(Dual-listed with MICRO 502). (Cross-listed with GEN). (3-0) Cr. 3. Alt. F., offered even-numbered years.

*Prereq: MICRO 302, Biol 313*

The fundamental concepts of bacterial and bacteriophage genetics including mutagenesis, mechanisms of vertical and horizontal genetic information transfer and gene regulation are covered, along with genetic and genomic-based approaches to study these and other cellular processes of microorganisms. Review and discussion of research literature to examine experimental design, methodology, and interpretation of both historical and contemporary relevance to microbial genetics and genomics.

**MICRO 407: Microbiological Safety of Foods of Animal Origins**

(Dual-listed with MICRO 507). (Cross-listed with FS HN). (3-0) Cr. 3. S.

*Prereq: MICRO 420*

Examination of the various factors in the production of foods, from production through processing, distribution and final consumption which contribute to the overall microbiological safety of the food. Upon successful completion of this class, the student will receive both the Preventive Controls for Human Foods certificate (FDA program) and the International HACCP Alliance certificate (USDA-FSIS program).

**MICRO 408: Virology**

(3-0) Cr. 3. F.

*Prereq: BIOL 313 or BBMB 301. BIOL 314 recommended*

The molecular virology and epidemiology of human, animal, plant and insect viruses.

**MICRO 420: Food Microbiology**

(Cross-listed with FS HN, TOX). (3-0) Cr. 3. F.

*Prereq: MICRO 201 or MICRO 302*

Effects of microbial growth in foods. Methods to control, detect, and enumerate microorganisms in food and water. Foodborne infections and intoxications.

**MICRO 421: Food Microbiology Laboratory**

(Cross-listed with FS HN). (1-5) Cr. 3. S.

*Prereq: MICRO 201 or MICRO 302; MICRO 201L or MICRO 302L. Credit or enrollment in FS HN/MICRO 420*

Standard techniques used for the microbiological examination of foods. Independent and group projects on student-generated questions in food microbiology. Emphasis on oral and written communication and group interaction.

**MICRO 428: Principles of Epidemiology and Population Health**

(Cross-listed with V MPM, VDPAM). (3-0) Cr. 3. S.

Epidemiology of disease in populations. Disease causality, observational study design and approaches to epidemiologic investigations. This course is available on campus and by distance.

**MICRO 430: Prokaryotic Diversity and Ecology**

(Dual-listed with MICRO 530). (Cross-listed with BBMB). (3-0) Cr. 3. Alt. S., offered odd-numbered years.

*Prereq: MICRO 302, MICRO 302L*

Survey of the diverse groups of prokaryotes emphasizing important and distinguishing metabolic, phylogenetic, morphological, and ecological features of members of those groups.

**MICRO 440: Laboratory in Microbial Physiology, Diversity, and Genetics**

(Cross-listed with BBMB). (2-6) Cr. 4. F.S.

*Prereq: MICRO 302, MICRO 302L, CHEM 332, BIOL 313L*

Fundamental techniques and theory for studying the cellular mechanisms, genetic processes and diversity of microbial life. Experimental techniques will include isolation and physiological characterization of bacteria that inhabit different environments as well as an emphasis on genetic and molecular techniques to understand antibiotic resistance processes and mechanisms. Also included are techniques for phylogenetic characterization, measuring gene expression, and genetic manipulation of bacteria. Essential components for the effective communication of scientific results are also emphasized.

**MICRO 450: Undergraduate Capstone Colloquium**

(2-0) Cr. 2. S.

*Prereq: SP CM 212 and senior standing in Microbiology*

Required of all undergraduate majors in microbiology. Students demonstrate mastery of core courses in microbiology through discussion of current literature in microbiology and immunology, issues in scientific conduct, and bioethics in microbiology. Students present current papers in a journal club format and gain experience in writing and reviewing grant proposals.

**MICRO 451: Survey in Microbiology**

Cr. R. F.

*Prereq: Junior or Senior standing in Microbiology*

Preparations for graduation. Topics include job search strategies, career information, mock interviews, graduate and professional school application processes and guidelines as well as outcomes assessment activities.

**MICRO 456: Principles of Mycology**

(Cross-listed with BIOL). (2-3) Cr. 3. F.

*Prereq: 10 credits in biological sciences*

Morphology, diversity, and ecology of fungi; their relation to agriculture, industry, and human health.

**MICRO 475: Immunology**

(Dual-listed with MICRO 575). (3-0) Cr. 3. S.

*Prereq: MICRO 310*

An examination of humoral and cellular immune function as well as the interaction of the cells and factors of the immune system that result in health and disease. Micro 475L optional. Credit for either Micro 475 or V MPM 520, but not both, may be applied to graduation.

**MICRO 475L: Immunology Laboratory**

(2-4) Cr. 2. S.

*Prereq: Credit or enrollment in MICRO 310 or MICRO 475 or MICRO 575*

Techniques in primary culture and tumor cell growth, measures of lymphocyte function, serological techniques and flow cytometry. Half semester course.

**MICRO 477: Bacterial-Plant Interactions**

(Dual-listed with MICRO 577). (Cross-listed with PL P). (3-0) Cr. 3. Alt. S., offered even-numbered years.

*Prereq: 3 credits in microbiology or plant pathology*

Overview of plant-associated bacteria including their ecology, diversity, and the physiological and molecular mechanisms involved with their interactions with plants. The course covers bacterial plant pathogens and pathogenesis, nitrogen fixation and plant symbioses, biological control and plant growth promotion, bacterial disease diagnosis and management, and approaches to the study of microbial communities in the rhizosphere and on leaves.

**MICRO 485: Soil and Environmental Microbiology**

(Dual-listed with MICRO 585). (Cross-listed with AGRON, ENSCI). (2-3) Cr. 3. F.

*Prereq: AGRON 182 or equivalent; MICRO 201 and MICRO 201L recommended*

The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues.

**MICRO 487: Microbial Ecology**

(Dual-listed with MICRO 587). (Cross-listed with BIOL, ENSCI, GEOL). (3-0) Cr. 3. F.

*Prereq: Six credits in biology and 6 credits in chemistry*

Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural and environmental systems. Consequences of microbial activity on water chemistry, weathering, and precipitation/dissolution reactions will be emphasized.

**MICRO 490: Independent Study**

Cr. 1-5. Repeatable, maximum of 6 credits. F.S.SS.

*Prereq: A minimum of 6 credits of 300-level or above coursework in microbiology, permission of instructor*

A maximum of 6 credits of Micro 490 may be used toward the total of 128 credits required for graduation.

**MICRO 490A: Independent Study: Laboratory Research**

Cr. arr. Repeatable. F.SS.

*Prereq: A minimum of 6 credits of 300-level or above coursework in microbiology, permission of instructor*

A maximum of 6 credits of Micro 490 may be used toward the total of 128 credits required for graduation.

**MICRO 490B: Independent Study: Literature Review**

Cr. arr. Repeatable. F.SS.

*Prereq: A minimum of 6 credits of 300-level or above coursework in microbiology, permission of instructor*

A maximum of 6 credits of Micro 490 may be used toward the total of 128 credits required for graduation.

**MICRO 490C: Independent Study: Instructional Assistant**

Cr. arr. Repeatable. F.SS.

*Prereq: A minimum of 6 credits of 300-level or above coursework in microbiology, permission of instructor*

A maximum of 6 credits of Micro 490 may be used toward the total of 128 credits required for graduation.

**MICRO 490G: Independent Study: General**

Cr. arr. Repeatable. F.S.S.

*Prereq: A minimum of 6 credits of 300-level or above coursework in microbiology, permission of instructor*

A maximum of 6 credits of Micro 490 may be used toward the total of 128 credits required for graduation.

**MICRO 490H: Independent Study, Honors**

Cr. 1-5. Repeatable, maximum of 6 credits. F.S.S.S.

*Prereq: A minimum of 6 credits of 300-level or above coursework in microbiology, permission of instructor*

A maximum of 6 credits of Micro 490 may be used toward the total of 128 credits required for graduation.

**MICRO 495: Internship**

Cr. 1-2. F.S.

*Prereq: At least 6 credits of 300-level or above coursework in microbiology, approval of academic adviser*

Participation in the Cooperative Extension Intern Program or an equivalent work experience. Written report of activities required. Offered on a satisfactory-fail basis only.

**Courses primarily for graduate students, open to qualified undergraduates:****MICRO 502: Microbial Genetics and Genomics**

(Dual-listed with MICRO 402). (Cross-listed with V MPM). (3-0) Cr. 3. Alt. F., offered even-numbered years.

*Prereq: MICRO 302, Biol 313*

The fundamental concepts of bacterial and bacteriophage genetics including mutagenesis, mechanisms of vertical and horizontal genetic information transfer and gene regulation are covered, along with genetic and genomic-based approaches to study these and other cellular processes of microorganisms. Review and discussion of research literature to examine experimental design, methodology, and interpretation of both historical and contemporary relevance to microbial genetics and genomics.

**MICRO 507: Microbiological Safety of Foods of Animal Origins**

(Dual-listed with MICRO 407). (Cross-listed with FS HN). (3-0) Cr. 3. S.

*Prereq: MICRO 420*

Examination of the various factors in the production of foods, from production through processing, distribution and final consumption which contribute to the overall microbiological safety of the food. Upon successful completion of this class, the student will receive both the Preventive Controls for Human Foods certificate (FDA program) and the International HACCP Alliance certificate (USDA-FSIS program).

**MICRO 509: Plant Virology**

(Dual-listed with MICRO 509). (Cross-listed with PL P). (2-0) Cr. 2. Alt. S., offered odd-numbered years.

*Prereq: BIOL 313 or BBMB 301. BIOL 314 recommended.*

Taxonomy, molecular mechanisms, host-interactions, vector transmission, epidemiology, detection, control and exploitation of plant viruses. Course will consist of a mixture of lectures, and student-led presentations using primary literature.

**MICRO 517: Gut Microbiome: Implications for Health and Diseases**

(Cross-listed with AN S, FS HN, V MPM). Cr. 3.

*Prereq: 2-3 credits in microbiology and/or immunology.*

Explore current research on gut microbiome including modern tools used to study the gut microbiome. Examine the linkages between gut microbiome and health status, diseases, and manipulation of gut microbiome to improve health.

**MICRO 525: Intestinal Microbiology**

(Cross-listed with V MPM). Cr. 3. Alt. S., offered even-numbered years.

*Prereq: Micro 302, BIOL 313*

Overview of commensal microbiota in the health and well-being of vertebrates. Topics include diversity of intestinal structure, microbial diversity/function, innate immune development, community interactions and metabolic diseases associated with alterations of the intestinal microbiome.

**MICRO 530: Prokaryotic Diversity and Ecology**

(Dual-listed with MICRO 430). (Cross-listed with BBMB). (3-0) Cr. 3. Alt. S., offered odd-numbered years.

*Prereq: MICRO 302, MICRO 302L*

Survey of the diverse groups of prokaryotes emphasizing important and distinguishing metabolic, phylogenetic, morphological, and ecological features of members of those groups.

**MICRO 540: Livestock Immunogenetics**

(Cross-listed with AN S, V MPM). (2-0) Cr. 2. Alt. S., offered odd-numbered years.

*Prereq: AN S 561 or MICRO 575 or V MPM 520*

Basic concepts and contemporary topics in genetic regulation of livestock immune response and disease resistance.

**MICRO 551: Microbial Diversity and Phylogeny**

(1-0) Cr. 1. F.

*Prereq: MICRO 302, BIOL 313*

Comparisons among the three kingdoms of life (Bacteria, Archaea, and Eukarya). Topics will include metabolism, adaptation, methods of phylogenetic analysis, and comparative genomics.

**MICRO 552: Bacterial Molecular Genetics and Physiology**

(1-0) Cr. 1. F.

*Prereq: MICRO 302, BIOL 313*

Review of genetics and selected physiological topics of model bacteria.

**MICRO 553: Pathogenic Microorganisms**

(1-0) Cr. 1. F.

*Prereq: MICRO 302, BIOL 313*

Review and contrast/comparison of common bacterial pathogens of plants and animals and their mechanisms of virulence, including toxins, protein secretion, host invasion and iron acquisition strategies. An overview of eukaryotic cell biology that is relevant to pathogenesis will also be included.

**MICRO 554: Virology**

(1-0) Cr. 1. S.

*Prereq: MICRO 302, BIOL 313*

Introduction to virus life cycles including entry, gene expression strategies, replication, and mechanisms to modify and overcome host defenses. The roles of specific viruses and sub-viral agents in animal and plant disease will also be included.

**MICRO 555: Fungal Biology**

(1-0) Cr. 1. S.

*Prereq: GEN 313 or GEN 320 or equivalent.*

Ecology, genetics, physiology and diversity of fungi, from yeasts to mushrooms, and their importance in human affairs.

**MICRO 556: Ecology of Microorganisms**

(1-0) Cr. 1. S.

*Prereq: MICRO 302, BIOL 313*

The study of microorganisms in their natural environments, with a focus on terrestrial and aquatic ecosystems, including eukaryotic hosts; interactions within biofilms and communities, including intercellular communication and symbioses; microbial adaptations to extreme environments; and metagenomic, genomic, molecular and microscopy techniques for the study of microbes in natural systems.

**MICRO 575: Immunology**

(Dual-listed with MICRO 475). (3-0) Cr. 3. S.

*Prereq: MICRO 310*

An examination of humoral and cellular immune function as well as the interaction of the cells and factors of the immune system that result in health and disease. Micro 475L optional. Credit for either Micro 475 or V MPM 520, but not both, may be applied to graduation.

**MICRO 577: Bacterial-Plant Interactions**

(Dual-listed with MICRO 477). (Cross-listed with PL P). (3-0) Cr. 3. Alt. S., offered even-numbered years.

*Prereq: 3 credits in microbiology or plant pathology*

Overview of plant-associated bacteria including their ecology, diversity, and the physiological and molecular mechanisms involved with their interactions with plants. The course covers bacterial plant pathogens and pathogenesis, nitrogen fixation and plant symbioses, biological control and plant growth promotion, bacterial disease diagnosis and management, and approaches to the study of microbial communities in the rhizosphere and on leaves.

**MICRO 585: Soil and Environmental Microbiology**

(Dual-listed with MICRO 485). (Cross-listed with AGRON, ENSCI). (2-3) Cr. 3. F.

*Prereq: AGRON 182 or equivalent; MICRO 201 and MICRO 201L recommended*

The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues.

**MICRO 586: Medical Bacteriology**

(Cross-listed with V MPM). (4-0) Cr. 4. F.

*Prereq: 310*

Bacteria associated with diseases of vertebrates, including virulence factors and interaction of host responses.

**MICRO 587: Microbial Ecology**

(Dual-listed with MICRO 487). (Cross-listed with EEOB, ENSCI, GEOL). (3-0) Cr. 3. F.

*Prereq: Six credits in biology and 6 credits in chemistry*

Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural and environmental systems. Consequences of microbial activity on water chemistry, weathering, and precipitation/dissolution reactions will be emphasized.

**MICRO 590: Special Topics**

Cr. 1-5. Repeatable. F.S.SS.

*Prereq: Permission of instructor*

**Courses for graduate students:**

**MICRO 604: Seminar**

(1-0) Cr. 1. Repeatable. F.S.

Course will expose students to the breadth of subdisciplines within microbiology, offer opportunities for direct interaction between the students and the faculty members within the Interdepartmental Microbiology Graduate Program, and promote interactions among the students within the program. Offered on a satisfactory-fail basis only.



**MICRO 608: Molecular Virology**

(Cross-listed with PL P, V MPM). (3-0) Cr. 3. Alt. F., offered even-numbered years.

*Prereq: BBMB 405 or GDCB 511*

Advanced study of virus host-cell interactions. Molecular mechanisms of viral replication and pathogenesis.

**MICRO 615: Molecular Immunology**

(Cross-listed with BBMB, V MPM). (3-0) Cr. 3. Alt. F., offered odd-numbered years.

*Prereq: BBMB 405 or BBMB 506 and BBMB 507*

Current topics in molecular aspects of immunology: T and B cell receptors; major histocompatibility complex; antibody structure; immunosuppressive drugs and viruses; and intracellular signaling pathways leading to expression of genes that control and activate immune function.

**MICRO 625: Mechanisms of Bacterial Pathogenesis**

(Cross-listed with V MPM). (3-0) Cr. 3. Alt. S., offered odd-numbered years.

*Prereq: Credit in Biochemistry and Microbiology.*

Review of current concepts in specific areas of microbial pathogenesis including the genetic basis for bacterial disease, genetic regulation and control of virulence factors and their mechanisms of action, and host-pathogen interactions at the cellular and molecular levels. The application of microbial genetics to understanding pathogenesis will be included.

**MICRO 626: Advanced Food Microbiology**

(Cross-listed with FS HN, TOX). (3-0) Cr. 3. Alt. F., offered odd-numbered years.

*Prereq: FS HN 420 or FS HN 421 or FS HN 504*

Topics of current interest in food microbiology, including new foodborne pathogens, rapid identification methods, effect of food properties and new preservation techniques on microbial growth, and mode of action of antimicrobials.

**MICRO 627: Rapid Methods in Food Microbiology**

(Cross-listed with FS HN, TOX). (2-0) Cr. 2. Alt. F., offered even-numbered years.

*Prereq: FS HN 420 or FS HN 421 or FS HN 504*

Provides an overview of rapid microbial detection methods for use in foods. Topics include historical aspects of rapid microbial detection, basic categories of rapid tests (phenotypic, genotypic, whole cell, etc.), existing commercial test formats and kits, automation in testing, sample preparation and "next generation" testing formats now in development.

**MICRO 685: Advanced Soil Biochemistry**

(Cross-listed with AGRON, ENSCI). (2-0) Cr. 2. Alt. S., offered even-numbered years.

*Prereq: AGRON 585*

Chemistry of soil organic matter and biochemical transformations brought about by microorganisms and enzymes in soils.

**MICRO 690: Current Topics**

Cr. 1-3. Repeatable. F.S.SS.

*Prereq: Permission of instructor*

Colloquia or advanced study of specific topics in a specialized field.

**MICRO 690A: Current Topics: Microbiology**

Cr. 1-3. Repeatable. F.S.SS.

*Prereq: Permission of instructor*

Colloquia or advanced study of specific topics in a specialized field.

**MICRO 690B: Current Topics: Immunology**

Cr. 1-3. Repeatable. F.S.SS.

*Prereq: Permission of instructor*

Colloquia or advanced study of specific topics in a specialized field.

**MICRO 690C: Current Topics: Infectious Diseases**

Cr. 1-3. Repeatable. F.S.SS.

*Prereq: Permission of instructor*

Colloquia or advanced study of specific topics in a specialized field.

**MICRO 692: Molecular Biology of Plant-Pathogen Interactions**

(Cross-listed with PL P). (3-0) Cr. 3. Alt. F., offered even-numbered years.

*Prereq: PL P 506 or BBMB 405 or GEN 411 or MICRO 402 or strong background in molecular biology*

Seminal and current research in molecular and physiological aspects of plant interactions with pathogens, including mechanisms of pathogenesis, host-pathogen recognition and host defense, with an emphasis on critical evaluation of primary literature. Students also complete a research proposal writing and peer review exercise.

**MICRO 697: Graduate Research Rotation**

Cr. arr. Repeatable. F.S.

Graduate research projects performed under the supervision of selected faculty members in the Interdepartmental Microbiology major.

**MICRO 698: Seminar in Molecular, Cellular, and Developmental Biology**

(Cross-listed with BBMB, GDCB, MCDB, V MPM). (2-0) Cr. 1-2. Repeatable.

F.S.

Student and faculty presentations.

**MICRO 699: Research**

Cr. arr. Repeatable.