



### **Twin Cities Campus**

## **Ecology, Evolution and Behavior M.S.**

*Ecology, Evolution & Behavior*

### **College of Biological Sciences**

Link to a [list of faculty](#) for this program.

#### **Contact Information:**

Ecology, Evolution, and Behavior Graduate Program, 100 Ecology, 1987 Upper Buford Circle, St. Paul, MN 55108 (612-624-6770, fax: 612-624-6777)

Email: [eebgrad@umn.edu](mailto:eebgrad@umn.edu)

Website: <http://www.cbs.umn.edu/explore/departments/eeb/graduate/about-program>

- Program Type: Master's
- Requirements for this program are current for Fall 2016
- Length of program in credits: 30
- This program requires summer semesters for timely completion.
- Degree: Master of Science

Along with the program-specific requirements listed below, please read the [General Information](#) section of the catalog website for requirements that apply to all major fields.

The graduate program in ecology, evolution, and behavior (EEB) links faculty and students interested in the biology of organisms from molecules to ecosystems. Studies address questions from molecular mechanisms of evolution, the interactions of organisms in social groups and populations, the distributions and abundances of species in communities and ecosystems, to global biogeochemical processes. The program provides broad training in the general areas of ecology, evolution, and animal behavior, and specialized courses and research in vertebrate and invertebrate zoology; behavior and ethology; evolution; population genetics; molecular evolution; systematics; population, community, and ecosystem ecology; global ecology; limnology; ecology of vegetation; and theoretical ecology. Opportunities for field research are available in Africa, Central America, and other parts of the world, as well as in local ecosystems, including the Cedar Creek Ecosystem Science Reserve and Itasca Biological Station. Seminars and individually designed tutorials are an important part of student programs and provide an exciting intellectual environment.

### **Program Delivery**

This program is available:

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

### **Prerequisites for Admission**

Other requirements to be completed before admission:

Courses in inorganic chemistry, organic chemistry, biochemistry, general physics, one year of college calculus, animal biology, genetics, physiology, and plant biology are strongly recommended and provide an important background to pursue graduate work in EEB. Proficiency in a foreign language is not required but is strongly recommended for students who expect to pursue field work in a country where English is not the native language. Deficiencies must be made up early in the graduate program.

#### **Special Application Requirements:**

Students are admitted only in fall semester. Deadline for application is December 1. Refer to the EEB website for more details.

International applicants must submit score(s) from one of the following tests:

- TOEFL
  - Internet Based - Total Score: 79
  - Internet Based - Writing Score: 21
  - Internet Based - Reading Score: 19
  - Paper Based - Total Score: 550
- IELTS
  - Total Score: 6.5
- MELAB
  - Final score: 80

Key to [test abbreviations](#)(TOEFL, IELTS, MELAB).

For an online application or for more information about graduate education admissions, see the [General Information](#) section of the catalog website.



## Program Requirements

**Plan A:** Plan A requires 14 major credits, 6 credits outside the major, and 10 thesis credits. The final exam is oral.

**Plan B:** Plan B requires 24 major credits and 6 credits outside the major. The final exam is oral.

This program may be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A minimum GPA of 3.00 is required for students to remain in good standing.

At least 2 semesters must be completed before filing a Degree Program Form.

The MS is offered under both Plan A (with thesis) and Plan B (without thesis). Plan A requires 20 course credits in the major and 10 thesis credits. Plan B requires 30 course credits in the major and one to three research papers, which may be written in conjunction with graduate courses. Significant field or laboratory experience and competence in statistics, to include hypothesis testing, regression, and correlation are required. Degree programs are planned by the student and an advisory committee of three faculty members to meet the student's interests and needs.

### Plan A and Plan B course options

#### Plan A

##### Elective courses

Take 20 or more credit(s) from the following:

- [EEB 5042](#) - Quantitative Genetics (3.0 cr)
- [EEB 5407](#) - Ecology (3.0 cr)
- [EEB 5601](#) - Limnology (3.0 cr)
- [EEB 5605](#) - Limnology Laboratory (2.0 cr)
- [EEB 8201](#) - Graduate Foundations in Ecology, Evolution and Behavior Semester 1 (4.0 cr)
- [EEB 8202](#) - Graduate Foundations in Ecology, Evolution and Behavior - Semester 2 (4.0 cr)
- [EEB 8360](#) - Behavioral Biology Seminar (1.0 cr)
- [EEB 8500](#) - NSF GRF Graduate Research Fellowship Proposal Writing Seminar (1.0 cr)
- [EEB 8301](#) - Prelim Proposal Writing Seminar (1.0 cr)
- [EEB 8302](#) - EEB Written Prelim Workshop (1.0 cr)
- [EEB 8601](#) - Introduction to Stream Restoration (3.0 cr)
- [EEB 8602](#) - Stream Restoration Practice (2.0 cr)
- [EEB 8641](#) - Spatial Ecology (3.0 cr)
- [EEB 8980](#) - Seminar on Current Topics (1.0 - 3.0 cr)
- [EEB 8990](#) - Graduate Seminar (1.0 - 3.0 cr)
- Students may select graduate level courses outside of EEB in consultation with their advisor.

##### Thesis credits

10 master's thesis credits are required.

[EEB 8777](#) - Thesis Credits: Master's (1.0 - 18.0 cr)

-OR-

#### Plan B

Students may select from the courses listed below, or, in consultation with their advisor, choose other graduate-level courses with other designators.

Take 30 or more credit(s) from the following:

- [EEB 5042](#) - Quantitative Genetics (3.0 cr)
- [EEB 5407](#) - Ecology (3.0 cr)
- [EEB 5601](#) - Limnology (3.0 cr)
- [EEB 5605](#) - Limnology Laboratory (2.0 cr)
- [EEB 8201](#) - Graduate Foundations in Ecology, Evolution and Behavior Semester 1 (4.0 cr)
- [EEB 8202](#) - Graduate Foundations in Ecology, Evolution and Behavior - Semester 2 (4.0 cr)
- [EEB 8301](#) - Prelim Proposal Writing Seminar (1.0 cr)
- [EEB 8302](#) - EEB Written Prelim Workshop (1.0 cr)
- [EEB 8360](#) - Behavioral Biology Seminar (1.0 cr)
- [EEB 8500](#) - NSF GRF Graduate Research Fellowship Proposal Writing Seminar (1.0 cr)
- [EEB 8601](#) - Introduction to Stream Restoration (3.0 cr)



- [EEB 8602](#) - Stream Restoration Practice (2.0 cr)
- [EEB 8641](#) - Spatial Ecology (3.0 cr)
- [EEB 8980](#) - Seminar on Current Topics (1.0 - 3.0 cr)
- [EEB 8990](#) - Graduate Seminar (1.0 - 3.0 cr)
- Students may select graduate-level courses outside of EEB in consultation with their advisor.



### **Twin Cities Campus**

## **Ecology, Evolution and Behavior Minor**

*Ecology, Evolution & Behavior*

### **College of Biological Sciences**

Link to a [list of faculty](#) for this program.

#### **Contact Information:**

Ecology, Evolution, and Behavior Graduate Program, 140 Gortner Laboratory, 1479 Gortner Ave, St. Paul, MN 55108 (612-624-6770, fax: 612-624-6777)

Email: [eebgrad@umn.edu](mailto:eebgrad@umn.edu)

Website: <http://www.cbs.umn.edu/explore/departments/eeb/graduate/about-program>

- Program Type: Graduate minor related to major
- Requirements for this program are current for Fall 2016
- Length of program in credits (Masters): 6
- Length of program in credits (Doctorate): 12
- This program does not require summer semesters for timely completion.

Along with the program-specific requirements listed below, please read the [General Information](#) section of the catalog website for requirements that apply to all major fields.

The graduate program in Ecology, Evolution, and Behavior (EEB) links faculty and students interested in the biology of organisms from molecules to ecosystems. Studies address questions from molecular mechanisms of evolution, the interactions of organisms in social groups and populations, the distributions and abundances of species in communities and ecosystems, to global biogeochemical processes. The program provides broad training in the general areas of ecology, evolution, and animal behavior, and specialized courses and research in vertebrate and invertebrate zoology; behavior and ethology; evolution; population genetics; molecular evolution; systematics; population, community, and ecosystem ecology; global ecology; limnology; ecology of vegetation; and theoretical ecology. Opportunities for field research are available in Africa, Central America, and other parts of the world, as well as in local ecosystems, including the Cedar Creek Ecosystem Science Reserve and Itasca Biological Station. Seminars and individually designed tutorials are an important part of student programs and provide an exciting intellectual environment.

### **Program Delivery**

This program is available:

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

### **Prerequisites for Admission**

For an online application or for more information about graduate education admissions, see the [General Information](#) section of the catalog website.

### **Program Requirements**

Use of 4xxx courses towards program requirements is not permitted.

### **Program Sub-plans**

Students are required to complete one of the following sub-plans.

Students may not complete the program with more than one sub-plan.

#### **Masters**

##### **Master's Course List**

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

- EEB 5xxx
- EEB 8xxx

#### **Doctoral**

##### **Doctoral Course List**

Take 12 or more credit(s) from the following:

- EEB 5xxx



•EEB 8xxx



### **Twin Cities Campus**

## **Ecology, Evolution and Behavior Ph.D.**

*Ecology, Evolution & Behavior*

### **College of Biological Sciences**

Link to a [list of faculty](#) for this program.

#### **Contact Information:**

Ecology, Evolution, and Behavior Graduate Program, 140 Gortner Laboratory, 1479 Gortner Avenue, St. Paul, MN 55108 (612-624-6770, fax: 612-624-6777)

Email: [eebgrad@umn.edu](mailto:eebgrad@umn.edu)

Website: <http://www.cbs.umn.edu/explore/departments/eeb/graduate/about-program>

- Program Type: Doctorate
- Requirements for this program are current for Fall 2016
- Length of program in credits: 48
- This program does not require summer semesters for timely completion.
- Degree: Doctor of Philosophy

Along with the program-specific requirements listed below, please read the [General Information](#) section of the catalog website for requirements that apply to all major fields.

The graduate program in ecology, evolution, and behavior (EEB) links faculty and students interested in the biology of organisms from molecules to ecosystems. Studies address questions from molecular mechanisms of evolution, the interactions of organisms in social groups and populations, the distributions and abundances of species in communities and ecosystems, to global biogeochemical processes. The program provides broad training in the general areas of ecology, evolution, and animal behavior, and specialized courses and research in vertebrate and invertebrate zoology; behavior and ethology; evolution; population genetics; molecular evolution; systematics; population, community, and ecosystem ecology; global ecology; limnology; ecology of vegetation; and theoretical ecology. Opportunities for field research are available in Africa, Central America, and other parts of the world, as well as in local ecosystems, including the Cedar Creek Ecosystem Science Reserve and Itasca Biological Station. Seminars and individually designed tutorials are an important part of student programs and provide an exciting intellectual environment.

### **Program Delivery**

This program is available:

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

### **Prerequisites for Admission**

Other requirements to be completed before admission:

Courses in inorganic chemistry, organic chemistry, biochemistry, general physics, one year of college calculus, animal biology, genetics, physiology, and plant biology are strongly recommended and provide an important background to pursue graduate work in EEB. Proficiency in a foreign language is not required but is strongly recommended for students who expect to pursue field work in a country where English is not the native language. Deficiencies must be made up early in the graduate program.

#### **Special Application Requirements:**

Students are admitted only in fall semester. Deadline for application is December 1. Refer to the EEB website for more details.

International applicants must submit score(s) from one of the following tests:

- TOEFL
  - Internet Based - Total Score: 79
  - Internet Based - Writing Score: 21
  - Internet Based - Reading Score: 19
  - Paper Based - Total Score: 550
- IELTS
  - Total Score: 6.5
- MELAB
  - Final score: 80

Key to [test abbreviations](#)(TOEFL, IELTS, MELAB).

For an online application or for more information about graduate education admissions, see the [General Information](#) section of the catalog website.



## Program Requirements

24 credits are required in the major.

24 thesis credits are required.

This program may be completed with a minor.

Use of 4xxx courses towards program requirements is not permitted.

A minimum GPA of 3.00 is required for students to remain in good standing.

At least 2 semesters must be completed before filing a Degree Program Form.

Significant field or laboratory experience, proficiency in using computers in research, and competence in advanced statistics are required. Students are expected to gain some appreciation of history or philosophy of science and are required to teach a minimum of two semesters at 50 percent time. Course plans are discussed and agreed upon by the student and an advisory committee of three to five faculty members.

### Required courses

[EEB 8201](#) - Graduate Foundations in Ecology, Evolution and Behavior Semester 1 (4.0 cr)

[EEB 8200](#) - Sustainability Science Distributed Graduate Seminar (3.0 cr)

[EEB 8500](#) - NSF GRF Graduate Research Fellowship Proposal Writing Seminar (1.0 cr)

[EEB 8980](#) - Seminar on Current Topics (1.0 - 3.0 cr)

[EEB 8301](#) - Prelim Proposal Writing Seminar (1.0 cr)

[EEB 8302](#) - EEB Written Prelim Workshop (1.0 cr)

### Quantitative course options

[EEB 5042](#) - Quantitative Genetics (3.0 cr)

or [EEB 5371](#) - Principles of Systematics (3.0 cr)

or [STAT 5021](#) - Statistical Analysis (4.0 cr)

or [STAT 5303](#) - Designing Experiments (4.0 cr)

or [STAT 5302](#) - Applied Regression Analysis (4.0 cr)

or Student may select another course with the approval of the Director of Graduate Studies.

### History and Philosophy of Science course options

[PHIL 3601W](#) - Scientific Thought [WI] (4.0 cr)

or [PHIL 4105W](#) - Epistemology [WI] (3.0 cr)

or [PHIL 4607](#) - Philosophy of the Biological Sciences (3.0 cr)

or [HSCI 3242](#) - The Darwinian Revolution [HIS] (3.0 cr)

or [HSCI 3244](#) - History of Ecology and Environmentalism [HIS, ENV] (3.0 cr)

or [HSCI 3815](#) - Revolutions in Science: Lavoisier, Darwin, and Einstein [HIS, GP] (3.0 - 4.0 cr)

or [HSCI 5401](#) - Ethics in Science and Technology (3.0 cr)

or [HSCI 5211](#) - Biology and Culture in the 19th and 20th Centuries [CIV] (3.0 cr)

or [HSCI 5242](#) - The Darwinian Revolution (3.0 cr)

or [HSCI 5244](#) - History of Ecology and Environmentalism (3.0 cr)

or [HSCI 8112](#) - Historiography of Science, Technology, and Medicine (3.0 cr)

or Student may select another course with the approval of the Director of Graduate Studies.

### Electives

Students take additional graduate level courses to supplement their 24 total credit requirement. Elective coursework is chosen in consultation with the adviser.

### Ethics requirement

The ethics requirement for doctoral students is training in four areas. The EEB graduate program has a four-session ethics seminar that is offered during the Friday noon seminar series. Students should complete all four sessions before the end of their second year.

**Joint- or Dual-degree Coursework:** Joint Degree Program in Law, Health & the Life Sciences Student may take a total of 12 credits in common among the academic programs.



### ***Twin Cities Campus***

## **Microbial Ecology Minor**

*College of Biological Sciences - Adm*

### **College of Biological Sciences**

Link to a [list of faculty](#) for this program.

#### **Contact Information:**

Microbial Ecology Minor Program, University of Minnesota, 439 Borlaug Hall, 1991 Upper Buford Circle, Saint Paul, MN 55108 (612-624-2706)

Email: [micecol@umn.edu](mailto:micecol@umn.edu)

- Program Type: Graduate free-standing minor
- Requirements for this program are current for Fall 2016
- Length of program in credits (Masters): 6
- Length of program in credits (Doctorate): 12
- This program does not require summer semesters for timely completion.

Along with the program-specific requirements listed below, please read the [General Information](#) section of the catalog website for requirements that apply to all major fields.

This minor is available to master's (M.S.) and doctoral (Ph.D.) students. Microbial ecology is an interdisciplinary research area concerned with the relationships between microorganisms and their natural environment. The microbial ecology minor offers core coursework in microbiology, microbial physiology, microbial genetics, microbial genomics, microbial ecology, ecology, and theoretical ecology. Additional courses and opportunities to interact with others interested in microbial ecology are also part of the minor. The microbial ecology/biotechnology seminar series allows students and faculty to interact with microbial ecologists from other universities. The curriculum encourages interdisciplinary interaction, communication, and synthesis.

### **Program Delivery**

This program is available:

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

### **Prerequisites for Admission**

Other requirements to be completed before admission:

To be admitted to the minor, a student must be admitted to a master's or doctoral degree-granting program within the Graduate School, should have broad training in the biological sciences, and must be accepted by the director of graduate studies of the microbial ecology minor program. All students are expected to have had the equivalent of introductory microbiology (MICB 3301) and general ecology, but may fulfill deficiencies in these areas by taking these courses while in the program.

For an online application or for more information about graduate education admissions, see the [General Information](#) section of the catalog website.

### **Program Requirements**

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

The master's minor requires 6 graduate credits, all of which must be outside the student's major department and must include at least one laboratory course in microbiology (e.g., MICB 4215) and one ecology (EEB) course chosen from the list below. The remaining courses also are chosen from this list with the guidance and approval of the director of graduate studies.

The doctoral minor requires 12 graduate credits, 9 credits of which must come from the core courses listed below (contact the director of graduate studies for potential alternatives to these courses). The remaining credits must come from at least two courses chosen from this list, but may not be in the student's major.

Core courses:

EEB 5053 (4 cr)

MICB 4111 (3 cr)

MICB 4121 (3 cr)

MICA 8002 (4 cr)





Additional courses

CE 8541

CE 8542

CE 8551

EEB 4601

EEB 4609

PLPA 8102

PLPA 8103

SOIL 5515

SOIL 5611



### **Twin Cities Campus**

## **Microbial Engineering M.S.**

*Biological Process Technology Institute*

**College of Biological Sciences**

Link to a [list of faculty](#) for this program.

### **Contact Information:**

M.S. Program in Microbial Engineering, University of Minnesota, 1479 Gortner Avenue, Suite 140, Saint Paul, MN 55108 (612-624-6774; fax 612-625-5780)

Email: [mice@umn.edu](mailto:mice@umn.edu)

Website: <http://www.bti.umn.edu/MicE>

- Program Type: Master's
- Requirements for this program are current for Fall 2016
- Length of program in credits: 30
- This program does not require summer semesters for timely completion.
- Degree: Master of Science

Along with the program-specific requirements listed below, please read the [General Information](#) section of the catalog website for requirements that apply to all major fields.

Microbial engineering allows students to pursue an interdisciplinary program that combines microbiology, biochemistry, molecular biology, bioinformatics, chemical engineering, and related sciences. Students perform brief rotations in faculty laboratories to choose an independent project, and tailor their coursework to support and complement their research. Projects can span modern basic microbiology, applied industrial engineering, as well as include computer science and informatics disciplines. After graduation, many students choose to continue on to a PhD program in a related discipline or work directly in biotechnology research and development. Supporting courses are chosen from fields including biochemistry, microbiology, food science, genetics and cell biology, and computer science. The program is coordinated by the BioTechnology Institute (BTI) and involves faculty from 10 departments and 5 institutes of the University.

### **Program Delivery**

This program is available:

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

### **Prerequisites for Admission**

Other requirements to be completed before admission:

Typically, applicants with a bachelor's degree in biological sciences, biochemistry, chemistry, or chemical engineering apply.

Recommended academic preparation includes one year each of calculus, organic chemistry, physics, microbiology, and a background in a field such as basic chemical engineering, biology, physical chemistry, or genetics. Background deficiencies can be made up during the first year of graduate work. Most students enter the program with a GPA of 3.40 or higher.

### **Special Application Requirements:**

Three letters of recommendation, scores from the General Test of the GRE, the TOEFL score for international applicants, transcripts, Curriculum Vitae, and an autobiographical statement including occupational goals must be submitted to the director of graduate studies. Applications are accepted for fall semester only. To receive full consideration for financial aid, students must apply for fall semester admission by February 1.

International applicants must submit score(s) from one of the following tests:

- TOEFL
  - Internet Based - Total Score: 79
  - Internet Based - Writing Score: 21
  - Internet Based - Reading Score: 19
  - Paper Based - Total Score: 550
- IELTS
  - Total Score: 6.5
- MELAB
  - Final score: 80
  - Speaking test score: 0

Key to [test abbreviations](#)(TOEFL, IELTS, MELAB).



For an online application or for more information about graduate education admissions, see the [General Information](#) section of the catalog website.

## Program Requirements

**Plan A:** Plan A requires 14 major credits, 6 credits outside the major, and 10 thesis credits. The final exam is oral.

**Plan B:** Plan B requires 24 major credits and 6 credits outside the major. The final exam is oral.

This program may not be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

Students must attend research seminars during the first-year spring semester, and must present a research seminar in a biotechnology seminar series the following year.

### Required Course

[MICE 5355](#) - Advanced Fermentation and Biocatalysis Laboratory (1.0 cr)

### Supporting Coursework

Take at least 6 credits of supporting coursework, which can either be from the following list or other courses, in consultation with the advisor.

BIOC 5xxx  
BIOC 8xxx  
FSCN 5xxx  
FSCN 8xxx  
PHAR 5xxx  
PHAR 8xxx  
PBIO 5xxx  
PBIO 8xxx  
GCB 5xxx  
GCB 8xxx

### Plan Options

#### Plan A

Take at least 13 credits, in consultation with the advisor, to meet the 14-credit minimum for the major.

CHEN 5xxx  
CHEN 8xxx  
MICB 5xxx  
MICB 8xxx

#### Thesis Credits

Take at least 10 master's thesis credits.

[MICE 8777](#) - Thesis Credits: Master's (1.0 - 18.0 cr)

-OR-

#### Plan B

Take at least 23 additional credits, in consultation with the advisor, to meet the 24-credit minimum for the major.

CHEN 5xxx  
CHEN 8xxx  
MICB 5xxx  
MICB 8xxx

#### Plan B Requirement

The Plan B project comprises a 4-credit summer preceptorship in a private company research laboratory, or in a University research institute, culminating in a project paper. The appropriate 4-credit course is selected with the approval of the advisor.



### ***Twin Cities Campus***

## **Microbial Engineering Minor**

*Biological Process Technology Institute*

**College of Biological Sciences**

Link to a [list of faculty](#) for this program.

### **Contact Information:**

M.S. Program in Microbial Engineering, University of Minnesota, 1479 Gortner Avenue, Suite 140, Saint Paul, MN 55108 (612-624-6774; fax 612-625-5780)

Email: [mice@umn.edu](mailto:mice@umn.edu)

Website: <http://www.bti.umn.edu/MicE>

- Program Type: Graduate minor related to major
- Requirements for this program are current for Fall 2016
- Length of program in credits (Masters): 10
- Length of program in credits (Doctorate): 12
- This program does not require summer semesters for timely completion.

Along with the program-specific requirements listed below, please read the [General Information](#) section of the catalog website for requirements that apply to all major fields.

Microbial engineering is an interdisciplinary program that combines an understanding of basic principles in microbiology, biochemistry, molecular biology, chemical engineering, and related sciences. Students are trained in the industrial application of microorganisms, cultured cells, and immunologic agents. Students learn both modern basic microbiology and biological engineering. Courses may be chosen from specific fields including biochemistry, microbiology, food science, genetics and cell biology, or pharmacognosy. The program is coordinated by the BioTechnology Institute (BTI) and involves faculty from 10 departments and 5 institutes of the University.

Note: The minor in microbial engineering is offered at the doctoral level only.

### **Program Delivery**

This program is available:

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

### **Prerequisites for Admission**

For an online application or for more information about graduate education admissions, see the [General Information](#) section of the catalog website.

### **Program Requirements**

Use of 4xxx courses towards program requirements is not permitted.

### **Program Sub-plans**

Students are required to complete one of the following sub-plans.

Students may not complete the program with more than one sub-plan.

#### **Masters**

##### **Master's-level Minor**

Take at least 10 credits, chosen in consultation with the Microbial Engineering director of graduate studies.

#### **Doctoral**

##### **Doctoral-level Minor**

Take at least 12 credits, chosen in consultation with the Microbial Engineering director of graduate studies.



### ***Twin Cities Campus***

## **Plant Biological Sciences M.S.**

*Plant and Microbial Biology*

### **College of Biological Sciences**

Link to a [list of faculty](#) for this program.

#### **Contact Information:**

Plant Biological Sciences Graduate Program, 1445 Gortner Avenue, Room 256, St. Paul, MN 55108 (612-625-4222; fax:612-625-1738)

Email: [pbioGP@umn.edu](mailto:pbioGP@umn.edu)

Website: <http://www.cbs.umn.edu/explore/departments/plantbio/gradprog>

- Program Type: Master's
- Requirements for this program are current for Fall 2016
- Length of program in credits: 30
- This program does not require summer semesters for timely completion.
- Degree: Master of Science

Along with the program-specific requirements listed below, please read the [General Information](#) section of the catalog website for requirements that apply to all major fields.

Plant biological sciences encompasses all aspects of the basic biology of both higher and lower plants. Major emphases include molecular and physiological approaches to development; physiological, structural, and functional studies at the cellular and organismal levels; systematic and evolutionary biology; and molecular genetics and applied biotechnology. Students study plants from the subcellular and molecular to the whole plant and community levels of biological organization. They also have opportunities for laboratory and field research at state, national, and international levels. Each student's program is planned to meet individual requirements within the framework of a multidisciplinary core of coursework. Seminars are an integral part of the program.

### **Program Delivery**

This program is available:

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

### **Prerequisites for Admission**

The preferred undergraduate GPA for admittance to the program is 3.00.

#### **Special Application Requirements:**

Applicants must submit scores from the General Test of the GRE; three letters of recommendation from persons familiar with their scholarship and research potential; a complete set of official transcripts; and a clearly written statement of career interests, goals, and objectives. Students may apply at any time; however, submission of all application materials by December 1st is required in order to ensure priority consideration for fellowships and teaching and research assistantships awarded for the next academic year.

Applicants must submit their test score(s) from the following:

- GRE

International applicants must submit score(s) from one of the following tests:

- TOEFL
  - Internet Based - Total Score: 79
  - Internet Based - Writing Score: 21
  - Internet Based - Reading Score: 19
  - Paper Based - Total Score: 550
- IELTS
  - Total Score: 6.5
- MELAB
  - Final score: 80

Key to [test abbreviations](#)(GRE, TOEFL, IELTS, MELAB).

For an online application or for more information about graduate education admissions, see the [General Information](#) section of the catalog website.



## Program Requirements

**Plan A:** Plan A requires 14 major credits, 6 credits outside the major, and 10 thesis credits. The final exam is oral.

**Plan B:** Plan B requires 24 major credits and 6 credits outside the major. The final exam is oral.

This program may be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A minimum GPA of 3.00 is required for students to remain in good standing.

At least 2 semesters must be completed before filing a Degree Program Form.

### Core Coursework

Take the following core courses. Take 8900 twice (Section 001 - Colloquium, and Section 003 - Seminar) for a total of 2 credits.

[PBIO 5960](#) - Special Topics (1.0 - 3.0 cr)

[PBS 8081](#) - Integrative Plant Biology: Connecting Molecules to Ecosystems (3.0 cr)

[PBS 8900](#) - Seminar (1.0 - 2.0 cr)

[PBS 8123](#) - Research Ethics in the Plant and Environmental Sciences (0.5 cr)

[PBS 8994](#) - Research (1.0 - 5.0 cr)

[GRAD 8101](#) - Teaching in Higher Education (3.0 cr)

### Electives

Take additional coursework, in consultation and director of graduate studies, to complete the 14-credit minimum for the major field.

### Outside Coursework

Take at least 6 credits of outside coursework in consultation with the advisor and director of graduate studies.

### Plan Options

#### Plan A Requirements

Take 10 master's thesis credits.

[PBS 8777](#) - Thesis Credits: Master's (1.0 - 18.0 cr)

-OR-

#### Plan B Requirements

Take an additional 10 credits, in consultation with the advisor and director of graduate studies, to meet the 30-credit minimum.



### ***Twin Cities Campus***

## **Plant Biological Sciences Minor**

*Plant and Microbial Biology*

### **College of Biological Sciences**

Link to a [list of faculty](#) for this program.

#### **Contact Information:**

Plant Biological Sciences Graduate Program; 1479 Gortner Avenue, Suite 140, St. Paul, MN 55108 (612-625-4222; fax: 612-625-1738)

Email: [pbioGP@umn.edu](mailto:pbioGP@umn.edu)

Website: <http://www.cbs.umn.edu/plantbio/gradprog>

- Program Type: Graduate minor related to major
- Requirements for this program are current for Fall 2016
- Length of program in credits (Masters): 6
- Length of program in credits (Doctorate): 12
- This program does not require summer semesters for timely completion.

Along with the program-specific requirements listed below, please read the [General Information](#) section of the catalog website for requirements that apply to all major fields.

Plant biological sciences encompasses all aspects of the basic biology of both higher and lower plants. Major emphases include molecular and physiological approaches to development; physiological, structural, and functional studies at the cellular and organismal levels; systematic and evolutionary biology; and molecular genetics and applied biotechnology. Students study plants from the subcellular and molecular to the whole plant and community levels of biological organization. They also have opportunities for laboratory and field research at state, national, and international levels. Each student's program is planned to meet individual requirements within the framework of a multidisciplinary core of coursework. Seminars are an integral part of the program.

### **Program Delivery**

This program is available:

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

### **Prerequisites for Admission**

For an online application or for more information about graduate education admissions, see the [General Information](#) section of the catalog website.

### **Program Requirements**

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

### **Program Sub-plans**

Students are required to complete one of the following sub-plans.

Students may not complete the program with more than one sub-plan.

#### **Masters**

##### **Master's-level Minor**

Take at least 6 credits, chosen in consultation with the Plant Biological Sciences director of graduate studies.

#### **Doctoral**

##### **Doctoral-level Minor**

Take at least 12 credits, chosen in consultation with the Plant Biological Sciences director of graduate studies.



### **Twin Cities Campus**

## **Plant Biological Sciences Ph.D.**

*Plant and Microbial Biology*

### **College of Biological Sciences**

Link to a [list of faculty](#) for this program.

#### **Contact Information:**

Plant Biological Sciences Graduate Program, 1479 Gortner Avenue, Suite 140, St. Paul, MN 55108 (612-625-4222; fax: 612-625-1738)

Email: [pbiogp@umn.edu](mailto:pbiogp@umn.edu)

Website: <http://www.cbs.umn.edu/explore/departments/plantbio/gradprog>

- Program Type: Doctorate
- Requirements for this program are current for Fall 2016
- Length of program in credits: 54
- This program does not require summer semesters for timely completion.
- Degree: Doctor of Philosophy

Along with the program-specific requirements listed below, please read the [General Information](#) section of the catalog website for requirements that apply to all major fields.

Plant biological sciences encompasses all aspects of the basic biology of both higher and lower plants. Major emphases include molecular and physiological approaches to development; physiological, structural, and functional studies at the cellular and organismal levels; systematic and evolutionary biology; and molecular genetics and applied biotechnology. Students study plants from the subcellular and molecular to the whole plant and community levels of biological organization. They also have opportunities for laboratory and field research at state, national, and international levels. Each student's program is planned to meet individual requirements within the framework of a multidisciplinary core of coursework. Seminars are an integral part of the program.

### **Program Delivery**

This program is available:

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

### **Prerequisites for Admission**

The preferred undergraduate GPA for admittance to the program is 3.00.

Other requirements to be completed before admission:

Prospective students are expected to have completed a year of coursework in at least three of the following four areas: differential and integral calculus; organic and inorganic chemistry; biology; and physics. For students with demonstrated ability, background deficiencies as determined by the admissions committee can be made up during the first year of graduate studies. All admitted students are assigned to an advisor in the graduate program before they begin their studies.

#### **Special Application Requirements:**

Applicants must submit scores from the General Test of the GRE; three letters of recommendation from persons familiar with their scholarship and research potential; a complete set of official transcripts; and a clearly written statement of career interests, goals, and objectives. Students may apply at any time; however, submission of all application materials by December 1st is required in order to ensure priority consideration for fellowships and teaching and research assistantships awarded for the next academic year.

Applicants must submit their test score(s) from the following:

- GRE

International applicants must submit score(s) from one of the following tests:

- TOEFL
  - Internet Based - Total Score: 79
  - Internet Based - Writing Score: 21
  - Internet Based - Reading Score: 19
  - Paper Based - Total Score: 550
- IELTS
  - Total Score: 6.5
- MELAB
  - Final score: 80





Key to [test abbreviations](#)(GRE, TOEFL, IELTS, MELAB).

For an online application or for more information about graduate education admissions, see the [General Information](#) section of the catalog website.

## Program Requirements

13 to 18 credits are required in the major.  
12 to 17 credits are required outside the major.  
24 thesis credits are required.

This program may not be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A minimum GPA of 3.00 is required for students to remain in good standing.

At least 2 semesters must be completed before filing a Degree Program Form.

Up to two 4xxx-level courses can be applied to the PhD degree.

### Required Coursework

Take the following required courses for a total of at least 13.5 credits. Take at least 1 credit each of PBIO 5960, PBS 8994, and PBS 8900 (Sec 01, Sec 02, and Sec 03).

[PBIO 5960](#) - Special Topics (1.0 - 3.0 cr)

[PBS 8081](#) - Integrative Plant Biology: Connecting Molecules to Ecosystems (3.0 cr)

[PBS 8123](#) - Research Ethics in the Plant and Environmental Sciences (0.5 cr)

[PBS 8900](#) - Seminar (1.0 - 2.0 cr)

[PBS 8901](#) - Preparation of Research Proposals (2.0 cr)

[PBS 8994](#) - Research (1.0 - 5.0 cr)

### Required Teaching Experience

PSTL 5106 (Sec 001) can be substituted for GRAD 8101.

[GRAD 8101](#) - Teaching in Higher Education (3.0 cr)

### Thesis Credits

Take at least 24 thesis credits.

[PBS 8888](#) - Thesis Credit: Doctoral (1.0 - 24.0 cr)

### Electives

Take at least 12 supporting program credits. Courses can be selected from the following list, or other courses can be chosen in consultation with the advisor and advisory committee with approval of the director of graduate studies.

Take 12 or more credit(s) from the following:

- [AGRO 4401](#) - Plant Genetics and Breeding (4.0 cr)  
or [AGRO 4505](#) - Biology, Ecology, and Management of Invasive Plants (3.0 cr)  
or [AGRO 4888](#) - Issues in Sustainable Agriculture (2.0 cr)  
or [AGRO 5121](#) - Applied Experimental Design (4.0 cr)  
or [AGRO 5321](#) - Ecology of Agricultural Systems (3.0 cr)  
or [AGRO 8023](#) - Evolution of Crop Plants (3.0 cr)  
or [AGRO 8202](#) - Breeding for Quantitative Traits in Plants (3.0 cr)  
or [AGRO 8241](#) - Chromosomal and Molecular Genetics of Plant Improvement (3.0 cr)
- [BIOL 3270](#) - Introduction To Systems Biology (3.0 cr)  
or [BIOL 5272](#) - Applied Biostatistics (3.0 cr)  
or [BIOL 5407](#) - Ecology (3.0 cr)  
or [BIOL 5409](#) - Evolution (3.0 cr)
- [BIOC 4331](#) - Biochemistry I: Structure, Catalysis, and Metabolism in Biological Systems (4.0 cr)  
or [BIOC 4332](#) - Biochemistry II: Molecular Mechanisms of Signal Transduction and Gene Expression (4.0 cr)  
or [BIOC 4521](#) - Introduction to Physical Biochemistry (3.0 cr)  
or [BIOC 5361](#) - Microbial Genomics and Bioinformatics (3.0 cr)  
or [BIOC 8001](#) - Biochemistry: Structure, Catalysis, and Metabolism (3.0 cr)  
or [BIOC 8002](#) - Molecular Biology and Regulation of Biological Processes (3.0 cr)  
or [BIOC 5216](#) - Current Topics in Signal Transduction (3.0 cr)
- [EEB 5042](#) - Quantitative Genetics (3.0 cr)  
or [EEB 5221](#) - Molecular Evolution (3.0 cr)  
or [EEB 5609](#) - Ecosystem Ecology (3.0 cr)



- or [EEB 8550](#) - Graduate Research Fellowship Proposal Writing Seminar (1.0 cr)
- [FNRM 5104](#) - Forest Ecology (4.0 cr)
- or [FNRM 5411](#) - Managing Forest Ecosystems: Silviculture (3.0 cr)
- or [FNRM 5412](#) - Advanced Remote Sensing and Geospatial Analysis (3.0 cr)
- or [FNRM 5131](#) - Geographical Information Systems (GIS) for Natural Resources (4.0 cr)
- [GCD 5036](#) - Molecular Cell Biology (3.0 cr)
- or [GCD 8131](#) - Advanced Molecular Genetics and Genomics (3.0 cr)
- or [GCD 8151](#) - Cell Structure and Function (3.0 cr)
- or [GCD 8161](#) - Advanced Developmental Biology (3.0 cr)
- [HORT 4071W](#) - Applications of Biotechnology to Plant Improvement [WI] (4.0 cr)
- or [HORT 4401](#) - Plant Genetics and Breeding (4.0 cr)
- or [HORT 5071](#) - Ecological Restoration (4.0 cr)
- [PBS 8910](#) - Journal Club (1.0 cr)
- or [PBS 8993](#) - Directed Studies (1.0 - 5.0 cr)
- [PBIO 4321](#) - Minnesota Flora (3.0 cr)
- or [PBIO 4511](#) - Flowering Plant Diversity (3.0 cr)
- or [PBIO 5412](#) - Plant Physiology and Development (3.0 cr)
- or [PBIO 5516](#) - Plant Cell Biology (3.0 cr)
- or [PBIO 5301](#) - Plant Genomics (3.0 cr)
- [PLPA 5103](#) - Plant-Microbe Interactions (3.0 cr)
- or [PLPA 8103](#) - Plant-Microbe Interactions (3.0 cr)
- or [PLPA 5203](#) - Introduction to Fungal Biology (3.0 cr)
- [SOIL 5611](#) - Soil Biology and Fertility (4.0 cr)