UNIVERSITY OF MINNESOTA
Driven to Discover℠

Twin Cities Campus

Plant and Microbial Biology B.S.

Plant and Microbial Biology

College of Biological Sciences

- Program Type: Baccalaureate
- Requirements for this program are current for Spring 2019
- Required credits to graduate with this degree: 120
- Required credits within the major: 71 to 78
- Degree: Bachelor of Science

The plant and microbial biology (PMB) major trains students in all aspects of biology as they pertain to plants and microorganisms. Students have the flexibility to focus their studies on plants, microorganisms, or the interactions between the two, such as symbiotic interactions or pathogenic interactions.

All PMB majors are guaranteed experience in a research laboratory, as long as they show satisfactory progress toward their degree and make arrangements by the middle of their junior year. Current faculty research interests include genomics, gene expression, chromosome structure, plant growth substances, signal transduction, plant responses to stress, metabolic activities during development, molecular evolution and systematics, fungal and plant interactions, bacterial physiology, microbial biotechnological applications, nitrogen fixation by bacteria in symbiosis with plants, microorganisms for biodegradation and bioremediation, molecular methods to detect and assess environmental bacteria, and microbial metagenomics.

Program Delivery

This program is available:

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

Admission Requirements

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 This track (BIOL 3001) is for transfer students only.
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)

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)
- CSCI 3003 - Introduction to Computing in Biology (3.0 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 3272H - 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)

Molecular and Cellular Biology

BIOL 3025 - Molecular Biology and Society [TS] (3.0 cr)
BIOL 4003 - Genetics (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)

Evolution and Biodiversity

MICB 3301 - Biology of Microorganisms (5.0 cr)
EEB 3409 - Evolution (3.0 cr)
or EEB 5409 - Evolution (3.0 cr)
PMB 3007W - Plant, Algal, and Fungal Diversity and Adaptation [WI] (4.0 cr)
or PMB 3002 - Plant Biology: Function (2.0 cr)
with PMB 3005W - Plant Function Laboratory [WI] (2.0 cr)

Ecology or Cell Biology

BIOL 4004 - Cell Biology (3.0 cr)
or EEB 3407 - Ecology (3.0 cr)
or EEB 3408W - Ecology [WI] (4.0 cr)
or EEB 3807 - Ecology (4.0 cr)

Plant and Microbial Biology Major-specific Courses

Plant and Microbial Biology Electives

A total of at least 12 elective credits are required. These 12 credits must include at least one course from the Lab/Field Electives list and six credits from the PMB Major Electives list. Any remaining credits can come from any list.
Take 12 or more credit(s) from the following:

Lab/Field Electives

A directed research experience of at least three credits may fulfill this requirement. A maximum of seven directed research credits may be counted toward the degree. Note that while some of these courses appear as options in other areas of the major, any individual course may only fulfill one major requirement.

Take 1 or more course(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 4794W - Directed Research: Writing Intensive [WI] (3.0 - 5.0 cr)
•BIOC 4994 - Directed Research (1.0 - 7.0 cr)
•PMB 3005W - Plant Function Laboratory [WI] (2.0 cr)
•PMB 3007W - Plant, Algal, and Fungal Diversity and Adaptation [WI] (4.0 cr)
•BIOL 4794W - Directed Research: Writing Intensive [WI] (3.0 - 5.0 cr)
•BIOL 4994 - Directed Research (1.0 - 7.0 cr)
•EEB 4068 - Plant Physiological Ecology (3.0 cr)
•EEB 4794W - Directed Research: Writing Intensive [WI] (3.0 - 5.0 cr)
•EEB 4994 - Directed Research (1.0 - 6.0 cr)
•EEB 5605 *{Inactive}*(2.0 cr)
•FNRM 3104 - Forest Ecology (4.0 cr)
•GCD 4794W - Directed Research: Writing Intensive [WI] (3.0 - 5.0 cr)
•GCD 4994 - Directed Research (1.0 - 7.0 cr)
•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 4794W - Directed Research: Writing Intensive [WI] (3.0 - 5.0 cr)
•MICB 4994 - Directed Research (1.0 - 7.0 cr)
•NSCI 4794W - Directed Research: Writing Intensive [WI] (3.0 - 5.0 cr)
•NSCI 4994 - Directed Research (1.0 - 6.0 cr)
•PMB 4321 - Minnesota Flora (3.0 cr)
•PMB 4511 - Flowering Plant Diversity (3.0 cr)
•PMB 4794W - Directed Research: Writing Intensive [WI] (3.0 - 5.0 cr)
•PMB 4994 - Directed Research (1.0 - 7.0 cr)

•PMB Major Electives

The following courses can be used for PMB major elective credit, if not used to fulfill any other major requirements.

Take 6 or more credit(s) from the following:

•PMB 3002 - Plant Biology: Function (2.0 cr)
•PMB 3005W - Plant Function Laboratory [WI] (2.0 cr)
•PMB 3007W - Plant, Algal, and Fungal Diversity and Adaptation [WI] (4.0 cr)
•BIOL 4004 - Cell Biology (3.0 cr)
•BIOL 5309 - Molecular Ecology And Ecological Genomics (3.0 cr)
•EEB 3407 - Ecology (3.0 cr)
•EEB 4068 - Plant Physiological Ecology (3.0 cr)
•EEB 4609W - Ecosystem Ecology [ENV, WI] (3.0 cr)
•ESCI 4801 - Geomicrobiology (3.0 cr)
•FNRM 3104 - Forest Ecology (4.0 cr)
•MATH 2241 - Mathematical Modeling of Biological Systems (3.0 cr)
•MICB 4161W - Eukaryotic Microbiology [WI] (3.0 cr)
•MICB 4215 - Advanced Laboratory: Microbial Physiology and Diversity (3.0 cr)
•MICB 4225W - Advanced Laboratory: Microbial Genetics [WI] (3.0 cr)
•PLPA 5203 - Introduction to Fungal Biology (3.0 cr)
•PMB 4111 - Microbial Physiology and Diversity (3.0 cr)
•PMB 4321 - Minnesota Flora (3.0 cr)
•PMB 4511 - Flowering Plant Diversity (3.0 cr)
•PMB 4516W - Plant Cell Biology: Writing Intensive [WI] (3.0 cr)
•PMB 4601 - Topics in Plant Biochemistry (3.0 cr)
•PLPA 5301 - Large Scale Omic Data in Plant Biology (3.0 cr)
•BIOL 3272 - Applied Biostatistics (4.0 cr)
or BIOL 5272 - Applied Biostatistics (4.0 cr)
•PMB 4412 - Plant Physiology and Development (3.0 cr)
or PMB 5412 - Plant Physiology and Development (3.0 cr)
•Take 0 - 6 credit(s) from the following:
•BIOC 4793W - Directed Studies: Writing Intensive [WI] (1.0 - 7.0 cr)
•BIOC 4993 - Directed Studies (1.0 - 7.0 cr)
•BIOL 4793W - Directed Studies: Writing Intensive [WI] (1.0 - 7.0 cr)
•BIOL 4993 - Directed Studies (1.0 - 7.0 cr)
•EEB 4793W - Directed Studies: Writing Intensive [WI] (1.0 - 7.0 cr)
•EEB 4993 - Directed Studies (1.0 - 7.0 cr)

- •GCD 4793W - Directed Studies: Writing Intensive [WI] (1.0 - 7.0 cr)
- •GCD 4993 - Directed Studies (1.0 - 7.0 cr)
- •MICB 4793W - Directed Studies: Writing Intensive [WI] (1.0 - 7.0 cr)
- •MICB 4993 - Directed Studies (1.0 - 7.0 cr)
- •NSCI 4793W - Directed Studies: Writing Intensive [WI] (1.0 - 6.0 cr)
- •NSCI 4993 - Directed Studies (1.0 - 7.0 cr)
- •PMB 4793W - Directed Studies: Writing Intensive [WI] (1.0 - 7.0 cr)
- •PMB 4993 - Directed Studies (1.0 - 7.0 cr)

•**Other Elective Options**

Take 0 - 4 credit(s) from the following:

- •BIOC 4xxx
- •BIOC 5xxx
- •BIOL 4xxx
- •BIOL 5xxx
- •CHEM 2302 - Organic Chemistry II (3.0 cr)
- •CHEM 2311 - Organic Lab (4.0 cr)
- •CSCI 1133 - Introduction to Computing and Programming Concepts (4.0 cr)
- •EEB 4xxx
- •EEB 5xxx
- •GCD 4xxx
- •GCD 5xxx
- •MATH 1272 - Calculus II (4.0 cr)
- •MICB 4xxx
- •MICB 5xxx
- •MICE 5035 - Personal Microbiome Analysis (3.0 cr)
- •NSCI 4xxx
- •NSCI 5xxx
- •PHYS 1202W *{Inactive}*[PHYS, WI] (5.0 cr)
- •PHYS 1302W - Introductory Physics for Science and Engineering II [PHYS, WI] (4.0 cr)
- •PHYS 1402V - Honors Physics II [PHYS, WI] (4.0 cr)
- •PHYS 1502V *{Inactive}*[PHYS, WI] (4.0 cr)
- •PMB 3500 *{Inactive}*(1.0 - 3.0 cr)
- •STAT 3011 - Introduction to Statistical Analysis [MATH] (4.0 cr)
- •STAT 3021 - Introduction to Probability and Statistics (3.0 cr)
- •EEB 3811W - Animal Behavior in the Field [WI] (4.0 cr)
  or EEB 3411 - Introduction to Animal Behavior (3.0 cr)
  or EEB 3412W - Introduction to Animal Behavior, Writing Intensive [WI] (4.0 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)
- •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)