***Twin Cities Campus***

# Microbiology B.S.

*Microbiology*

**College of Biological Sciences**

- Program Type: Baccalaureate
- Requirements for this program are current for Fall 2017
- Required credits to graduate with this degree: 120
- Required credits within the major: 78 to 88
- Degree: Bachelor of Science

Microbiologists study the structure, function, and interaction of microbes, which make up 60 percent of the earth's biomass. Regarded by many as the foundation of the biosphere, microbes were likely the first form of life on earth, predating plants and animals by more than three billion years. Microbiologists study the role of microbes, such as bacteria, fungi, and viruses in our world. A key goal of microbiologists is to find new ways to use microbes to our advantage, such as engineering bacteria to synthesize cancer drugs or clean up toxic waste sites.

The microbiology major prepares students for advanced work in graduate programs in microbiology and related fields and serves as preparation for careers in the health sciences. Microbiologists find employment in a variety of governmental, industrial, and pharmaceutical fields.

## Program Delivery

This program is available:

- via classroom (the majority of instruction is face-to-face)

## Admission Requirements

Freshmen  students are usually admitted to pre-major status before admission to this major

A GPA above 2.0 is preferred for the following:

- 2.50 transferring from another University of Minnesota college
- 2.50 transferring from outside the University

For information about University of Minnesota admission requirements, visit the Office of Admissions website.

## General Requirements

All students are required to complete general University and college requirements including writing and liberal education courses. For more information about University-wide requirements, see the liberal education requirements.Required courses for the major or minor in which a student receives a D grade (with or without plus or minus) do not count toward the major or minor (including transfer courses).

## Program Requirements

**Foundational Courses**

**Nature of Life/Nature of Science and Research**

BIOL 1805 - Nature of Life: Introducing New Students to the Biological Sciences (0.5 cr)
BIOL 1806 - Nature of Life, Part Two (0.5 cr)
BIOL 2905 - Nature of Life, Part III (0.5 cr)
BIOL 2906 - Nature of Life, Part IV (0.5 cr)
*or* BIOL 3001 - Nature of Science and Research (1.0 cr)

**Foundations of Biology**

BIOL 1951 - Foundations of Biology Lecture I for Biological Sciences Majors [BIOL] (4.0 cr)
BIOL 1961 - Foundations of Biology Lab I for Biological Sciences Majors [BIOL] (2.0 cr)
*or* BIOL 1951H - Foundations of Biology Lecture I for Biological Sciences Majors [BIOL] (4.0 cr)
BIOL 1961H *{Inactive}*[BIOL] (2.0 cr)
BIOL 2003 - Foundations of Biology for Biological Sciences Majors, Part II (3.0 cr)
BIOL 3004 - Foundations of Biology for Biological Sciences Majors, Part II Laboratory (3.0 cr)
*or* BIOL 2003H - Foundations of Biology for Biological Sciences Majors, Part II (3.0 cr)
BIOL 3004H *{Inactive}*(3.0 cr)

**Quantitative Requirements**

MATH 1241 - Calculus and Dynamical Systems in Biology [MATH] (4.0 cr)
*or* MATH 1271 - Calculus I [MATH] (4.0 cr)

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*or* MATH 1571H - Honors Calculus I [MATH] (4.0 cr)
Take 1 or more course(s) from the following:
•CSCI 1133 - Introduction to Computing and Programming Concepts (4.0 cr)
•CSCI 1133H - Honors Introduction to Computing and Programming Concepts (4.0 cr)
•MATH 1272 - Calculus II (4.0 cr)
•MATH 1572H - Honors Calculus II (4.0 cr)
•MATH 2241 - Mathematical Modeling of Biological Systems (3.0 cr)
•STAT 3011 - Introduction to Statistical Analysis [MATH] (4.0 cr)
•BIOL 3272 - Applied Biostatistics (4.0 cr)
*or* BIOL 5272 - Applied Biostatistics (4.0 cr)

**Chemistry**

**Track 1: Preferred CBS Chemistry Sequence**
CHEM 1081 - Chemistry for the Life Sciences I [PHYS] (3.0 cr)
CHEM 1065 - Chemical Principles I Laboratory [PHYS] (1.0 cr)
CHEM 1082 - Chemistry for the Life Sciences II (3.0 cr)
CHEM 1086 - Chemistry for the Life Sciences II Laboratory (1.0 cr)
CHEM 2081 - Chemistry for the Life Sciences III (3.0 cr)
CHEM 2085 - Chemistry for the Life Sciences III Laboratory (2.0 cr)

*or* **Track 2**
This track is allowable for students entering CBS with previous chemistry credit or for whom space is not available in the preferred track. Students should speak with a CBS academic advisor to determine eligibility for this track.
CHEM 1061 - Chemical Principles I [PHYS] (3.0 cr)
CHEM 1065 - Chemical Principles I Laboratory [PHYS] (1.0 cr)
CHEM 1062 - Chemical Principles II [PHYS] (3.0 cr)
CHEM 1066 - Chemical Principles II Laboratory [PHYS] (1.0 cr)
CHEM 2301 - Organic Chemistry I (3.0 cr)

*or* **Track 2 (Honors Option)**
This track is allowable for CBS honors students.
CHEM 1071H - Honors Chemistry I [PHYS] (3.0 cr)
CHEM 1075H - Honors Chemistry I Laboratory [PHYS] (1.0 cr)
CHEM 1072H - Honors Chemistry II [PHYS] (3.0 cr)
CHEM 1076H - Honors Chemistry II Laboratory [PHYS] (1.0 cr)
CHEM 2331H - Honors Elementary Organic Chemistry I (3.0 cr)

**Physics**
PHYS 1201W *{Inactive}*[PHYS, WI] (5.0 cr)
*or* PHYS 1301W - Introductory Physics for Science and Engineering I [PHYS, WI] (4.0 cr)
*or* PHYS 1401V - Honors Physics I [PHYS, WI] (4.0 cr)
*or* PHYS 1501V *{Inactive}*[PHYS, WI] (4.0 cr)
PHYS 1202W *{Inactive}*[PHYS, WI] (5.0 cr)
*or* PHYS 1302W - Introductory Physics for Science and Engineering II [PHYS, WI] (4.0 cr)
*or* PHYS 1402V - Honors Physics II [PHYS, WI] (4.0 cr)
*or* PHYS 1502V *{Inactive}*[PHYS, WI] (4.0 cr)

**Molecular and Cellular Biology**
BIOL 3025 - Molecular Biology and Society [TS] (3.0 cr)
BIOC 3022 - Biochemistry for Life Scientists (3.0 cr)
*or* BIOC 4331 - Biochemistry I: Structure, Catalysis, and Metabolism in Biological Systems (4.0 cr)
BIOL 4003 - Genetics (3.0 cr)

**Ecology, Evolution, and Biodiversity**
MICB 3301 - Biology of Microorganisms (5.0 cr)

**Microbiology Major-specific Courses**

**Microbiology Major Core**
Take exactly 4 course(s) from the following:
•BIOC 5352 - Biotechnology and Bioengineering for Biochemists (3.0 cr)
•BIOC 5353 *{Inactive}*(3.0 cr)
•BIOC 5361 - Microbial Genomics and Bioinformatics (3.0 cr)
•PMB 4121 - Microbial Ecology and Applied Microbiology (3.0 cr)
•PMB 4111 - Microbial Physiology and Diversity (3.0 cr)
•MICB 4131 - Immunology (3.0 cr)
•MICB 4151 - Molecular and Genetic Bases for Microbial Diseases (3.0 cr)
•MICB 4161W - Eukaryotic Microbiology [WI] (3.0 cr)
•MICB 4171 - Biology, Genetics, and Pathogenesis of Viruses (3.0 cr)

**Microbiology Labs**
In order for directed research to fulfill one of the two required labs, 6 credits of MICB 4994 and/or 4794W must be completed over the

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course of two or more semesters. Directed research may only count for one lab. Students may use a maximum of seven credits of directed research toward a CBS degree.
Take 2 or more course(s) from the following:
•MICB 4215 - Advanced Laboratory: Microbial Physiology and Diversity (3.0 cr)
•MICB 4225W - Advanced Laboratory: Microbial Genetics [WI] (3.0 cr)
•MICB 4235 - Advanced Laboratory: Virology, Immunology, and Microbial Genetics (3.0 cr)
•MICB 4994 - Directed Research (1.0 - 7.0 cr)
•MICB 4794W - Directed Research: Writing Intensive [WI] (3.0 - 5.0 cr)

**STEM Electives**

Take 7 or more credit(s) from the following:
•BIOC 4025W - Laboratory in Biochemistry [WI] (2.0 cr)
•BIOC 4125 - Laboratory in Molecular Biology and Biotechnology (3.0 cr)
•BIOC 4325 - Laboratory in Mass Spectrometry (1.0 cr)
•BIOC 4351 - Protein Engineering (3.0 cr)
•BIOC 4521 - Introduction to Physical Biochemistry (3.0 cr)
•BIOC 5309 - Biocatalysis and Biodegradation (3.0 cr)
•BIOC 5352 - Biotechnology and Bioengineering for Biochemists (3.0 cr)
•BIOC 5353 *{Inactive}*(3.0 cr)
•BIOC 5361 - Microbial Genomics and Bioinformatics (3.0 cr)
•BIOC 5527 *{Inactive}*(4.0 cr)
•PMB 3007W - Plant, Algal, and Fungal Diversity and Adaptation [WI] (4.0 cr)
•BIOL 4004 - Cell Biology (3.0 cr)
•BIOL 5309 - Molecular Ecology And Ecological Genomics (3.0 cr)
•CHEM 2302 - Organic Chemistry II (3.0 cr)
•CHEM 2311 - Organic Lab (4.0 cr)
•CHEM 4412 - Chemical Biology of Enzymes (3.0 cr)
•CSCI 3003 - Introduction to Computing in Biology (3.0 cr)
•EEB 4611 - Biogeochemical Processes (3.0 cr)
•EEB 5042 - Quantitative Genetics (3.0 cr)
•EEB 5221 *{Inactive}*(3.0 cr)
•GCD 4034 - Molecular Genetics and Genomics (3.0 cr)
•GCD 4111 - Histology: Cell and Tissue Organization (4.0 cr)
•GCD 4151 - Molecular Biology of Cancer (3.0 cr)
•GCD 5005 - Computer Programming for Biology (3.0 cr)
•GCD 5036 - Molecular Cell Biology (3.0 cr)
•MATH 5445 - Mathematical Analysis of Biological Networks (4.0 cr)
•NSCI 5300 *{Inactive}*(3.0 cr)
•STAT 3021 - Introduction to Probability and Statistics (3.0 cr)
•STAT 3022 - Data Analysis (4.0 cr)
•STAT 4101 - Theory of Statistics I (4.0 cr)
•STAT 4102 - Theory of Statistics II (4.0 cr)
•EEB 3409 - Evolution (3.0 cr)
*or* EEB 5409 - Evolution (3.0 cr)
•Take 0 - 1 course(s) from the following:
•GCC 3xxx
•GCC 5xxx

**Upper Division Writing Intensive within the Major**

Students are required to take one upper division writing intensive course within the major. If that requirement has not been satisfied within the core major requirements, students must choose one course from the following list. Some of these courses may also fulfill other major requirements.
Take 0 - 1 course(s) from the following:
•BIOC 4025W - Laboratory in Biochemistry [WI] (2.0 cr)
•BIOC 4793W - Directed Studies: Writing Intensive [WI] (1.0 - 7.0 cr)
•BIOC 4794W - Directed Research: Writing Intensive [WI] (3.0 - 5.0 cr)
•PMB 3005W - Plant Function Laboratory [WI] (2.0 cr)
•PMB 3007W - Plant, Algal, and Fungal Diversity and Adaptation [WI] (4.0 cr)
•BIOL 4321W - Deconstructing Research: Writing about Biological Research for Non-scientists [WI] (2.0 cr)
•BIOL 4793W - Directed Studies: Writing Intensive [WI] (1.0 - 7.0 cr)
•BIOL 4794W - Directed Research: Writing Intensive [WI] (3.0 - 5.0 cr)
•EEB 3408W - Ecology [WI] (4.0 cr)
•EEB 3412W - Introduction to Animal Behavior, Writing Intensive [WI] (4.0 cr)
•EEB 4330W - Animal Communication [WI] (3.0 cr)
•EEB 4609W - Ecosystem Ecology [ENV, WI] (3.0 cr)
•EEB 4793W - Directed Studies: Writing Intensive [WI] (1.0 - 7.0 cr)
•EEB 4794W - Directed Research: Writing Intensive [WI] (3.0 - 5.0 cr)

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- GCD 4005W - Cell Biology-Writing Intensive [WI] (4.0 cr)
- GCD 4793W - Directed Studies: Writing Intensive [WI] (1.0 - 7.0 cr)
- GCD 4794W - Directed Research: Writing Intensive [WI] (3.0 - 5.0 cr)
- MICB 4161W - Eukaryotic Microbiology [WI] (3.0 cr)
- MICB 4225W - Advanced Laboratory: Microbial Genetics [WI] (3.0 cr)
- MICB 4793W - Directed Studies: Writing Intensive [WI] (1.0 - 7.0 cr)
- MICB 4794W - Directed Research: Writing Intensive [WI] (3.0 - 5.0 cr)
- NSCI 3001W - Neuroscience and Society [CIV, WI] (4.0 cr)
- NSCI 3102W - Neurobiology II: Perception and Behavior [WI] (3.0 cr)
- NSCI 4793W - Directed Studies: Writing Intensive [WI] (1.0 - 6.0 cr)
- NSCI 4794W - Directed Research: Writing Intensive [WI] (3.0 - 5.0 cr)
- PMB 4516W - Plant Cell Biology: Writing Intensive [WI] (3.0 cr)
- PMB 4793W - Directed Studies: Writing Intensive [WI] (1.0 - 7.0 cr)
- PMB 4794W - Directed Research: Writing Intensive [WI] (3.0 - 5.0 cr)

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Information current as of March 29, 2024