Microbiology
Microbiology is the study of organisms that usually require the aid of a microscope in order to be seen.

Micro-organisms include viruses, bacteria, archaea bacteria, algae, fungi, and protozoa. Microbiologists seek to understand the interactions between these organisms and components of our biosphere. Many micro-organisms are essential for life, as we know it, to exist on earth. Many of these organisms produce useful biologically active products, such as enzymes and antibiotics. A small number of them cause diseases in plants and animals, including humans.

The study of micro-organisms has led to many important discoveries concerning:

- the complexities, universality and mechanism of expression of the genetic code;
- the transfer of genetic information between species and modulation of the gene pool;
- the mechanism of antigen-antibody reactions and cellular immunity;
- the synthesis of proteins, nucleic acids and other cellular constituents;
- the structure, function and biogenesis of membranes; and,
- the process of molecular and cellular differentiation.

Students majoring in Microbiology will understand basic principles relating to molecular, cellular and organismal biology. In addition to these, students will exhibit proficiency in selected empirical laboratory skills, develop knowledge of contemporary research using the scientific method and demonstrate competence in oral and written communication. This background of knowledge and experience will prepare the students for entry into professional/graduate school or for employment in government, academic or industrial positions. The learning goals are divided into five parts including (1) Conceptual knowledge; (2) Critical and independent thinking skills; (3) Communication skills; (4) Collaborative skills; and (5) Societal impact.

Please visit the Microbiology (https://umdearborn.edu/casl/undergraduate-programs/areas-study/microbiology) webpage for more information.

Dearborn Discovery Core Requirement
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.

<table>
<thead>
<tr>
<th>Language</th>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>Arabic I and II</td>
<td>ARBC 101 and ARBC 102</td>
<td>MCL 105 and MCL 106</td>
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<tr>
<td>Armenian I and II</td>
<td>MCL 111 and MCL 112</td>
<td>Arabic I and II</td>
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<tr>
<td>French I and II</td>
<td>FREN 101 and FREN 102</td>
<td>MCL 105 and MCL 106</td>
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<tr>
<td>German I and II</td>
<td>GER 101 and GER 102</td>
<td>MCL 105 and MCL 106</td>
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<tr>
<td>Latin I and II</td>
<td>LAT 101 and LAT 102</td>
<td>MCL 105 and MCL 106</td>
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<tr>
<td>Spanish I and II</td>
<td>SPAN 101 and SPAN 102</td>
<td>MCL 105 and MCL 106</td>
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<tr>
<td>Chinese I and II</td>
<td>CHIN 101 and CHIN 102</td>
<td>MCL 105 and MCL 106</td>
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</table>

Pre-Major Requirements
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.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>BIOL 130</td>
<td>Intro Org and Environ Biology</td>
<td>8</td>
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<tr>
<td>&amp; BIOL 140</td>
<td>and Intro Molec &amp; Cellular Biology</td>
<td></td>
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</tbody>
</table>
CHEM 134 General Chemistry IA 4
or CHEM 144 Gen Chemistry IB
CHEM 136 General Chemistry IIA 4
or CHEM 146 General Chemistry IIB
CHEM 225 Organic Chemistry I 8
& CHEM 226 and Organic Chemistry II
& CHEM 227 and Organic Chemistry Laboratory
MATH 113 Calc I for Biology & Life Sci 4
or MATH 115 Calculus I
Select one of the following: 3-4
MATH 114 Calc II for Biology & Life Sci
MATH 116 Calculus II
STAT 301 Biostatistics I 4
STAT 327 Statistical Computing 4
Select one of the following: 8
PHYS 125 Introductory Physics I
& PHYS 126 and Introductory Physics II (preferred sequence)
PHYS 150 General Physics I
& PHYS 151 and General Physics II

**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

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>MICR/BIOL 385 Microbiology</td>
<td>4</td>
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<tr>
<td>MICR/BIOL 405 Applied &amp; Environ Microbiology</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>MICR/BIOL 406 Microbial Genetics</td>
<td>3</td>
<td></td>
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<tr>
<td>MICR/BIOL 440 Micro Genetics &amp; Phys Lab</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>MICR/BIOL 485 Physiology of Microorganisms</td>
<td>3</td>
<td></td>
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<tr>
<td>Select at least one credit hour from the following: 1</td>
<td>1</td>
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<tr>
<td>MICR 495 Off-Campus Research</td>
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<tr>
<td>MICR 497 Seminar in Microbiology</td>
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<tr>
<td>MICR 498 Ind Study in Microbiology</td>
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<tr>
<td>MICR 499 Lab in Micro Research</td>
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Select a minimum of 9 credits from:

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<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>BIOL 301 Cell Biology</td>
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<tr>
<td>BIOL 306 General Genetics</td>
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<tr>
<td>BIOL 310 Histology</td>
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<tr>
<td>BIOL/BCHM/ CHEM 370 Principles of Biochemistry</td>
<td>5</td>
<td></td>
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<tr>
<td>BIOL/MICR Epidemiology</td>
<td></td>
<td></td>
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<tr>
<td>BIOL/MICR Virology</td>
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<tr>
<td>BIOL/MICR Immunology</td>
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<tr>
<td>BIOL/MICR Pathogenic Microbiology</td>
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<tr>
<td>BIOL/BCHM/ CHEM 459 Biochemistry I</td>
<td>5</td>
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<tr>
<td>BIOL/BCHM/ CHEM 471 Biochemistry II</td>
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<tr>
<td>BIOL/BCHM/ CHEM 470 Biochemistry Lab I</td>
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</tr>
<tr>
<td>BIOL/BCHM/ CHEM 472 Biochemistry Laboratory II</td>
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<tr>
<td>BIOL/BCHM Molecular Biology</td>
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<tr>
<td>BIOL/BCHM 474</td>
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### Cognates

A minimum of six credit hours upper level courses from the following: 6

<table>
<thead>
<tr>
<th>Code</th>
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<tbody>
<tr>
<td>MATH 325 Probability</td>
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<tr>
<td>STAT 301 Biostatistics I</td>
<td>4</td>
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<tr>
<td>STAT 327 Statistical Computing</td>
<td>4</td>
<td></td>
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<tr>
<td>STAT 330 Intro to Survey Sampling</td>
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<tr>
<td>PHIL/HPS 442 Medical Ethics</td>
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<tr>
<td>PHIL/STS 485 Philosophy of Science</td>
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<tr>
<td>ANTH/STS 430 Medical Anthropology</td>
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<tr>
<td>PSYC 370 Physiological Psychology</td>
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<tr>
<td>SOC/HPS 440 Medical Sociology</td>
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</table>

**Total Credit Hours** 35

Other appropriate cognate courses may be permitted with approval of the faculty program advisor by petition.

1 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.
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 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 & Phys 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

Notes:
1. A maximum of 44 credit hours of MICR or BIOL may count in the 120 hours required for graduation.
2. At least 12 of the 29 credit hours of upper level MICR/BIOL used toward the major must be elected at UM-Dearborn.
3. 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.
4. A maximum of 6 credit hours combined in MICR 495/BIO 495, MICR 498/BIO 498, MICR 499/BIO 499 may be applied toward the 29 credit hours required in the major.
5. In the entire minimum 35 credit hours required for both the microbiology major and cognates, students may use either BIOL/BCHM/CHM 370 or BIOL/BCHM/CHM 470 and/or 471.
6. Any one course may be used to satisfy only one requirement within the major.

Minor or Integrative Studies 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 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.