General Information

The mission of the College of Biological Sciences (CBS) is to advance knowledge of the mechanisms of life through breakthrough discoveries and prepare today’s students to create the biology of tomorrow. To accomplish this mission, the college integrates a strong basic research program with both traditional and innovative classroom teaching and with intensive mentoring of students at all levels.

Admission

Admission to the College of Biological Sciences is competitive. Decisions are based on an overall assessment of each applicant’s accomplishments and potential as presented in the application materials. New freshmen are admitted once a year in the fall. Transfer students are admitted at any point in their course of study and can enter either fall or spring semesters. Admission of transfer students is also based on overall assessment of their application and usually requires satisfactory completion of prerequisite coursework and/or a record of past academic success in the sciences. All prospective students are encouraged to visit the CBS Web site at www.cbs.umn.edu or call 612-624-9717.

Requirements

Freshman Admission Requirements

For official and up-to-date information about the University’s admissions policies, procedures, and deadlines, please see the latest edition of the Undergraduate Application Booklet available from the Office of Admissions or online at http://admissions.tc.umn.edu.

Admission requirements for students transferring from within the University of Minnesota:

1. 2.00 or higher grade point average (GPA) and grades of at least C in the following courses is usually required:
   a. BIOL 1009 or 1001 or equivalent
   b. CHEM 1021 or equivalent
   c. MATH 1271 or 1281 or equivalent

2. Prerequisite courses must usually be completed at the time of application, with the following exception: students with a 3.00 or higher GPA may be admitted with two of the three prerequisite courses completed and the last prerequisite course in progress (courses in progress during summer session are not included). For specific transfer information visit the CBS Web site at www.cbs.umn.edu or call 612-624-9717.

Admission requirements for transfer students from higher education institutions other than the University of Minnesota:

The College of Biological Sciences (CBS) admits qualified transfer students to all of its majors. Admission is competitive and based on an overall assessment of the applicant’s academic record and potential for success as presented in the application materials. Completion of science-related courses will be viewed as important evidence of preparation and interest in studying biology. Primary review factors include cumulative GPA and course grades in science-related courses, such as calculus, chemistry, and biology. Secondary review factors include grade trends, completion patterns, and biology-related lab or field research experience. High school grades, class rank and ACT or SAT scores may also be factored into the admission decision for students who have completed fewer than 26 transferable credits.

Most successful CBS applicants have completed one semester each of calculus, chemistry, and biology. Priority consideration is given to students who intend to complete a degree program in CBS. Students who have previously completed bachelor’s degrees and wish to complete prerequisites for professional or graduate schools should strongly consider completing coursework as non-degree-seeking students through the College of Continuing Education.

Visit the CBS Web site at www.cbs.umn.edu/studentservices/transfercredits.html to find specific transfer information and course equivalencies for chemistry, math, and physics, or call 612-624-9717.

Applications to the University of Minnesota, Twin Cities may be requested from the Office of Admissions (612-625-2008) or toll free in the United States (1-800-752-1000). For more information, contact the Office of Student Services (612-624-9717).

Beginning College in Biological Sciences

If you’re about to begin college and think biology may be your area of interest, there are some important questions you need to consider. (If you’ve already completed one or two years of college work and are thinking of transferring to the University of Minnesota, see Transfer Admission in the General Information section of this catalog.)

How do I know if biology is a good choice for me?

Some students have always had an interest in biology. Others were inspired to learn more about biology by a special teacher or course in high school. Some see biology as a step toward a career in medicine or preserving the environment; others think they may have a strong interest, but want to learn more. If you fall into one of these categories and have a strong high school background in science and math, consider the following questions.

Is biology a good choice right now? Do biology careers look promising for the future?

Thanks to advances such as the sequencing of the human genome and the development of new biotechnologies, biology is playing an increasingly important role in health, agriculture, the environment, the economy, and society in general. New career opportunities are emerging in the biotechnology industry, government, and education. As a result, there has never been a better time to earn a degree in biology.

The University of Minnesota is a research university. What does this mean for undergraduates?

It means that faculty are engaged in federally sponsored research, which gives undergraduates many opportunities to gain research experience working with faculty in laboratories. It also means that many of your classes will be taught by leading researchers in their fields.
Do all students have the opportunity to be involved in research?

Most CBS students participate in research, choosing from opportunities in basic sciences, medicine, dentistry, pharmacy, veterinary medicine, agriculture, and natural resources. Hands-on experience in a laboratory or in the field is an essential part of the educational experience in CBS. Research experiences help students gain admission to competitive graduate programs, and many employers require candidates to have research or internship experience.

The University has a College of Biological Sciences rather than just a department. What does this mean for students?

As a college, CBS has a much larger faculty, more varied course offerings, and more services for biology students. Services for students include an honors program, research, internships, study abroad opportunities, and career services offered jointly with the Institute of Technology.

What if I’m not sure I want to major in biology? If I choose CBS now, will I have problems if I change my major later?

All undergraduates take general education courses, including biology. It is always possible to change your mind and transfer to another college, but this decision may affect your ability to graduate in four years. If you are undecided and considering several options, liberal education courses can help you explore a variety of interests.

Orientation

Before classes begin, all freshmen and transfer students are required to attend orientation. Orientation acquaints students with the campus and provides information about CBS and the University. Students spend part of the session with an adviser who helps them plan their undergraduate program.

Freshmen attend a two-day program that provides information for a successful beginning at the University. During the first day, students meet other incoming students while attending small group sessions about University of Minnesota programs. Advisers in CBS familiarize students with CBS programs, courses, and opportunities. CBS advisers also help students start planning their class schedule. During the second day, students register for fall semester classes.

Transfer Orientation is a one-day program designed to help students make a smooth transition to the University. During orientation new transfer students meet other CBS students, get acquainted with the Twin Cities campus, plan a schedule of classes, and register online. CBS offers a Web-enhanced orientation with a required online component before students attend the on-campus program.

Undergraduate Programs

Students choose CBS because it has high quality programs offered by professors who are nationally recognized researchers and educators. As students begin planning for a specific career, they should supplement their coursework with research experiences and internships to further develop their skills and prepare for their chosen professions. Students may also explore biology career interests through the biology colloquium, freshman seminars, and the Career Center for Science and Engineering.

The CBS bachelor of science degree program is composed of four essential elements. Each helps prepare students to be leaders in their chosen professions in an increasingly complex and interdisciplinary world.

I. Liberal Education—A liberal education gives students a broad perspective that strengthens judgment and critical thinking skills. Students develop communication skills, an understanding of the ways scientists and others contribute to knowledge, historical and philosophical perspectives on the world, and insights into life and nature provided by literature and the arts.

To help achieve these goals, the University requires all students to distribute a portion of their coursework in areas of study outside of those linked to their specialized interests in their major.

II. Physical Sciences and Mathematics—The biological sciences rely heavily on the tools of mathematics and physical science. Organisms consist of molecules that obey the rules of physics and chemistry; these rules are often described using mathematics. Modern biologists in the field and in the laboratory must be able to use principles of mathematics, chemistry, and physics to understand living organisms at all levels from molecules to ecosystems.

III. Biology Core Curriculum—Specialists will always be important in biology, but today there is a growing need for people whose understanding spans the disciplines of biology. CBS students are introduced to diverse aspects of biology by completing a set of core courses. Some courses introduce students to various kinds of organisms—animals, plants, and microorganisms. Biochemistry introduces students to organic compounds of importance to organisms, enzyme-catalyzed reactions, and metabolic pathways involved in the synthesis or catabolism of macromolecules. Cell biology provides an in-depth analysis of cellular structure and function. Genetics examines mechanisms of heredity, including molecular genetics and population genetics. Ecology, evolution, and behavior introduce students to populations, evolution, and the behavior of animals.

IV. Specialization in the Major—All seven major programs in CBS lead to the bachelor of science degree. Students may major in

- biology
- biochemistry
- ecology, evolution, and behavior
- genetics, cell biology, and development
- microbiology
- neuroscience
- plant biology

All CBS freshmen start as lower division students and choose one of the majors listed above at the end of their first year. During the first year, students take foundation courses in mathematics, chemistry, and general biology essential for success in any of the biological sciences majors. Transfer students declare a specific major when they begin their studies in CBS. During their junior and/or senior years, most students complete a research project in their area of interest by taking Directed Research (4994 and 4794W).

Graduate Programs

Graduate study at the University is coordinated and administered by the Graduate School. For information about general policies regarding admission requirements, registration procedures, financial aid, and requirements for graduate degrees, see the Graduate School Catalog. Application materials may be obtained from CBS department offices.

Questions regarding specific bioscience programs should be addressed to the director of graduate studies in the appropriate program area.
Biochemistry, Molecular Biology, and Biophysics—
David LaPorte, 612-625-4983, and Claudia Schmidt-Dunnert, 612-625-5782

Conservation Biology — Susan M. Galatowitsch, 612-624-3242

Ecology, Evolution, and Behavior — Andrew Simons, 612-624-6292

Genetic Counseling — Bonnie LeRoy, 612-624-7193

Joint Program in Law, Health, and Life Sciences —
Susan Wolf, 612-625-3356

Microbial Engineering — Robert J. Brooker, 612-624-3053

Microbiology, Immunology, and Cancer Biology —
Yoji Shimizu, 612-626-6849

Molecular, Cellular, Developmental Biology, and Genetics —
Margaret Titus, 612-625-8498

Neuroscience — Paul Letourneau, 612-624-5999

Plant Biological Sciences — Carolyn Silflow, 612-624-0729

Water Resources Science — Ray Newman, 612-624-9282

Honors Program

The CBS honors program is designed for highly motivated students who want more challenging courses, closer contact with faculty, an extensive research experience, and a supportive academic community. Students in honors choose from dozens of honors courses and benefit from special co-curricular events and extended library privileges.

Freshman-Sophomore Program — During the first two years, students are strongly encouraged to explore research opportunities and to complete at least two honors courses per year. First-year students participate in early orientation sessions and a Nature of Life honors focus session during the summer. Honors students may choose to live in the CBS Honors Living and Learning Community in Middlebrook Hall.

Students apply to the honors program when they apply to the University by completing the Application for Scholarships and Honors Programs. Admission is based on high school grades, course work, standardized test scores, an essay, extracurricular involvement, evidence of leadership, and a letter of recommendation. Application forms are available in the Office of Admissions and online at http://admissions.tc.umn.edu/apply/.

Students who complete the honors program course requirements and achieve a minimum cumulative GPA of 3.50 receive a certificate and a notation on their transcript after the second year. The requirements to complete the freshman-sophomore program include:

1. a freshman seminar during the first year,
2. two honors courses in any subject, and
3. BIOL 2960H, the CBS honors colloquium, during fall semester of the second year.

Junior-Senior Program — The junior-senior honors program focuses on a directed research project, which is presented in a written thesis and at the Undergraduate Research Symposium. Students participate in a two-semester sequence of capstone seminars, in which they explore the breadth of biological inquiry and have opportunities to refine their communication skills. Admission to the upper division honors program is based on grades earned during the first two years of college and does not require participation in the freshman-sophomore program. Students with a 3.50 GPA are eligible to apply to upper division honors upon completion of 60 college credits. Participants are encouraged to select a research adviser from University faculty and start on a research project early in their junior year.

Graduation With Honors — To qualify for a degree “with honors” (e.g., cum laude), a student must have completed 60 or more semester credits at the University of Minnesota and be enrolled in the upper division honors program for at least two semesters. In addition to the requirements for graduation, candidates for graduation with honors must complete the following:

1. two semesters (6 credits) of directed research, the results of which are reported in an honors thesis, written in the style of a publishable manuscript. The thesis must be approved by the faculty research adviser and by two other faculty (at least one of whom must be from CBS).
2. two semesters of CBS honors seminars (BIOL 3960H), one of which must be completed during the fall semester and the other during the last spring semester in residence.
3. one additional honors research opportunity, which may be selected from
   a. an additional semester (or 2 credits) of participation in directed research
   b. an upper division honors course or seminar (xxx-4xxx)
   c. a graduate-level course (seniors only; requires permission)
4. achieve a GPA for the last 60 credits of A-F registration of 3.50 for summa cum laude, 3.666 for magna cum laude, and 3.750 for cum laude.

   a. The last 60 credits include all courses taken in the earliest term included in this calculation.
   b. If a portion of the last 60 credits has been transferred from another institution, the proportion of residence credits with grades of A must at least equal the proportion of transfer credits with grades of A.

Graduation With Distinction — A student may obtain a degree with both honors and distinction. To qualify for a degree “with distinction,” a student must have completed 60 or more semester credits at the University and have a cumulative GPA of 3.75 or higher. To graduate “with high distinction,” a student must have a cumulative GPA of 3.90 or higher.

For More Information—For information and application materials, please refer to the honors program Web site at http://www.cbs.umn.edu/studentservices/honors. Students may also inquire about the honors program with a CBS adviser or honors staff member (612-624-9717).

Advising

To help students navigate the University and take advantage of these opportunities, current and prospective students are served by the advising services, resources, and programs provided by CBS Office of Student Services. CBS academic advising helps students develop meaningful educational plans that are compatible with their long-term goals.

First-year students and transfer students are assigned to a professional adviser in CBS Student Services. Students meet with their adviser during fall semester of their first year and spring of their sophomore year to review academic progress, plan course schedules, and learn about additional college and University resources. During their second year of study, CBS students are also assigned to a faculty mentor in their particular area of interest. Professional advisers continue to assist all CBS students with setting goals, selecting courses, developing skills, and interpreting and navigating University rules and policies throughout their academic careers.

In addition to academic advising, the Office of Student Services coordinates undergraduate admission, provides student orientation and registration programs, offers academic progress...
review, updates APAS reports, and evaluates student records for degree certification.

**Program Planning**—Students should meet with their faculty mentor each year to evaluate and plan their academic program. Students consult their faculty mentors regarding courses specific to their major, graduate study, planning internships, or arranging directed research in laboratory and field settings.

**Special Learning Opportunities and Resources**

Students are encouraged to explore the full scope of learning experiences available at the University, including those beyond the required curriculum. Many students plan projects they carry out under faculty supervision in research laboratories and at environmental field stations. Some students participate in off-campus internships in private industry, government agencies, and nonprofit organizations. Other students seek employment as undergraduate teaching and research assistants or museum tour guides.

**Nature of Life**—Incoming freshmen are required to take a class at the Itasca Biological Station and Laboratories. At Itasca, students explore some of the major issues in biology, learn about ways of discovery in various fields of biology, and begin to see the interdisciplinary nature of the field. In addition, they get to know each other and many CBS faculty and staff, leaving Itasca with new friends and a better understanding of how to make the most of their CBS experience. Follow-up activities during fall semester continue to build a sense of community and connection among students and faculty.

**Biology House**—Biology House, located in Frontier Hall, combines residence hall life with social and academic opportunities for students interested in the biological sciences. Activities include social events, lab tours and field trips, study groups, on-site advising, faculty and student research presentations, and career exploration. Space in Biology House is limited to incoming freshmen and PSEO students, and applicants are encouraged to apply early for admission to this community. For more information, visit the Housing and Residential Life Web site at www.housing.umn.edu.

**New Student Reception**—This annual welcome event helps new students connect with CBS departments, majors, clubs, and research opportunities.

**Biology Colloquium (BIOL 1020)**—This unique course, organized and run by students, provides an opportunity to explore a variety of fields and careers in the biological sciences. The course offers large group seminars, featuring prominent scientists discussing their research programs, and small group tours to research facilities on and off campus, such as the Raptor Center, the International Wolf Center in Ely, or behind-the-scenes at the Minnesota Zoo.

**Freshman Seminars**—These discussion-focused small classes are taught by the University’s finest faculty. Students explore exciting topics and also learn more about the wide range of services and opportunities available at the University.

**The College of Biological Sciences Alumni/Student Mentor Program**—This program provides an opportunity for CBS students to connect one-to-one with an alumnus or friend of the college for career exploration, planning, and networking. Mentors advise about career-related issues such as career options, the value of networking and gaining work experience, resume writing, and interviewing skills. Mentors also provide feedback and support to help students succeed in their chosen fields.

**Multicultural Affairs**—CBS and its constituent programs are committed to providing equal access to educational opportunities while promoting diversity and fostering successful academic experiences. Diversity encompasses many characteristics that are inclusive of economic or educational disadvantage, special talents, leadership qualities, race or ethnicity, disability, sexual orientation, and gender identification.

**Achieving College Excellence in the Sciences (ACES)**—This structured multicultural honors tutorial program for high-achieving students in mathematics or science whose long-term plans include attending professional or graduate programs in the life sciences. Freshmen in ACES have the opportunity to receive individualized attention from distinguished faculty through a SEAM (Student Excellence in Academics and Multiculturalism) freshman seminar: Success on the Road to Medical School or Graduate Programs in the Science Community. Additionally, graduate student mentors help students earn A’s and B’s in University mathematics and science courses.

**Internships for credit**—Students can earn internship credit by registering for BIOL 3610 - Internship: Professional Experience in Biological Science.

Recent internships involved:
- developing plastics from renewable resources at a new biotech company
- assisting with dolphin care and training at a local aquarium
- researching new forensic science techniques in a criminal identification lab
- organizing volunteers for tissue donor programs
- assisting high school biology teachers
- helping develop a groundwater monitoring program
- researching the needs of people with neurological injuries

**Undergraduate Research**—As part of a large public research university, CBS offers a wealth of opportunities for hands-on research experience. Most students complete an independent research project under the supervision of a faculty member. All students are invited to present their research at the Undergraduate Research Symposium, which is held annually in the spring. Opportunities to get involved in research include volunteer experiences, directed research for academic credit, part-time jobs, and special grants through the Undergraduate Research Opportunities Program. Information about research opportunities and resources for finding a faculty mentor are available at www.cbs.umn.edu/studentservices/research.html.

**Scholarships**—CBS offers a variety of scholarships to new and continuing students based on academic achievement, leadership, research experience, and humanitarian service. Scholarship information, deadlines, and application materials are available at www.cbs.umn.edu/studentservices/scholarships.html.

**Career Information**

Biology encompasses many fields and appeals to students with diverse interests. Career avenues are equally broad, including employment by scientific research and testing laboratories, pharmaceutical and medicine development industries, health-care related organizations, and federal, state, or local government agencies.

According to the Bureau of Labor Statistics, employment of biological scientists is projected to grow over the next ten years and beyond, as biotechnological research and development continue to drive job growth. The outlook for science-related jobs in sales, marketing, and research is also very good.
CBS majors prepare students for careers in many different fields of research. For example, CBS students can participate in research related to health issues such as AIDS, cancer, Alzheimer’s disease, obesity, and heart disease. Students assist in the development of bio-based products and methods that help protect and improve the environment. Students learn about new industrial applications of biotechnology and how to improve agricultural products.

Many students study biology to prepare for professional training in the health sciences. Because entry requirements for the health sciences generally include courses similar to those required in CBS (mathematics, chemistry, physics, and biology), a CBS major provides a good foundation in pre-medicine, pre-pharmacy, pre-dentistry, and other health fields. In fact, nearly a third of CBS graduates each year continue their education in health fields including medicine, dentistry, pharmacy, veterinary medicine, and public health.

Some students combine their training in the biological sciences with other fields, such as engineering, graphic arts, law, business, or computer technology. Those graduates who choose to continue their study are regularly admitted to high-quality or highly ranked graduate schools and professional programs.

The Career Center for Science and Engineering provides resources and services for students at all levels to explore career options and prepare for professional success in the multitude of bioscience-related careers available to CBS and IT graduates. The Career Center provides assistance to undergraduates and alumni.

These resources include career advising, job search assistance, workshops on resume writing, professional networking, and interview preparation. The Career Center also provides employer and company information, publicizes current job openings, arranges on-campus interviews, and keeps updated information on salaries, employment outlook, and hiring trends.

More information is available at [www.ccse.umn.edu](http://www.ccse.umn.edu) or by calling the Career Center for Science and Engineering at 612-624-4090.

### Student Organizations

CBS student groups provide opportunities to learn more about research, careers, and leadership in the sciences. Participation is open to all University students. For more information, visit the Student Activities Office Web site at [www.sao.umn.edu](http://www.sao.umn.edu) or call CBS Student Services at 612-624-9717.

**AED—Alpha Epsilon Delta (AED), the pre-med honor society, is for anyone who is considering becoming a physician in the future. Members meet other pre-med students and learn about how to prepare for a career in medicine.**

**American Medical Student Association (AMSA) Pre-med Chapter—AMSA is a national pre-med student group that helps students connect with others who share their interests in the health sciences and helps prepare them for medical school and the MCAT.**

**Ambassador Program—Selected students have the opportunity to promote the opportunities available within the college and the University to other students and the community by participating in college-sponsored outreach activities and working with prospective students. This program provides leadership and skills development training.**

**Biochemistry Club—This club strengthens ties between biochemistry students and faculty, provides personalized career guidance, helps undergraduates identify biochemistry labs for directed research, and keep abreast of advances in biochemistry.**

**Biology Club—This organization promotes interest in undergraduate study in biology at the University. This club helps biology majors explore their options, the major, and learn about other CBS majors early in their academic careers. Fields of research, career possibilities, and unique educational experiences are also showcased at club meetings.**

**Biological Sciences Alumni Society (BSAS)—BSAS is a professional association for CBS graduates that fosters relationships among alumni, students, faculty, and the community. Enhancing student opportunities is a top priority of BSAS. Toward that end, BSAS sponsors scholarships, research and internship grants, and a mentor program. Additionally, alumni work with the CBS Career Center to develop the Career Network, an innovative program that enables students and graduates to explore career options. For more information, contact Kristen Denzer, alumni relations coordinator at 612-624-4770 or stop by 123 Snyder Hall.**

**Headwaters Ecology Club—The Headwaters Ecology Club promotes interest in undergraduate study in ecology, evolution, and animal behavior through social, educational, and volunteer events. An important focus of the Headwaters Ecology Club is to promote the unique educational opportunities available through the Itasca Biological Station and Laboratories, and other national and international field biology programs.**

**Forensic Science Club—This club organizes events, field trips, information, and guest speakers for members of the University community interested in forensic science.**

**Genetics, Cell Biology, and Development Club—Students formed this club to bring together students, faculty, and staff interested in these disciplines. Members enjoy speakers, educational experiences, and social activities.**

**Microbiology Club—This club provides a forum in which students and faculty can meet informally to share common interests in microbiology. Members are officially part of the Student Chapter of the American Society for Microbiology (ASM), which provides information on microbiology lectures, meetings, seminars, and local job listings. Activities include discussions of microbiological issues, social events, and visits to local employers.**

**Neuroscience Club—The Neuroscience Club promotes interest in undergraduate neuroscience study and research at the University of Minnesota. Club activities include lab tours, study groups, participation in Department of Neuroscience outreach projects—such as Brain Awareness Week—and faculty-student meetings. Club members meet informally every other week; undergraduates interested in neuroscience are encouraged to participate.**

**Pre-Dental Club—Students learn about preparing to become a dentist, the practice of dentistry, opportunities at the University and the American Student Dental Association, and meet other students with common interests.**

**Pre-Pharmacy Club—Students learn more about becoming a pharmacist and the practice of pharmacy. They are introduced to opportunities at the University and meet other students who share an interest in pharmacy.**

**Student Board—The CBS Student Board works collaboratively with the CBS administration, departments, and student organizations, builds community and connections among CBS students, and serves as the official student representation to the CBS Administration.**

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International Programs

CBS encourages all students to consider an international experience as part of their undergraduate program. Many unique opportunities exist for students to study abroad in the biological sciences. Study abroad can help students gain field experience in different ecosystems, learn international perspectives in biology, develop laboratory research skills in an academic setting, enhance communication and problem-solving skills, and prepare for a career in the ever expanding global market.

Internships, volunteer experiences, and academic programs are available to help students prepare for careers in health care, academic, industry, or the public sector. Students are also encouraged to consider how an experience abroad might enhance language learning or help them make progress toward liberal education or major requirements.

For more information, contact the Learning Abroad Center at 612-626-9000 or visit the Web site at www.UMabroad.umn.edu.

Graduation Requirements

To earn a B.S. degree from CBS, students must meet the following requirements:

- Be admitted to a CBS degree program or major and complete all campus, college and program requirements with a minimum GPA of 2.00 in the major and a cumulative GPA of 2.00 or higher in all University coursework.
- Complete at least 120 credits; grades of C- or better are required in the math, chemistry, physics, or biological sciences courses used to meet requirements for the major.
- S grades are not allowed in major courses unless the course is only offered S-N.
- Have at least 30 semester credits from the University.
- Earn at least 15 of their last 30 credits from courses offered by the University.

Students must apply for graduation by submitting an Application for Degree online. CBS students may apply to clear for graduation after fall, spring, May, or summer session. There is no fee to apply for the degree, and students need to apply for graduation only once and update their application online if graduation is delayed for any reason. Students are strongly encouraged to apply a few semesters in advance of the desired semester of graduation. Procedures and forms for submitting applications for degree can be found at www.onestop.umn.edu/onestop/graduating.html.

Research and Teaching Facilities

CBS has research and teaching facilities on the Minneapolis and St. Paul campuses, and operates two field stations.

Biodale, CBS’s one-stop shopping center for research support services, houses $40 million in bioscience research equipment that is available to faculty, students, and industry scientists. Facilities include the Imaging Center, which provides low-cost printing for research posters. Biodale is located in Snyder Hall on the St. Paul campus.

The Biological Sciences Greenhouse is part of a new complex of plant growth facilities on the St. Paul campus that were completed in 2005. The CBS greenhouse is a teaching and research facility with four landscaped rooms that exhibit the flora of the tropics, subtropics, desert, and aquatic regions.

The Biotechnology Institute (BTI) in Gortner Laboratories on the St. Paul campus brings together faculty and students from CBS, Institute of Technology, and Medical School for interdisciplinary research and training in emerging areas of biotechnology such as biocatalysis, renewable energy and materials, bioremediation of toxic waste, and creation of new biological agents for use in medicine and industry. BTI promotes collaboration between University researchers and industry and trains students for Minnesota’s growing biotechnology industry. Visit www.bti.umn.edu.

The Cargill Building for Microbial and Plant Genomics opened in 2003 and provides a hub for researchers from several schools. Faculty conduct basic research in functional genomics of microbes and crop plants to identify innovative ways to make crops more resistant to disease and drought, clean up the environment, and improve human health.

Cedar Creek Natural History Area is a 5,400-acre ecological research site located 30 miles north of the Twin Cities, at the convergence of three large North American biomes: grass prairies, evergreen forests, and deciduous forests. Discovered in 1930, it has been nationally known as an important site for ecology research since the early 1940s. Today, Cedar Creek is a living laboratory for David Tilman, Regents Professor of Ecology, who studies human impact on biodiversity in global ecosystems.

Long-term experiments at Cedar Creek examine three of the most significant human alterations to the biosphere: increased carbon dioxide in the air, increased nitrogen in land and water from fertilizers, and reduced biodiversity. All three factors affect the performance of global ecosystems.

The number of faculty and students who work at Cedar Creek has increased tenfold over the past 20 years. To accommodate this growth, a new 12,000-square-foot Science and Outreach Center is planned. The center will include new labs, classrooms, meeting space and an exhibit area. New housing for students and visiting faculty is also planned.

More information is available at www.Itasca.umn.edu.

Itasca Biological Station and Laboratories is a CBS field station within Itasca State Park, which is located at the headwaters of the Mississippi. The most visited park in the state, Itasca offers 50 square miles of pristine ecosystems populated with Minnesota’s native flora and fauna and a spectacular collection of clear lakes, peat bogs, and old-growth forests.

The complex of 70 rustic buildings at the field station includes cabins, laboratories, a library, dining hall, and offices. In 2005, CBS launched “Habitat for Biologists” a fundraising campaign to restore historic cabins and build new laboratories and other facilities.

Nature of Life, CBS’ annual class for incoming freshmen, is held at Itasca every year in July and August. Several graduate programs also offer orientation sessions at Itasca. Field biology classes are offered to students from the University of Minnesota and other schools. See http://biosci.cbs.umn.edu/itasca for a description of courses and facilities.

In addition, Itasca is training headquarters for the Science Education Program for Greater Minnesota, which provides programs to recruit and retain science teachers for secondary schools in greater Minnesota. Visit www.cbs.umn.edu/main/resources/ScienceEducation.htm.

Jane Goodall Institute’s Center for Primate Studies is the University of Minnesota branch of Jane Goodall’s worldwide organization, which is devoted to studying and protecting chimpanzees. Anne Pusey, a former student of Goodall’s, is director of the center and of the JGI international research program. The center houses all of Goodall’s notebooks and photos from her 38 years of research in Tanzania’s Gombe National Park. Visit www.discoverchimpanzees.org.
The Molecular and Cellular Biology Building is a state-of-the-art facility for life sciences research and education shared by the College of Biological Sciences and the Medical School. This building opened in 2002 and has four floors of faculty research laboratories and two floors of biology classrooms and instructional laboratories.

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**Biochemistry B.S.**

**Biochemistry, Molecular Biology, and Biophysics**

Requirements for this program are current for Fall 2006.

- Required credits to graduate with this degree: 120
- Required credits within the major: 70

This program requires summer terms

**Degree: Bachelor of Science**

Biochemists study molecules found in living organisms, particularly proteins, nucleic acids, lipids, and carbohydrates. Biochemistry majors focus their studies on the biosynthesis, metabolism, function, and regulation of these molecules of life. This information is essential to gain an understanding of many biological processes, including how diseases like cancer and diabetes develop, and to learn how genetic engineering and biotechnology can be used in ways that benefit society.

Earning a B.S. in biochemistry prepares majors for graduate study in biochemistry or other biological sciences; professional training programs in the health sciences; careers in teaching; and entry-level positions in industry, agencies, and universities.

Biochemistry is an experimental science, and majors, especially those planning to pursue graduate studies in the field, should become acquainted with laboratory research approaches beyond those in the formal lab courses. Research options are available through BIOC 4994 or BIOC 4794W. Students should consult early with their faculty mentor to begin planning the research component of their major.

**Program Requirements**

**Introductory Biology**

Choose either Sequence A or Sequence B to fulfill the General and Organismal Biology requirement. Sequence A is preferred. If Sequence A is chosen, take one organismal course or course pair. Sequence B has two options for completing the requirements.

Students are required to complete one of the following course groups.

**Sequence A (Preferred)**

BIOL 1001 - Introductory Biology I: Evolutionary and Ecological Perspectives, BIOL SCI/L, ENVT (4.0 cr)

BIOL 1002W - Introductory Biology II: Molecular, Cellular, and Developmental Perspectives, WI (5.0 cr)

*OR*

**Sequence B**

Take BIOL 1009 and choose from animal biology, plant biology, or microbiology course groups.

BIOL 1009 - General Biology, BIOL SCI/L (4.0 cr)

**Animal Biology**

BIOL 2012 - General Zoology (4.0 cr)

*OR*

*take the following course pair*

BIOL 3211 - Animal Physiology (3.0 cr)

BIOL 2005 - Animal Diversity Laboratory (1.0 cr)

**Botany or Plant Biology**

BIOL 2022 - General Botany (3.0 cr)

*or* BIOL 3007W - Plant Biology: Diversity and Adaptation, WI (4.0 cr)

*Take all of the following in the same term:*

BIOL 3002 - Plant Biology: Function (2.0 cr)

BIOL 3005W - Plant Function Laboratory, WI (2.0 cr)

**Microbiology**

BIOL 2032 - General Microbiology with Laboratory (4.0 cr)

*or* MICB 3301 - Biology of Microorganisms (5.0 cr)

*or* VBS 2032 - General Microbiology with Laboratory (4.0 cr)

**Required Courses**

**Physical Science and Mathematics**

**Chemistry**

CHEM 1021 - Chemical Principles I, ENVT, PHYS SCI/L (4.0 cr)

CHEM 1022 - Chemical Principles II, ENVT, PHYS SCI/L (4.0 cr)

CHEM 2301 - Organic Chemistry I (3.0 cr)

CHEM 2302 - Organic Chemistry II (3.0 cr)

CHEM 2311 - Organic Lab (4.0 cr)

BIOC 4521 - Introduction to Physical Biochemistry (3.0 cr)

*or* *take the following course pair*

CHEM 3501 - Physical Chemistry I (3.0 cr)

CHEM 3502 - Physical Chemistry II (3.0 cr)

**Mathematics**

MATH 1271 - Calculus I, MATH (4.0 cr)

*or* MATH 1281 - Calculus with Biological Emphasis I, MATH (4.0 cr)

MATH 1272 - Calculus II (4.0 cr)

*or* MATH 1282 - Calculus With Biological Emphasis II (4.0 cr)

**Physics**

PHYS 1201W - Introductory Physics for Biology and Pre-medicine I, PHYS SCI/L, WI (5.0 cr)

*or* PHYS 1301W - Introductory Physics for Science and Engineering I, PHYS SCI/L, WI (4.0 cr)

PHYS 1202W - Introductory Physics for Biology and Pre-medicine II, PHYS SCI/L, WI (5.0 cr)

*or* PHYS 1302W - Introductory Physics for Science and Engineering II, PHYS SCI/L, WI (4.0 cr)

**Major Courses**

Take BIOL 4003 and 4004, and choose one course or course pair from the remaining courses. MICB 3301 is preferred. Selected course(s) may not count towards the organismal requirement in Sequence B.

**Biochemistry**

BIOC 3960 - Research Topics in Biochemistry (1.0 cr)

BIOC 4025 - Laboratory in Biochemistry (2.0 cr)

BIOC 4331 - Biochemistry I: Structure, Catalysis, and Metabolism in Biological Systems (4.0 cr)

BIOC 4332 - Biochemistry II: Molecular Mechanisms of Signal Transduction and Gene Expression (4.0 cr)

BIOL 4003 - Genetics (3.0 cr)

BIOL 4004 - Cell Biology (3.0 cr)

MICB 3301 - Biology of Microorganisms (5.0 cr)

*or* BIOL 3007W - Plant Biology: Diversity and Adaptation, WI (4.0 cr)

*or* BIOL 3407 - Ecology, ENVT (3.0 cr)

*or* BIOL 3409 - Evolution (3.0 cr)

*or* BIOL 3411 - Introduction to Animal Behavior (3.0 cr)
or BIOL 3807 - Ecology, ENVT (4.0 cr)
or BIOL 3811 - Introduction to Animal Behavior (3.0 cr)
or

**Animal Physiology**
BIOL 3211 - Animal Physiology (3.0 cr)
BIOL 2005 - Animal Diversity Laboratory (1.0 cr)
or
PHSL 3051 - Human Physiology (4.0 cr)
BIOL 2005 - Animal Diversity Laboratory (1.0 cr)
or
BIOL 2005 - Animal Diversity Laboratory (1.0 cr)
PHSL 3061 - Principles of Physiology (4.0 cr)
or

**Plant Biology**
BIOL 3002 - Plant Biology: Function (2.0 cr)
BIOL 3005W - Plant Function Laboratory, WI (2.0 cr)
or BIOL 3007W - Plant Biology: Diversity and Adaptation, WI (4.0 cr)

**Electives**
Electives may not be used to fulfill other major requirements. One course must include an upper division CBS laboratory experience.

*Take 6 or more credit(s) from the following:*
BIOC 4125 - Laboratory in Molecular Biology and Biotechnology (3.0 cr)
BIOC 4794W - Directed Research: Writing Intensive, WI (1.0-7.0 cr)
BIOC 4994 - Directed Research (1.0-7.0 cr)
BIOL 3007W - Plant Biology: Diversity and Adaptation, WI (4.0 cr)
EEB 4014W - Ecology of Vegetation, WI (3.0 cr)
EEB 4016W - Ecological Biogeography, WI (3.0 cr)
EEB 4019 - Mammoth (4.0 cr)
EEB 4034 - Introduction to Ornithology (4.0 cr)
EEB 4065 - Limnology Laboratory (1.0 cr)
EEB 4067 - Plankton Ecology (4.0 cr)
EEB 4074W - Directed Research: Writing Intensive, WI (1.0-7.0 cr)
EEB 4994 - Directed Research (1.0-7.0 cr)
FW 3136 - Ecology of Fishes (4.0 cr)
GCD 5015 - Genetics Laboratory (2.0 cr)
GCD 5025 - Cell Biology Laboratory (2.0 cr)
GCD 5111 - Histology: Cell and Tissue Organization (4.0 cr)
GCD 4794W - Directed Research: Writing Intensive, WI (1.0-7.0 cr)
GCD 4994 - Directed Research (1.0-7.0 cr)
MICB 3301 - Biology of Microorganisms (5.0 cr)
MICB 4215 - Advanced Laboratory: Microbial Physiology and Diversity (3.0 cr)
MICB 4235 - Advanced Laboratory: Virology, Immunology, and Microbial Genetics (3.0 cr)
MICB 4794W - Directed Research: Writing Intensive, WI (1.0-7.0 cr)
MICB 4994 - Directed Research (1.0-7.0 cr)
NSCI 4794W - Directed Research: Writing Intensive, WI (1.0-7.0 cr)
NSCI 4994 - Directed Research (1.0-7.0 cr)
PBO 4321 - Taxonomy of Minnesota Flora (3.0 cr)
PBO 4404 - Developmental Plant Anatomy (3.0 cr)
PBO 4511 - Flowering Plant Diversity (3.0 cr)
PBO 4516 - Plant Morphology, Development, and Evolution (4.0 cr)
PBO 4794W - Directed Research: Writing Intensive, WI (1.0-7.0 cr)
PBO 4994 - Directed Research (1.0-7.0 cr)

**Animal Physiology**
*Take all of the following in the same term:*
BIOL 2005 - Animal Diversity Laboratory (1.0 cr)
BIOL 3211 - Animal Physiology (3.0 cr)

**Plant Biology**
*Take all of the following in the same term:*
BIOL 3002 - Plant Biology: Function (2.0 cr)
BIOL 3005W - Plant Function Laboratory, WI (2.0 cr)

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**Biochemistry Minor**

Required credits in this minor: 10

Biochemists study molecules found in living organisms, particularly proteins, nucleic acids, lipids, and carbohydrates. Biochemistry minors focus their studies on the biosynthesis, metabolism, function, and regulation of these molecules of life. This information is essential to gain an understanding of many biological processes, including how diseases like cancer and diabetes develop, and how genetic engineering and biotechnology can be used in ways that benefit society.

**Admission Requirements**

For information about University of Minnesota admission requirements, visit the Office of Admissions Web site at http://admissions.tc.umn.edu.

**Program Requirements**

Students who wish to declare a minor in biochemistry should call 612-624-9717 to schedule an appointment with an adviser.

**Required Courses**

**Minor Courses**
BIOC 4331 - Biochemistry I: Structure, Catalysis, and Metabolism in Biological Systems (4.0 cr)
BIOC 4332 - Biochemistry II: Molecular Mechanisms of Signal Transduction and Gene Expression (4.0 cr)
PBO 4025 - Laboratory in Biochemistry (2.0 cr)
College of Biological Sciences

Biology B.S.

Biology

Requirements for this program are current for Fall 2006.

Required credits to graduate with this degree: 120.
Required credits within the major: 69.
This program requires summer terms.

Degree: Bachelor of Science

Students majoring in biology gain a broad understanding of the fundamental nature and characteristics of living things and the ways in which they interact. Their studies cover the full range of life sciences, from cancer genes to acid rain, from lichens to marine mammals.

The biology B.S. program prepares students for study in a broad spectrum of biological sciences; for professional training programs in the health sciences; careers in teaching; and entry-level scientist positions in industry, government agencies, and universities.

Program Requirements

Introductory Biology

Choose either Sequence A or Sequence B to fulfill the general and organismal biology requirement. Sequence A is preferred. If Sequence A is chosen, take one organismal course or course pair. If Sequence B is chosen, take two organismal courses or course pairs.

Students are required to complete one of the following course groups.

Sequence A (Preferred)
BIOL 1001 - Introductory Biology I: Evolutionary and Ecological Perspectives, BIOL SCI/L, ENVT (4.0 cr)
BIOL 1002W - Introductory Biology II: Molecular, Cellular, and Developmental Perspectives, WI (5.0 cr)

Animal Biology
BIOL 2012 - General Zoology (4.0 cr)
or
take the following course pair
BIOL 3211 - Animal Physiology (3.0 cr)
BIOL 2005 - Animal Diversity Laboratory (1.0 cr)
or
take the following course pair
BIOL 2005 - Animal Diversity Laboratory (1.0 cr)
PHSL 3051 - Human Physiology (4.0 cr)
or

Plant Biology
BIOL 2022 - General Botany (3.0 cr)
or BIOL 3007W - Plant Biology: Diversity and Adaptation, WI (4.0 cr)
or
take the following course pair
BIOL 3002 - Plant Biology: Function (2.0 cr)
BIOL 3005W - Plant Function Laboratory, WI (2.0 cr)
or

Microbiology
BIOL 2032 - General Microbiology with Laboratory (4.0 cr)
or MICB 3301 - Biology of Microorganisms (5.0 cr)
or VBS 2032 - General Microbiology With Laboratory (4.0 cr)

-OR-

Sequence B
BIOL 1009 - General Biology, BIOL SCI/L (4.0 cr)

Organismal Biology
Take 2 or more sub-requirement(s) from the following:

Animal Biology
BIOL 2012 - General Zoology (4.0 cr)
or
take the following course pair
BIOL 3211 - Animal Physiology (3.0 cr)
BIOL 2005 - Animal Diversity Laboratory (1.0 cr)
or
take the following course pair
BIOL 2005 - Animal Diversity Laboratory (1.0 cr)
PHSL 3051 - Human Physiology (4.0 cr)
or

Plant Biology
BIOL 2022 - General Botany (3.0 cr)
or BIOL 3007W - Plant Biology: Diversity and Adaptation, WI (4.0 cr)
or
take the following course pair
BIOL 3002 - Plant Biology: Function (2.0 cr)
BIOL 3005W - Plant Function Laboratory, WI (2.0 cr)
or

Microbiology
BIOL 2032 - General Microbiology with Laboratory (4.0 cr)
or MICB 3301 - Biology of Microorganisms (5.0 cr)
or VBS 2032 - General Microbiology With Laboratory (4.0 cr)

Required Courses

Math and Physical Sciences
CHEM 1021 - Chemical Principles I, ENVT, PHYS SCI/L (4.0 cr)
CHEM 1022 - Chemical Principles II, ENVT, PHYS SCI/L (4.0 cr)
CHEM 2301 - Organic Chemistry I (3.0 cr)
CHEM 2302 - Organic Chemistry II (3.0 cr)
CHEM 2311 - Organic Lab (4.0 cr)
MATH 1271 - Calculus I, MATH (4.0 cr)
or MATH 1281 - Calculus with Biological Emphasis I, MATH (4.0 cr)
MATH 1272 - Calculus II (4.0 cr)
or MATH 1282 - Calculus With Biological Emphasis II (4.0 cr)
PHYS 1201W - Introductory Physics for Biology and Pre-medicine I, PHYS SCI/L, WI (5.0 cr)
or PHYS 1301W - Introductory Physics for Science and Engineering I, PHYS SCI/L, WI (4.0 cr)
PHYS 1202W - Introductory Physics for Biology and Pre-medicine II, PHYS SCI/L, WI (5.0 cr)
or PHYS 1302W - Introductory Physics for Science and Engineering II, PHYS SCI/L, WI (4.0 cr)

Biology Core
BIOC 3021 - Biochemistry (3.0 cr)
or BIOC 4331 - Biochemistry I: Structure, Catalysis, and Metabolism in Biological Systems (4.0 cr)
BIOL 3407 - Ecology, ENVT (3.0 cr)
or BIOL 3409 - Evolution (3.0 cr)
or BIOL 3411 - Introduction to Animal Behavior (3.0 cr)
BIOL 4003 - Genetics (3.0 cr)
BIOL 4004 - Cell Biology (3.0 cr)
Electives

Electives may not be used to fulfill other requirements. Complete 11 additional upper division credits in elective courses. Two courses must be lab/field courses. Any 38xx or higher field course taken at the Lake Itasca Biological Station may be used toward the lab/field requirement. Remaining classes to meet the elective credit total may be: 3xxx or higher additional lab/field courses, non lab/field electives, or directed research. See your adviser for a list of possible courses.

Take at least one additional course in any of the biological sciences.

*Take 2 or more course(s) from the following:*

- **BIOC 4025** - Laboratory in Biochemistry (2.0 cr)
- **BIOC 4125** - Laboratory in Molecular Biology and Biotechnology (3.0 cr)
- **BIOC 4794W** - Directed Research: Writing Intensive, WI (1.0-6.0 cr)
- **BIOC 4994** - Directed Research (1.0-6.0 cr)
- **BIOL 3007W** - Plant Biology: Diversity and Adaptation, WI (4.0 cr)
- **EEB 4014** - Ecology of Vegetation (3.0 cr)
- **EEB 4016W** - Ecological Biogeography, WI (3.0 cr)
- **EEB 4134** - Introduction to Ornithology (4.0 cr)
- **EEB 4605** - Limnology Laboratory (1.0 cr)
- **EEB 4607** - Plankton Ecology (4.0 cr)
- **EEB 4794W** - Directed Research: Writing Intensive, WI (1.0-6.0 cr)
- **EEB 4842** - Arctic Field Ecology (4.0 cr)
- **EEB 4994** - Directed Research (1.0-6.0 cr)
- **EEB 5013** - Quaternary Plant Macrofossils (2.0 cr)
- **GCD 4015** - Genetics Laboratory (2.0 cr)
- **GCD 4025** - Cell Biology Laboratory (2.0 cr)
- **GCD 4111** - Histology: Cell and Tissue Organization (4.0 cr)
- **GCD 4794W** - Directed Research: Writing Intensive, WI (1.0-6.0 cr)
- **GCD 4994** - Directed Research (1.0-6.0 cr)
- **MICB 3301** - Biology of Microorganisms (5.0 cr)
- **MICB 4215** - Advanced Laboratory: Microbial Physiology and Diversity (3.0 cr)
- **MICB 4235** - Advanced Laboratory: Virology, Immunology, and Microbial Genetics (3.0 cr)
- **MICB 4794W** - Directed Research: Writing Intensive, WI (1.0-7.0 cr)
- **MICB 4994** - Directed Research (1.0-7.0 cr)
- **NSCI 4794W** - Directed Research: Writing Intensive, WI (1.0-7.0 cr)
- **NSCI 4994** - Directed Research (1.0-7.0 cr)
- **PBIO 4321** - Minnesota Flora (3.0 cr)
- **PBIO 4404** - Developmental Plant Anatomy (3.0 cr)
- **PBIO 4511** - Flowering Plant Diversity (3.0 cr)
- **PBIO 4794W** - Directed Research: Writing Intensive, WI (1.0-6.0 cr)
- **PBIO 4994** - Directed Research (1.0-6.0 cr)
- **PBIO 5416** - Plant Morphology, Development, and Evolution (4.0 cr)

*Take one of the following course pairs*

- **BIOL 2005** - Animal Diversity Laboratory (1.0 cr)
- **BIOL 3211** - Animal Physiology (3.0 cr)
  or
- **BIOL 2005** - Animal Diversity Laboratory (1.0 cr)
- **PHSL 3051** - Human Physiology (4.0 cr)
  or
- **BIOL 2005** - Animal Diversity Laboratory (1.0 cr)
- **PHSL 3061** - Principles of Physiology (4.0 cr)
  or
- **BIOL 3002** - Plant Biology: Function (2.0 cr)
- **BIOL 3005W** - Plant Function Laboratory, WI (2.0 cr)

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**Biology Minor**

Requirements for this program are current for Fall 2006.

Required credits in this minor: 20.

Biology minors gain a broad understanding of the fundamental nature and characteristics of living things and the ways in which they interact. Their studies cover the full range of life sciences, from cancer genes to acid rain, from lichens to marine mammals.

**Admission Requirements**

To declare a biology minor, students must make an appointment (and bring a transcript). Call 612-624-9717.

For information about University of Minnesota admission requirements, visit the Office of Admissions Web site at [http://admissions.tc.umn.edu](http://admissions.tc.umn.edu).

**Program Requirements**

All courses must be taken A-F with a grade of C- or better.

**Required Courses**

**Minor Courses**

- **BIOL 1001** - Introductory Biology I: Evolutionary and Ecological Perspectives, BIOL SCI/L, ENVT (4.0 cr)
- or **BIOL 1009** - General Biology, BIOL SCI/L (4.0 cr)
- **CHEM 1021** - Chemical Principles I, ENVT, PHYS SCI/L (4.0 cr)
- **PBIO 3002** - Plant Biology: Function (2.0 cr)
- **BIOL 3005W** - Plant Function Laboratory, WI (2.0 cr)

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

- **BIOC 2xxx**
- **BIOL 2xxx**
- **EEB 2xxx**
- **GCD 2xxx**
- **MICB 2xxx**
- **NSCI 2xxx**
- **PBIO 2xxx**

*Take 0 - 9 credit(s) from the following:*

- **BIOC 3xxx**
- **BIOC 4xxx**
- **BIOL 3xxx**
- **BIOL 4xxx**
- **EEB 3xxx**
- **EEB 4xxx**
- **GCD 3xxx**
- **GCD 4xxx**
- **MICB 3xxx**
- **MICB 4xxx**
- **NSCI 3xxx**
- **NSCI 4xxx**
- **PBIO 3xxx**
- **PBIO 4xxx**

*Take 3 or more credit(s) from the following:*

- **BIOC 3xxx**
- **BIOC 4xxx**
- **BIOL 3xxx**
- **BIOL 4xxx**
- **EEB 3xxx**
- **EEB 4xxx**
- **GCD 3xxx**
- **GCD 4xxx**
- **MICB 3xxx**
- **MICB 4xxx**
- **NSCI 3xxx**
- **NSCI 4xxx**
- **PBIO 3xxx**
- **PBIO 4xxx**
Ecology, Evolution, and Behavior
B.S.

Ecology, Evolution & Behavior

Requirements for this program are current for Fall 2006.
Required credits to graduate with this degree: 120.
Required credits within the major: 73.
This program requires summer terms.

Degree: Bachelor of Science

Students majoring in ecology, evolution, and behavior (EEB) focus on three related areas of biology. Ecology examines the growth and maintenance of populations and their interactions in communities, and relationships among organisms and physical events in terrestrial and aquatic ecosystems. Evolution investigates the origin and change of biological diversity by studying evolutionary patterns and processes at various temporal and spatial scales. Behavioral biology explores behavioral adaptations to the environment, mechanisms of behavior, and the evolution of social systems.

A B.S. in EEB prepares students for graduate study in integrative biology and related biological sciences; careers in teaching; and entry-level scientist positions in industry, government agencies, nonprofit agencies, and universities.

Program Requirements

Introductory Biology

Students are required to complete one of the following course groups.

Sequence A
BIOL 1001 - Introductory Biology I: Evolutionary and Ecological Perspectives, BIOL SCI/L, ENVT (4.0 cr)
BIOL 1002W - Introductory Biology II: Molecular, Cellular, and Developmental Perspectives, WI (5.0 cr)

Take 2 or more sub-requirement(s) from the following:
Animal Biology
BIOL 2012 - General Zoology (4.0 cr)
or
take the following course pair
BIOL 2005 – Animal Diversity Laboratory (1.0 cr)
BIOL 3211 – Animal Physiology (3.0 cr)
or
BIOL 2005 – Animal Diversity Laboratory (1.0 cr)
PHSL 3051 – Human Physiology (4.0 cr)
or
BIOL 2005 – Animal Diversity Laboratory (1.0 cr)
PHSL 3061 – Principles of Physiology (4.0 cr)

Plant Biology
BIOL 2022 – General Botany (3.0 cr)
or

take the following course pair
BIOL 3002 – Plant Biology : Function (2.0 cr)
BIOL 3005W - Plant Function Laboratory, WI (2.0 cr)
or
BIOL 3007W – Plant Biology: Diversity and Adaptation, WI (4.0 cr)

Microbiology
BIOL 2032 – General Microbiology with Laboratory (4.0 cr)
or
VBS 2032 - General Microbiology with Laboratory (4.0 cr)
or
MICB 3301 – Biology of Microorganisms (5.0 cr)

-OR-

Sequence B
BIOL 1009 - General Biology, BIOL SCI/L (4.0 cr)

Take 3 or more sub-requirement(s) from the following:
Animal Biology
BIOL 2012 - General Zoology (4.0 cr)
or

take the following course pair
BIOL 2005 – Animal Diversity Laboratory (1.0 cr)
BIOL 3211 – Animal Physiology (3.0 cr)
or
BIOL 2005 – Animal Diversity Laboratory (1.0 cr)
PHSL 3051 – Human Physiology (4.0 cr)
or
BIOL 2005 – Animal Diversity Laboratory (1.0 cr)
PHSL 3061 – Principles of Physiology (4.0 cr)

Plant Biology
BIOL 2022 – General Botany (3.0 cr)
or

take the following course pair
BIOL 3002 – Plant Biology : Function (2.0 cr)
BIOL 3005W - Plant Function Laboratory, WI (2.0 cr)
or
BIOL 3007W – Plant Biology: Diversity and Adaptation, WI (4.0 cr)

Microbiology
BIOL 2032 – General Microbiology with Laboratory (4.0 cr)
or
VBS 2032 - General Microbiology with Laboratory (4.0 cr)
or
MICB 3301 – Biology of Microorganisms (5.0 cr)

Required Courses

Math and Physical Sciences
CHEM 1021 - Chemical Principles I, ENVT, PHYS SCI/L (4.0 cr)
CHEM 1022 - Chemical Principles II, ENVT, PHYS SCI/L (4.0 cr)
CHEM 2301 - Organic Chemistry I (3.0 cr)
CHEM 2302 - Organic Chemistry II (3.0 cr)
or EEB 4611 - Biogeochemical Processes (3.0 cr)
MATH 1271 - Calculus I, MATH (4.0 cr)
or MATH 1281 - Calculus with Biological Emphasis I, MATH (4.0 cr)
MATH 1272 - Calculus II (4.0 cr)
or MATH 1282 - Calculus With Biological Emphasis II (4.0 cr)
STAT 3011 - Introduction to Statistical Analysis, MATH (4.0 cr)
or STAT 3021 - Introduction to Probability and Statistics (3.0 cr)
PHYS 1201W - Introductory Physics for Biology and Pre-medicine I, PHYS SCI/L, WI (5.0 cr)
or
PHYS 1301W - Introductory Physics for Science and Engineering I, PHYS SCI/L, WI (4.0 cr)
PHYS 1202W - Introductory Physics for Biology and Pre-medicine II, PHYS SCI/L, WI (5.0 cr)
or
PHYS 1302W - Introductory Physics for Science and Engineering II, PHYS SCI/L, WI (4.0 cr)

Biology Core

Students may take any 38xx course offered at the Lake Itasca Biological Station to count toward the ecology/animal behavior/evolution portion of the major core curriculum.

BIOL 3021 - Biochemistry (4.0 cr)
BIOL 4003 - Genetics (3.0 cr)

Take 2 or more course(s) from the following:
BIOL 3409 - Evolution (3.0 cr)
BIOL 3407 - Ecology, ENVT (3.0 cr)
or
BIOL 3807 - Ecology, ENVT (4.0 cr)
BIOL 3411 - Introduction to Animal Behavior (3.0 cr)
or
BIOL 3811 - Introduction to Animal Behavior (4.0 cr)
Genetics, Cell Biology, and Development B.S.

Genetics, Cell Biology, and Development TCBS

Requirements for this program are current for Fall 2006.

Required credits to graduate with this degree: 120.

Required credits within the major: 77.

Degree: Bachelor of Science.

Genetics, cell biology, and development (GCD) students focus their studies on the mechanisms by which genetic information is used to specify cell structure and function, and how that information drives cellular interactions that convert a single cell to develop into a complete organism. GCD students learn about advances in the field by studying model organisms like plants, fruit flies, zebrafish, and mice.

A B.S. in GCD prepares students for graduate study in molecular biology or related biological sciences; for professional training programs in health sciences; careers in teaching; and entry-level positions in industry, government agencies, or universities.

Admission Requirements

A GPA above 2.00 is preferred for the following:

- 2.50 for students transferring from outside the University.

For information about University of Minnesota admission requirements, visit the Office of Admissions Web site at http://admissions.tc.umn.edu.

Program Requirements

Introductory Biology

Students are required to complete one of the following course groups.

Sequence A

Take BIOL 1001 and 1002W and choose from animal biology, plant biology, or microbiology course groups.

BIOL 1001 - Introductory Biology I: Evolutionary and Ecological Perspectives, BIOL SCI/L, ENVT (4.0 cr)
BIOL 1002W - Introductory Biology II: Molecular, Cellular, and Developmental Perspectives, WI (5.0 cr)
or BIOL 1002V - Introductory Biology II: Molecular, Cellular, and Developmental Perspectives, WI, H (5.0 cr)

Animal Biology

BIOL 1012 - General Zoology (4.0 cr)
or take the following course pair
BIOL 2005 – Animal Diversity Laboratory (1.0 cr)
BIOL 3211 – Animal Physiology (3.0 cr)
or
BIOL 2005 – Animal Diversity Laboratory (1.0 cr)
PHSL 3051 – Human Physiology (4.0 cr)
or
BIOL 2005 – Animal Diversity Laboratory (1.0 cr)
PHSL 3061 – Principles of Physiology (4.0 cr)

Plant Biology

BIOL 2022 – General Botany (3.0 cr)
or take the following course pair
BIOL 2012  - General Zoology (4.0 cr)
or
BIOL 3007W – Plant Biology: Diversity and Adaptation, WI (4.0 cr)
BIOL 3005W - Plant Function Laboratory, WI (2.0 cr)
or
BIOL 3007W – Plant Biology: Diversity and Adaptation, WI (4.0 cr)

Microbiology

BIOL 2032 - General Microbiology with Laboratory (4.0 cr)
or VBS 2032 - General Microbiology with Laboratory (4.0 cr)
or MIBC 3301 – Biology of Microorganisms (5.0 cr)

-OR-

Sequence B

BIOL 1009 - General Biology, BIOL SCI/L (4.0 cr)

Take 2 or more sub-requirement(s) from the following:

Animal Biology

BIOL 2012 - General Zoology (4.0 cr)
or take the following course pair
BIOL 2005 – Animal Diversity Laboratory (1.0 cr)
BIOL 3211 – Animal Physiology (3.0 cr)
or
BIOL 2005 – Animal Diversity Laboratory (1.0 cr)
PHSL 3051 – Human Physiology (4.0 cr)
or
BIOL 2005 – Animal Diversity Laboratory (1.0 cr)
PHSL 3061 – Principles of Physiology (4.0 cr)

Plant Biology

BIOL 2022 – General Botany (3.0 cr)
or
take the following course pair
BIOL 3002 – Plant Biology: Function (2.0 cr)
BIOL 3005W - Plant Function Laboratory, WI (2.0 cr)
or BIOL 3007W – Plant Biology: Diversity and Adaptation, WI (4.0 cr)

Microbiology
BIOL 2032 – General Microbiology with Laboratory (4.0 cr)
or VBS 2032 - General Microbiology with Laboratory (4.0 cr)
or MICB 3301 – Biology of Microorganisms (5.0 cr)

Required Courses

Physical Science and Mathematics
CHEM 1021 - Chemical Principles I, ENVT, PHYS SCI/L (4.0 cr)
CHEM 1022 - Chemical Principles II, ENVT, PHYS SCI/L (4.0 cr)
CHEM 2301 - Organic Chemistry I (3.0 cr)
CHEM 2302 - Organic Chemistry II (3.0 cr)
CHEM 2311 - Organic Lab (4.0 cr)
MATH 1271 - Calculus I, MATH (4.0 cr)
or MATH 1281 Calculus with Biological Emphasis I, MATH (4.0 cr)
MATH 1272 - Calculus II (4.0 cr)
or MATH 1282 - Calculus With Biological Emphasis II (4.0 cr)

PHYS 1201W - Introductory Physics for Biology and Pre-medicine I, PHYS SCI/L, WI (5.0 cr)
or PHYS 1301W - Introductory Physics for Science and Engineering I, PHYS SCI/L, WI (4.0 cr)
PHYS 1202W - Introductory Physics for Biology and Pre-medicine II, PHYS SCI/L, WI (5.0 cr)
or PHYS 1302W - Introductory Physics for Science and Engineering II, PHYS SCI/L, WI (4.0 cr)

Major Courses
BIOL 4003 - Genetics (3.0 cr)
BIOL 4004 - Cell Biology (3.0 cr)
BIOC 3021 – Biochemistry (3.0 cr)
or BIOC 4331 - Biochemistry I: Structure, Catalysis, and Metabolism in Biological Systems (4.0 cr)
BIOL 3407 - Ecology, ENVT (3.0 cr)
or BIOL 3409 - Evolution (3.0 cr)
or BIOL 3411 - Introduction to Animal Behavior (3.0 cr)

Electives
Electives must include three courses from at least two of the following three course groups, as well as two courses from the elective labs course group. Consult your adviser on additional courses to total 18 credits. GCD 4151, 4161, and PBIO 5514 may be used in only one elective area.

Take 18 or more credit(s) including 3 or more sub-requirement(s) from the following:

Genetics
Take 0 - 3 course(s) from the following:
EEB 5033 - Population and Quantitative Genetics (4.0 cr)
GCD 4034 - Molecular Genetics (3.0 cr)
GCD 4143 - Human Genetics (3.0 cr)
GCD 4151 - Molecular Biology of Cancer (3.0 cr)

Cell Biology
Take 0 - 3 course(s) from the following:
GCD 4111 - Histology: Cell and Tissue Organization (4.0 cr)
GCD 4134 - Endocrinology (3.0 cr)
GCD 5036 - Molecular Cell Biology (3.0 cr)
MICB 4131 - Immunology (3.0 cr)
NSCI 3101 - Introduction to Neuroscience I: From Molecules to Madness (3.0 cr)
PBIOL 4516W - Plant Cell Biology: Writing Intensive, WI (3.0 cr)

Developmental Biology
Take 0 - 3 course(s) from the following:
GCD 4151 - Molecular Biology of Cancer (3.0 cr)
GCD 4161 - Developmental Biology (3.0 cr)
PBIOL 5514 - Plant Molecular Biology (3.0 cr)
PBIOL 5416 - Plant Morphology, Development, and Evolution (4.0 cr)

Elective Labs
Take 3 - 7 credit(s) from the following:
GCD 4994 - Directed Research (1.0-7.0 cr)
GCD 4794W - Directed Research: Writing Intensive, WI (1.0-7.0 cr)

Take 1 or more course(s) from the following:
BIOC 4025 - Laboratory in Biochemistry (2.0 cr)
BIOC 4125 - Laboratory in Molecular Biology and Biotechnology (3.0 cr)
GCD 4015 - Genetics Laboratory (2.0 cr)
GCD 4025 - Cell Biology Laboratory (2.0 cr)
MICB 4235 - Advanced Laboratory: Virology, Immunology, and Microbial Genetics (3.0 cr)

Microbiology B.S.

Microbiology
Requirements for this program are current for Fall 2006.
Required credits to graduate with this degree: 120.
Required credits within the major: 71 to 76.
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 today 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 Requirements

Introductory Biology
Students are required to complete one of the following course groups.

Sequence A (preferred)
BIOL 1001 - Introductory Biology I: Evolutionary and Ecological Perspectives, BIOL SCI/L, ENVT (4.0 cr)
BIOL 1002W - Introductory Biology II: Molecular, Cellular, and Developmental Perspectives, WI (5.0 cr)
or BIOL 1002V - Introductory Biology II: Molecular, Cellular, and Developmental Perspectives, WI, H (5.0 cr)

Sequence B
BIOL 1009 - General Biology, BIOL SCI/L (4.0 cr)

Take 1 or more sub-requirement(s) from the following:
BIOL 2012 - General Zoology (4.0 cr)
or
Animal Physiology
BIOL 3211 - Animal Physiology (3.0 cr)
BIOL 2005 - Animal Diversity Laboratory (1.0 cr)

Plant Biology
BIOL 2022 - General Botany (3.0 cr)
or BIOL 3007W - Plant Biology: Diversity and Adaptation, WI (4.0 cr)
or
Take the following course pair
BIOL 3002 - Plant Biology: Function (2.0 cr)
BIOL 3005W - Plant Function Laboratory, WI (2.0 cr)

Required Courses

Physical Science and Mathematics

Chemistry
CHEM 1021 - Chemical Principles I, ENVT, PHYS SCI/L (4.0 cr)
CHEM 1022 - Chemical Principles II, ENVT, PHYS SCI/L (4.0 cr)
CHEM 2301 - Organic Chemistry I (3.0 cr)
CHEM 2302 - Organic Chemistry II (3.0 cr)
CHEM 2311 - Organic Lab (4.0 cr)

Mathematics
MATH 1271 - Calculus I, MATH (4.0 cr)
or MATH 1281 - Calculus with Biological Emphasis I, MATH (4.0 cr)
MATH 1272 - Calculus II (4.0 cr)
or MATH 1282 - Calculus with Biological Emphasis II (4.0 cr)

Physics
PHYS 1201W - Introductory Physics for Biology and Pre-medicine I, PHYS SCI/L, WI (5.0 cr)
or PHYS 1301W - Introductory Physics for Science and Engineering I, PHYS SCI/L, WI (4.0 cr)
PHYS 1202W - Introductory Physics for Biology and Pre-medicine II, PHYS SCI/L, WI (5.0 cr)
or PHYS 1302W - Introductory Physics for Science and Engineering II, PHYS SCI/L, WI (4.0 cr)

Major Courses

BIOL 4003 - Genetics (3.0 cr)
MICB 3301 - Biology of Microorganisms (5.0 cr)
BIOC 3021 - Biochemistry (3.0 cr)
or BIOC 4331 - Biochemistry I: Structure, Catalysis, and Metabolism in Biological Systems (4.0 cr)

Electives

These courses fulfill the microbiology elective requirement.

Take 4 or more course(s) from the following:

BIOL 4009 - Genetics (3.0 cr)
MICB 3301 - Biology of Microorganisms (5.0 cr)
or BIOC 4331 - Biochemistry I: Structure, Catalysis, and Metabolism in Biological Systems (4.0 cr)

Elective Labs

Choose Option A or B to fulfill the advanced laboratory requirement. If Option B is chosen, MICB 4794W/4994 must be taken for 6 credits.

Option A
MICB 4215 - Advanced Laboratory: Microbial Physiology and Diversity (3.0 cr)
MICB 4235 - Advanced Laboratory: Virology, Immunology, and Microbial Genetics (3.0 cr)

Option B
MICB 4215 - Advanced Laboratory: Microbial Physiology and Diversity (3.0 cr)
or MICB 4235 - Advanced Laboratory: Virology, Immunology, and Microbial Genetics (3.0 cr)

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

MICB 4794W - Directed Research: Writing Intensive, WI (1.0-7.0 cr)
MICB 4994 - Directed Research (1.0-7.0 cr)

Neuroscience B.S.

Neuroscience

Requirements for this program are current for Fall 2006.
Required credits to graduate with this degree: 120.
Required credits within the major: 78 to 81.
Degree: Bachelor of Science

Neuroscience majors study the molecular and cellular building blocks that make up the brain and control its function. The study of neuroscience aims to understand how complex animals, including humans, see, hear, move, think, and feel. Neuroscientists also study abnormalities that cause diseases and mechanisms that underlie pain and addiction.

A B.S. in neuroscience prepares undergraduates to pursue advanced studies in neuroscience or related health careers; professional degrees in medicine or psychology; or careers in the pharmaceutical, medical, or biotechnology industries.

Program Requirements

Introductory Biology

Students are required to complete one of the following course groups.

Sequence A (preferred)
BIOL 1001 - Introductory Biology I: Evolutionary and Ecological Perspectives, BIOL SCI/L, ENVT (4.0 cr)
BIOL 1002W - Introductory Biology II: Molecular, Cellular, and Developmental Perspectives, WI (5.0 cr)

Animal Biology

BIOL 2012 - General Zoology (4.0 cr)
or
BIOL 3211 - Animal Physiology (3.0 cr)
BIOL 2005 - Animal Diversity Laboratory (1.0 cr)
or
BIOL 2005 - Animal Diversity Laboratory (1.0 cr)
PHSL 3051 - Human Physiology (4.0 cr)
or
BIOL 2005 - Animal Diversity Laboratory (1.0 cr)
PHSL 3061 - Principles of Physiology (4.0 cr)

-OR-

Sequence B
BIOL 1009 - General Biology, BIOL SCI/L (4.0 cr)
BIOL 2012 - General Zoology (4.0 cr)
or
BIOL 3211 - Animal Physiology (3.0 cr)
BIOL 2005 - Animal Diversity Laboratory (1.0 cr)
or
BIOL 2005 - Animal Diversity Laboratory (1.0 cr)
PHSL 3051 - Human Physiology (4.0 cr)
or
BIOL 2005 - Animal Diversity Laboratory (1.0 cr)
PHSL 3061 - Principles of Physiology (4.0 cr)

Animal Biology

BIOL 3211 - Animal Physiology (3.0 cr)
BIOL 2005 - Animal Diversity Laboratory (1.0 cr)
or
BIOL 2005 - Animal Diversity Laboratory (1.0 cr)
PHSL 3051 - Human Physiology (4.0 cr)
or
BIOL 2005 - Animal Diversity Laboratory (1.0 cr)
PHSL 3061 - Principles of Physiology (4.0 cr)
or
BIOL 2022 - General Botany (3.0 cr)
or
BIOL 2032 - General Microbiology with Laboratory (4.0 cr)
or
VBS 2032 - General Microbiology with Laboratory (4.0 cr)
or
BIOL 3007W - Plant Biology: Diversity and Adaptation, WI (4.0 cr)
or
MICB 3301 - Biology of Microorganisms (5.0 cr)
or

take the following course pair
BIOL 3002 - Plant Biology: Function (2.0 cr)
BIOL 3005W - Plant Function Laboratory, WI (2.0 cr)
Required Courses

Physical Science and Mathematics

Chemistry
CHEM 1021 - Chemical Principles I, ENVT, PHYS SCI/L (4.0 cr)
CHEM 1022 - Chemical Principles II, ENVT, PHYS SCI/L (4.0 cr)
CHEM 2301 - Organic Chemistry I (3.0 cr)
CHEM 2302 - Organic Chemistry II (3.0 cr)
CHEM 2311 - Organic Lab (4.0 cr)

Mathematics
MATH 1271 - Calculus I, MATH (4.0 cr)
or MATH 1281 - Calculus with Biological Emphasis I, MATH (4.0 cr)
MATH 1272 - Calculus II (4.0 cr)
or MATH 1282 - Calculus With Biological Emphasis II (4.0 cr)

Physics
PHYS 1201W - Introductory Physics for Biology and Pre-medicine I, PHYS SCI/L, WI (5.0 cr)
or PHYS 1301W - Introductory Physics for Science and Engineering I, PHYS SCI/L, WI (4.0 cr)
PHYS 1202W - Introductory Physics for Biology and Pre-medicine II, PHYS SCI/L, WI (5.0 cr)
or PHYS 1302W - Introductory Physics for Science and Engineering II, PHYS SCI/L, WI (4.0 cr)

Major Courses

Students must complete a minimum of 2 credits of directed research.

Biol 4003 - Genetics (3.0 cr)
Biol 4004 - Cell Biology (3.0 cr)
NSCI 3101 - Introduction to Neuroscience I: From Molecules to Madness (3.0 cr)
NSCI 3102W - Introduction to Neuroscience II: Biological Basis of Behavior, WI (3.0 cr)
NSCI 4105 - Neurobiology Laboratory I (2.0 cr)
BIOC 3021 - Biochemistry (3.0 cr)
or BIOC 4331 - Biochemistry I: Structure, Catalysis, and Metabolism in Biological Systems (4.0 cr)
Biol 3407 - Ecology, ENVT (3.0 cr)
or Biol 3409 - Evolution (3.0 cr)
or Biol 3411 - Introduction to Animal Behavior (3.0 cr)

Directed Research

NSCI 4167 - Neuroscience in the Community (1.0-3.0 cr)
or NSCI 4794W - Directed Research: Writing Intensive, WI (1.0-7.0 cr)
or NSCI 4994 - Directed Research (1.0-7.0 cr)

Electives

Take at least one course from each course group.

Take 9 or more credit(s) including 3 or more sub-requirement(s) from the following:

Group A: Cell and Molecular Biology
EEB 5221 - Molecular and Genomic Evolution (3.0 cr)
or GCD 4034 - Molecular Genetics (3.0 cr)
or GCD 5036 - Molecular Cell Biology (3.0 cr)
or NSC 5201 - Computational Neuroscience I: Membranes and Channels (3.0 cr)
or NSC 5461 - Cellular and Molecular Neuroscience (4.0 cr)

Group B: Neural Systems and Behavior
EEB 5221 - Evolution of Social Behavior (3.0 cr)
or EEB 5227 - Behavioral Ecology (3.0 cr)
or NSC 5202 - Theoretical Neuroscience: Systems and Information Processing (3.0 cr)
or NSC 5462 - Neuroscience Principles of Drug Abuse (2.0 cr)
or NSC 5561 - Systems Neuroscience (4.0 cr)
or NSC 5661 - Behavioral Neuroscience (3.0 cr)
or PSY 5036W - Computational Vision, WI (3.0 cr)
or PSY 5038W - Introduction to Neural Networks, WI (3.0 cr)

Group C: History and Philosophy of Science
HSCI 3211 - Biology and Culture in the 19th and 20th Centuries, HP (3.0 cr)
or HSCI 3242 - The Darwinian Revolution (3.0 cr)
or PHIL 3601W - Scientific Thought, OH, WI (4.0 cr)
or PHIL 4607 - Philosophy of the Biological Sciences, WI (3.0 cr)

Plant Biology B.S.

Plant Biology

Requirements for this program are current for Fall 2006.

Required credits to graduate with this degree: 120.

Required credits within the major: 68 to 77.

Degree: Bachelor of Science

Plant biologists study all aspects of biology as they pertain to plants or fungi and make important contributions to analyzing and preserving biodiversity worldwide. They work to enhance the nutritional value of crops as well as their resistance to disease, pests, and drought while working to reduce the need for pesticides, fertilizer, and irrigation.

Current faculty research interests include genomics, gene expression, chromosome structure, plant growth substances, signal transduction, plant responses to stress, the plant cytoskeleton and cell morphogenesis, metabolic activities during development, cellular structure and ultrastructure of vascular and nonvascular plants, aquatic biology, lichenology, molecular evolution and systematics, fungal/plant interactions, biological rhythms, and fungal diversity.

Plant biology majors follow one of two tracks. One track fits the need of students who are primarily interested in environmental biology, evolution, or other aspects of whole organisms; the other track is appropriate for students interested in molecular, cellular, and development biology. All plant biology 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.

Program Requirements

Introductory Biology

Choose either Sequence A or Sequence B to fulfill the general and organismal biology requirement. Sequence A is preferred. If Sequence A is chosen, take one additional organismal course or course pair. Sequence B has two options for completing the requirements.

Students are required to complete one of the following course groups.

Sequence A (Preferred)

Biol 1001 - Introductory Biology I: Evolutionary and Ecological Perspectives, Biol SCI/L, ENVT (4.0 cr)
Biol 1002W - Introductory Biology II: Molecular, Cellular, and Developmental Perspectives, WI (5.0 cr)

Plant Biology

Biol 3007W - Plant Biology: Diversity and Adaptation, WI (4.0 cr)
Take all of the following in the same term:
Biol 3002 - Plant Biology: Function (2.0 cr)
Biol 3005W - Plant Function Laboratory, WI (2.0 cr)

-OR-

Sequence B Option 1

If Sequence A is not pursued, the following is the preferred path for Sequence B.

Biol 1009 - General Biology, Biol SCI/L (4.0 cr)
Biol 3002 - Plant Biology: Function (2.0 cr)
Biol 3005W - Plant Function Laboratory, WI (2.0 cr)
Biol 3007W - Plant Biology: Diversity and Adaptation, WI (4.0 cr)

-OR-
Sequence B Option 2
BIOL 1009 - General Biology, BIOL SCI/L (4.0 cr)

Plant Biology
BIOL 3007W - Plant Biology: Diversity and Adaptation, WI (4.0 cr)
or
Take all of the following in the same term:
BIOL 3002 - Plant Biology: Function (2.0 cr)
BIOL 3005W - Plant Function Laboratory, WI (2.0 cr)

Other Organismal Biology
BIOL 2012 - General Zoology (4.0 cr)
or BIOL 2032 - General Microbiology with Laboratory (4.0 cr)
or VBS 2032 - General Microbiology with Laboratory (4.0 cr)
or MICB 3301 - Biology of Microorganisms (5.0 cr)
or
Take one of the following course pairs
BIOL 2005 - Animal Diversity Laboratory (1.0 cr)
BIOL 3211 - Animal Physiology (3.0 cr)
or
BIOL 2005 - Animal Diversity Laboratory (1.0 cr)
PHSL 3051 - Human Physiology (4.0 cr)
or
BIOL 2005 - Animal Diversity Laboratory (1.0 cr)
PHSL 3061 - Principles of Physiology (4.0 cr)

Required Courses

Physical Science and Mathematics
CHEM 1021 - Chemical Principles I, ENVT, PHYS SCI/L (4.0 cr)
CHEM 1022 - Chemical Principles II, ENVT, PHYS SCI/L (4.0 cr)
CHEM 2301 - Organic Chemistry I (3.0 cr)
CHEM 2302 - Organic Chemistry II (3.0 cr)
BIOC 4025 - Laboratory in Biochemistry (2.0 cr)
or CHEM 2311 - Organic Lab (4.0 cr)
MATH 1271 - Calculus I, MATH (4.0 cr)
or MATH 1272 - Calculus II (4.0 cr)
MATH 1271 - Calculus I, MATH (4.0 cr)
or MATH 1272 - Calculus II (4.0 cr)
or MATH 1281 - Calculus with Biological Emphasis I, MATH (4.0 cr)
PHYS 1201W - Introductory Physics for Biology and Pre-medicine I, PHYS SCI/L, WI (5.0 cr)
or PHYS 1202W - Introductory Physics for Biology and Pre-medicine I, PHYS SCI/L, WI (5.0 cr)
PHYS 1202W - Introductory Physics for Biology and Pre-medicine II, PHYS SCI/L, WI (5.0 cr)
or PHYS 1203W - Introductory Physics for Science and Engineering II, PHYS SCI/L, WI (5.0 cr)

Biology Core
BIOC 3021 - Biochemistry (3.0 cr)
or BIOC 4331 - Biochemistry I: Structure, Catalysis, and Metabolism in Biological Systems (4.0 cr)
BIOL 3407 - Ecology, ENVT (3.0 cr)
or BIOL 3409 - Evolution (3.0 cr)
BIOL 4003 - Genetics (3.0 cr)
or BIOL 4004 - Cell Biology (3.0 cr)

Major Electives
Take at least one course from Group A and one course from Group B. Other appropriate courses may be substituted by petition.
Take 11 or more credit(s).

Take 1 or more course(s) from the following:
EEB 4014 - Ecology of Vegetation (3.0 cr)
EEB 4814 - Plant Community Ecology (4.0 cr)
EEB 4842 - Arctic Field Ecology (4.0 cr)
EEB 5122W - Plant Interactions with Animals and Microbes, WI (3.0 cr)
PBIO 4321 - Minnesota Flora (3.0 cr)
PBIO 4404 - Developmental Plant Anatomy (3.0 cr)
PBIO 4511 - Flowering Plant Diversity (3.0 cr)

PBIO 5416 - Plant Morphology, Development, and Evolution (4.0 cr)
Take 1 or more course(s) from the following:
BIOC 501W - Advanced Metabolism and Its Regulation, WI (3.0 cr)
PBIO 4516W - Plant Cell Biology: Writing Intensive, WI (3.0 cr)
PBIO 5301 - Plant Genomics (3.0 cr)
PBIO 5412 - Plant Physiology (3.0 cr)
PBIO 5514 - Plant Molecular Biology (3.0 cr)
PBIO 5516 - Plant Cell Biology (3.0 cr)

Other statistics or mathematics electives must be approved by an adviser.
Take 1 or more course(s) from the following:
STAT 3011 - Introduction to Statistical Analysis, MATH (4.0 cr)
STAT 3021 - Introduction to Probability and Statistics (3.0 cr)

Elective Labs
Any 38xx or 48xx CBS plant or algal biology course offered at the Lake Itasca Forestry and Biological station may be used to fulfill the lab/field requirement. BIOL 3002 and 3005W or BIOL 3007W may be used to meet a laboratory/field requirement if not used for Sequence A or B. Lab courses taken for Sequence A or B may be used toward the lab/field requirement.
Take 2 or more course(s) from the following:
BIOC 4025 - Laboratory in Biochemistry (2.0 cr)
BIOC 4125 - Laboratory in Molecular Biology and Biotechnology (3.0 cr)
BIOC 4794W - Directed Research: Writing Intensive, WI (1.0-6.0 cr)
BIOC 4994 - Directed Research (1.0-6.0 cr)
EEB 4014 - Ecology of Vegetation (3.0 cr)
EEB 4016W - Ecological Biogeography, WI (3.0 cr)
EEB 4405 - Limnology Laboratory (1.0 cr)
EEB 4407 - Plankton Ecology (4.0 cr)
EEB 4794W - Directed Research: Writing Intensive, WI (1.0-6.0 cr)
EEB 4842 - Arctic Field Ecology (4.0 cr)
EEB 4994 - Directed Research (1.0-6.0 cr)
EEB 5013 - Quaternary Plant Macrofossils (2.0 cr)
GCD 4015 - Genetics Laboratory (2.0 cr)
GCD 4025 - Cell Biology Laboratory (2.0 cr)
GCD 4794W - Directed Research: Writing Intensive, WI (1.0-6.0 cr)
GCD 4994 - Directed Research (1.0-6.0 cr)
MICB 3301 - Biology of Microorganisms (5.0 cr)
MICB 4215 - Advanced Laboratory: Microbial Physiology and Diversity (3.0 cr)
MICB 4235 - Advanced Laboratory: Virology, Immunology, and Microbial Genetics (3.0 cr)
MICB 4794W - Directed Research: Writing Intensive, WI (1.0-7.0 cr)
MICB 4994 - Directed Research (1.0-7.0 cr)
NSCI 4994 - Directed Research (1.0-7.0 cr)
NSCI 4794W - Directed Research: Writing Intensive, WI (1.0-7.0 cr)
PBIO 4321 - Minnesota Flora (3.0 cr)
PBIO 4404 - Developmental Plant Anatomy (3.0 cr)
PBIO 4511 - Flowering Plant Diversity (3.0 cr)
PBIO 4794W - Directed Research: Writing Intensive, WI (1.0-6.0 cr)
PBIO 4994 - Directed Research (1.0-6.0 cr)
PBIO 5416 - Plant Morphology, Development, and Evolution (4.0 cr)

Plant Biology Minor

Requirements for this program are current for Fall 2006. Required credits in this minor: 10.

Plant biologists study all aspects of biology as they pertain to plants or fungi and make important contributions to analyzing and preserving biodiversity worldwide. They work to enhance the nutritional value of crops as well as their resistance to disease, pests, and drought while working to reduce the need for pesticides, fertilizer, and irrigation.
Admission Requirements

For information about University of Minnesota admission requirements, visit the Office of Admissions Web site at http://admissions.tc.umn.edu.

Program Requirements

The plant biology minor is available to CBS students pursuing one of the other college majors. It is also available to non-CBS students. Students must take all courses A-F and earn at least a C- in all courses used for the minor.

Students who wish to declare a minor in plant biology should call the director of undergraduate studies for plant biology at 612-624-3499.

Required Courses

Minor Courses

*Take 10 or more credit(s) from the following:*

- BIOL 3002 - Plant Biology: Function (2.0 cr)
- BIOL 3005W - Plant Function Laboratory, WI (2.0 cr)
- BIOL 3007W - Plant Biology: Diversity and Adaptation, WI (4.0 cr)
- PBIO 4321 - Taxonomy of Minnesota Flora (3.0 cr)
- PBIO 4404 - Developmental Plant Anatomy (3.0 cr)
- PBIO 4511 - Flowering Plant Diversity (3.0 cr)
- PBIO 4516W - Plant Cell Biology: Writing Intensive, WI (3.0 cr)
- PBIO 4801 - Plains and Boreal Flora (4.0 cr)
- PBIO 4811 - Flowering Plant Systematics (3.0 cr)
- PBIO 5301 - Plant Genomics (3.0 cr)
- PBIO 5412 - Plant Physiology (3.0 cr)
- PBIO 5416 - Plant Morphology, Development, and Evolution (4.0 cr)
- PBIO 5514 - Plant Molecular Biology (3.0 cr)
- PBIO 5516 - Plant Cell Biology (3.0 cr)