

# MICROBIOLOGY

The field of microbiology encompasses the study of a wide diversity of micro-organisms, including viruses, bacteria, archaea bacteria, algae, fungi and protozoa. Microbiologists seek to understand the interactions between these organisms and components of our biosphere. The program in microbiology is designed to prepare students for laboratory positions in industry, government, and university research. The program also provides a foundation for graduate work in microbiology, virology, molecular biology, medicine and other areas. Certification is possible by special examination upon graduation.

## Prerequisites to the Major

A solid background in mathematics is essential to success in any of the scientific disciplines. Incoming students who intend to choose a major in Microbiology should have completed at least three years of high school mathematics. First year students should plan to enroll in MATH 104 or MATH 105; MATH 113 or MATH 115; or MATH 114 or MATH 116 based on the results of their math placement tests. CHEM 134 or CHEM 144 and CHEM 136 or CHEM 146 are prerequisites to many other courses in the Natural Sciences Department; students majoring in any of the sciences should complete this sequence as soon as possible.

Code	Title	Credit Hours
BIOL 130 & BIOL 140	Intro Org and Environ Biology and Intro Molec & Cellular Biology	8
CHEM 134 or CHEM 144	General Chemistry IA Gen Chemistry IB	4
CHEM 136 or CHEM 146	General Chemistry IIA General Chemistry IIB	4
CHEM 225 & CHEM 226 & CHEM 227	Organic Chemistry I and Organic Chemistry II and Organic Chemistry Laboratory	8
MATH 113 or MATH 115	Calc I for Biology & Life Sci Calculus I	4
Select one of the following:		3-4
MATH 114	Calc II for Biology & Life Sci	
MATH 116	Calculus II	
STAT 301	Biostatistics I <sup>4</sup>	
STAT 326	Applied Statistics II	
Select one of the following:		8
PHYS 125 & PHYS 126	Introductory Physics I and Introductory Physics II (preferred sequence)	
PHYS 150 & PHYS 151	General Physics I and General Physics II	
Total Credit Hours		39-40

## Dearborn Discovery Core Requirement

The minimum passing grade for a Dearborn Discovery Core (DDC) course is 2.0. The minimum GPA for the program is 2.0. In addition, the DDC permits any approved course to satisfy up to three credit hours within three different categories. Please see the General Education Program: The Dearborn Discovery Core (<http://catalog.umd.umich.edu/undergraduate/general-information/general-education-program-dearborn-discovery-core/>) section for additional information.

## Foundational Studies

Written and Oral Communication (GEWO) – 6 Credits (<http://catalog.umd.umich.edu/undergraduate/general-information/general-education-program-dearborn-discovery-core/#gewo>)

Upper Level Writing Intensive (GEWI) – 3 Credits (<http://catalog.umd.umich.edu/undergraduate/general-information/general-education-program-dearborn-discovery-core/#gewi>)

Quantitative Thinking and Problem Solving (GEQT) – 3 Credits (<http://catalog.umd.umich.edu/undergraduate/general-information/general-education-program-dearborn-discovery-core/#geqt>)

Critical and Creative Thinking (GECC) – 3 Credits (<http://catalog.umd.umich.edu/undergraduate/general-information/general-education-program-dearborn-discovery-core/#gecc>)

## Areas of Inquiry

Natural Science (GENS) – 7 Credits (<http://catalog.umd.umich.edu/undergraduate/general-information/general-education-program-dearborn-discovery-core/#gens>)

- Lecture/Lab Science Course
- Additional Science Course

Social and Behavioral Analysis (GESB) – 9 Credits (<http://catalog.umd.umich.edu/undergraduate/general-information/general-education-program-dearborn-discovery-core/#gesb>)

Humanities and the Arts (GEHA) – 6 Credits (<http://catalog.umd.umich.edu/undergraduate/general-information/general-education-program-dearborn-discovery-core/#geha>)

Intersections (GEIN) – 6 Credits (<http://catalog.umd.umich.edu/undergraduate/general-information/general-education-program-dearborn-discovery-core/#gein>)

## Capstone

Capstone (GECE) – 3 Credits (<http://catalog.umd.umich.edu/undergraduate/general-information/general-education-program-dearborn-discovery-core/#gece>)

## Foreign Language Requirement

Complete a two-semester beginning language sequence.

Language	Courses
Ancient Greek I and II	MCL 105 and MCL 106
Arabic I and II	ARBC 101 and ARBC 102
Armenian I and II	MCL 111 and MCL 112
French I and II	FREN 101 and FREN 102
German I and II	GER 101 and GER 102
Latin I and II	LAT 101 and LAT 102
Spanish I and II	SPAN 101 and SPAN 102

## Major Requirements

A minimum of 29 upper level credit hours in Microbiology (MICR) or Biological Sciences (BIOL) must be completed as outlined below:

*Note: Students should begin the chemistry sequence before electing any MICR/BIOL course.*

## Required Courses

Code	Title	Credit Hours
<b>AREA A</b>		
All of the following (minimum 12 credit hours required):		
MICR 385	Microbiology	4
MICR 406	Microbial Genetics	3
MICR 440	Micro Genetics & Physi Lab	1
MICR 485	Physiology of Microorganisms	3
Select at least one credit hour from the following: <sup>1</sup>		1
MICR 495	Off-Campus Research	
MICR 497	Seminar in Microbiology	
MICR 498	Ind Study in Microbiology	
MICR 499	Lab in Micro Research	
<b>AREA B</b>		
An organismal/environmental course:		
MICR 405	Applied & Environ Microbiology	4
<b>AREA C</b>		
Complete an additional 13 credit hours (to reach minimum 29 hours required for the major) from the following list, of which at least four credit hours must be from microbiology courses (MICR).		
Microbiology (MICR) Courses- A minimum of 4 credit hours from: <sup>2</sup>		4
MICR 380	Epidemiology	
MICR 390	Topics in Microbiology <sup>3</sup>	
MICR 430	Medical Virology	
MICR 450	Virology	
MICR 455	Immunology	
MICR 459	Pathogenic Microbiology	
MICR 495	Off-Campus Research	
MICR 497	Seminar in Microbiology	
MICR 498	Ind Study in Microbiology	
MICR 499	Lab in Micro Research	
Select a minimum of 9 credits from:		9
BIOL 301	Cell Biology	
BIOL 306	General Genetics	
BIOL 310	Histology	
BIOL 370	Principles of Biochemistry	
BIOL 390	Topics in Biology <sup>3</sup>	
BIOL 470	Biochemistry I	
BIOL 471	Biochemistry II	
BIOL 472	Biochemistry Lab I	
BIOL 473	Biochemistry Laboratory II	
BIOL 474	Molecular Biology	
<b>Cognates</b>		
A minimum of six credit hours upper level courses from the following: <sup>6</sup>		
Any upper level courses in BCHM, CHEM, ENST, ESCI, GEOL, PHYS		
MATH 325	Probability	
STAT 301	Biostatistics I <sup>4</sup>	
STAT 326	Applied Statistics II	
STAT 330	Intro to Survey Sampling	
PHIL 442	Medical Ethics	
PHIL 485	Philosophy of Science	

ANTH 430	Medical Anthropology	
ANTH 435	Human Genetics	
PSYC 370	Physiological Psychology	
SOC 440	Medical Sociology	
Total Credit Hours		35

Other appropriate cognate courses may be permitted with approval of Program Advisor by Petition.

- <sup>1</sup> No more than a total of six credit hours combined in MICR 495, MICR 498, and MICR 499 may be applied toward the 120 credit hours required for graduation. Both MICR 498 and MICR 499 require independent study contracts agreed upon by a faculty member.
- <sup>2</sup> All 400-level MICR courses have MICR 385 as a prerequisite.
- <sup>3</sup> When topic is appropriate – must Petition.
- <sup>4</sup> STAT 301 may be used as a prerequisite requirement or as a cognate requirement but not both.

### Notes:

1. A maximum of 44 credit hours of MICR or BIOL may count in the 120 hours required for graduation.
2. A maximum of 36 credit hours from Areas A, B, and C may count toward the 120 hours required for graduation.
3. At least 12 of the 29 credit hours of upper level MICR/BIOL used toward the major must be elected at UM-Dearborn.
4. A maximum of 6 credit hours of Independent Study (courses numbered 495, 498, 499) in any science discipline may count in the 120 hours to graduate.
5. A maximum of 6 credit hours combined in MICR 495/BIOL 495, MICR 498/BIOL 498, MICR 499/BIOL 499 may be applied toward the 29 credit hours required in the major.
6. In the entire minimum 35 credit hours required for both the microbiology major and cognates, students may use either BIOL/BCHM/CHEM 370 or BIOL/BCHM/CHEM 470 and/or 471.

## Minor or LIBS Concentration

A minor or concentration consists of 12 credit hours of upper-level courses in microbiology (MICR).

### MICR 309 Introduction to Mycology 4 Credit Hours

An introduction to the biology of the fungi. Classification, structure, industrial use, gastronomic qualities, and disease-producing ability of macroscopic and microscopic forms are studied. Laboratories include microscopic and macroscopic examinations of fungi, and their growth and field studies on the occurrence and classification of edible and poisonous varieties. Three hours lecture, four hours laboratory. (OC).

**Prerequisite(s):** BIOL 130 and BIOL 140

### MICR 380 Epidemiology 2 Credit Hours

A study of disease occurrence and spread in human populations. The primary concern is with groups of persons, rather than individuals. Emphasizes methods of study that would contribute to understanding disease etiology. Two hours lecture. (OC).

**Prerequisite(s):** BIOL 140

**MICR 385 Microbiology 4 Credit Hours**

The biology of microorganisms is considered through study of the properties of bacteria, fungi, algae, protozoa, and viruses. Microbial structures are discussed and correlated with their function. Aspects of cellular metabolism pertinent to microorganisms are emphasized. The interaction of microorganisms and their environment, animate and inanimate, is discussed with respect to the beneficial or harmful effects of the different microbial groups. Laboratory exercises introduce the student to basic, practical microbiological techniques and illustrate various principles of microbial life. Three hours lecture, four hours laboratory. (F,S).

**Prerequisite(s):** BIOL 130 and BIOL 140

**Corequisite(s):** MICR 385L

**MICR 390 Topics in Microbiology 1 to 6 Credit Hours**

Current topics in microbiology will be presented through a lecture, discussion and/or laboratory format. Topics will vary, as appropriate, and may cover any area of microbiology including studies on bacteria, algae, fungi, protozoa, viruses, biotechnology, mechanisms of pathogenesis and immunology. (OC).

**Prerequisite(s):** BIOL 385 or MICR 385

**MICR 405 Applied & Environ Microbiology 4 Credit Hours**

Advanced treatment of the interplay of microorganisms and the environment. Topics will include soil and water microbiology (bacteria, archaea, fungi, algae, protozoans and viruses) and plant-microbe interactions (pathogenic and symbiotic) as well as the role of microorganisms in decomposition, nutrient cycling (carbon, nitrogen, sulfur and metal cycling), wastewater and biosolids treatment, and bioremediation. 3 hr lec, 1-4 hr lab. For graduate credit elect MICR 505.

**Prerequisite(s):** MICR 385 or BIOL 385

**Corequisite(s):**

**Restriction(s):**

Can enroll if Class is Junior or Senior

**MICR 406 Microbial Genetics 3 Credit Hours**

A course that emphasizes the genetics and molecular biology of bacteria and their viruses. Topics include DNA structure and replication, recombination, DNA repair, genetic mapping, mechanisms of gene transfer, regulation of gene expression, mutagenesis, and recombinant DNA techniques. (YR, W).

**Prerequisite(s):** MICR 385 or BIOL 385 or BIOL 306

**MICR 430 Medical Virology 3 Credit Hours**

The course provides a general description of the history and nature of animal virus disease. Emphasis is placed on the pathogenesis and clinical description of specific diseases. Three hours lecture.

**Prerequisite(s):** MICR 385 or BIOL 385

**MICR 440 Micro Genetics & Physi Lab 1 Credit Hour**

This course emphasizes the use of advanced microbiological techniques for understanding the genetics and physiology of microorganisms.

Experiments focus on the understanding of general microbial phenomena, such as nutrition, metabolism and biochemistry; protein and nucleic acid synthesis; energy generation, enzyme regulation, membrane transport, motility, differentiation, cellular communication and the behavior of populations.

**Prerequisite(s):** BIOL 385\* or MICR 385\* or BIOL 301\* or BIOL 406\* or MICR 406\* or BIOL 485\* or MICR 485\*

**Restriction(s):**

Cannot enroll if Class is Freshman

Can enroll if Level is Undergraduate

**MICR 450 Virology 4 Credit Hours**

The first half of this course deals with bacterial viruses, with emphasis on classical events in this field. The second half surveys the field of animal viruses, with emphasis on recent discoveries, including replication, pathogenesis, and viral association with cancers. Three hours lecture, four hours laboratory. (AY,W).

**Prerequisite(s):** (BIOL 385 or MICR 385) and CHEM 226

**MICR 455 Immunology 4 Credit Hours**

A detailed study of the field of immunology. Among the topics covered are various aspects of the immunological response, such as humoral or cell-mediated immunity, cell-cell interactions, and immunology as related to the cause and prevention of disease. Three hours lecture, four hours laboratory. (AY,F).

**Prerequisite(s):** BIOL 385 or BIOL 301 or MICR 385

**MICR 459 Pathogenic Microbiology 4 Credit Hours**

An introduction to pathogenic microorganisms and mechanisms of microbial pathogenicity. Disease-causing bacteria, fungi, viruses, and protozoa are studied. Laboratories emphasize clinical approaches to isolation, identification, and treatment. Three hours lecture, four hours laboratory. (AY,F).

**Prerequisite(s):** BIOL 385 or MICR 385

**MICR 485 Physiology of Microorganisms 3 Credit Hours**

An in-depth examination of the physiology of microorganisms. Areas of emphasis include the growth and nutrition of microorganisms, the development of viruses, the microbial degradation of organic compounds, the regulation of degradation reactions, and the biosynthesis of uniquely microbial compounds and secondary metabolites, such as antibiotics and toxins. Consideration is given to the natural environments of specific microorganisms. (YR, W).

**Prerequisite(s):** (BIOL 385 or MICR 385 and CHEM 225\* or BCHM 370) or BIOL 370 or CHEM 370

**MICR 490A Topics in Microbiology 3 Credit Hours**

TOPIC TITLE: Receptors and Cell Signalling. A study of how receptor binding causes changes in cell activity. Topics will include an analysis of protein/ligand binding and a study of selected receptor signalling systems: ion channels, G-protein systems, tyrosine kinase activation, and the steroid receptors.

**Prerequisite(s):** BIOL 301 or BIOL 303 or BCHM 470 or BIOL 470 or CHEM 470

**MICR 495 Off-Campus Research 1 to 3 Credit Hours**

Participation in ongoing experimental research at an off-campus laboratory (or in the field). Arrangements made between the research laboratory, (director of field study), the student, and the microbiology concentration advisor. No more than 6 hours combined from MICR 495, 498, and 499 may be credited toward the 120 hours required for a degree. Four to twelve hours laboratory. Permission of concentration advisor. (F,W,S).

**MICR 497 Seminar in Microbiology 1 Credit Hour**

Topics of current interest in microbiology will be presented by guest lecturers, faculty members or students. Topics chosen will vary from term to term. Can be elected up to three times. One hour seminar. Permission of instructor. (W).

**MICR 498 Ind Study in Microbiology 1 to 3 Credit Hours**

Library research and independent study performed under the guidance of a faculty member. Four to twelve hours readings. (F,W,S).

**MICR 499 Lab in Micro Research 1 to 3 Credit Hours**

Directed laboratory research performed under the guidance of a faculty member. Four to twelve hours laboratory. Permission of instructor. (F,W,S).

\* An asterisk denotes that a course may be taken concurrently.

Frequency of Offering

The following abbreviations are used to denote the frequency of offering: (F) fall term; (W) winter term; (S) summer term; (F, W) fall and winter terms; (YR) once a year; (AY) alternating years; (OC) offered occasionally