Duluth Campus

Biology B.S.

Biology

Swenson College of Science and Engineering

- Program Type: Baccalaureate
- Requirements for this program are current for Fall 2017
- Required credits to graduate with this degree: 120
- Required credits within the major: 80 to 89
- Degree: Bachelor of Science

The BS in biology offers preparation for graduate school and a sound basis for professional training in biological and health sciences. Biology is a broad field, and students can tailor their programs to fit personal interests or career aspirations.

The two subplans: genetics, cell and development, & ecology, evolution and behavior, are the two major emphases in the study and practice of biology and choice of upper division electives gives students the flexibility to further focus their degree programs.

The Department of Biology encourages students to develop as active scholars and to participate in undergraduate research. The degree involves faculty from multiple departments in the Swenson College of Science and Engineering and the UM Medical School.

Program Delivery

This program is available:

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

Admission Requirements

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

General Requirements

The Board of Regents, on recommendation of the faculty, grants degrees from the University of Minnesota. Requirements for an undergraduate degree from University of Minnesota Duluth include the following:

1. Students must meet all course and credit requirements of the departments and colleges or schools in which they are enrolled including an advanced writing course. Students seeking two degrees must fulfill the requirements of both degrees. However, two degrees cannot be awarded for the same major.
2. Students must complete all requirements of the Liberal Education Program.
3. Students must complete a minimum of 120 semester credits.
4. At least 30 of the last 60 degree credits earned immediately before graduation must be awarded by UMD.
5. Students must complete at least half of their courses at the 3xxx-level and higher at UMD. Study-abroad credits earned through courses taught by UM faculty and at institutions with which UMD has international exchange programs may be used to fulfill this requirement.
6. If a minor is required, students must take at least three upper division credits in their minor field from UMD.
7. The minimum cumulative UM GPA required for graduation will be 2.00 and will include only University of Minnesota coursework. A minimum UM GPA of 2.00 is required in each UMD undergraduate major and minor. No academic unit may impose higher grade point standards to graduate.
8. Diploma, transcripts, and certification will be withheld until all financial obligations to the University have been met.

Program Requirements

1. A minor or second major from another area of study outside the Department of Biology with the exception of the natural history minor.

This schedule presupposes placement into BIOL 1013, CHEM 1153, 1154 which require the prerequisites of high school chemistry and a math ACT of 24 or college algebra; and calculus I which requires the prerequisite of a math ACT of 27 or precalculus.

Biology BS Core Requirements (15 cr)

BIOL 1013 *{Inactive}*[NAT SCI] (5.0 cr)
BIOL 1012 - General Biology II [SUSTAIN] (5.0 cr)

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BIOL 2201 - Genetics (3.0 cr)
BIOL 3987 - Communication in Biology (2.0 cr)

Courses From Other Programs (30 cr)
Advanced Writing
BIOL 3011 can count toward Biology SBE electives if there has been a previous completion of either WRIT 3150 or BIOL 3011.
WRIT 3150 - Advanced Writing: Science (3.0 cr)
or BIOL 3011 - Writing for the Duluth Journal of Undergraduate Biology (3.0 cr)
Calculus I
MATH 1290 - Calculus for the Natural Sciences [LE CAT2, LOGIC & QR] (5.0 cr)
or MATH 1296 - Calculus I [LE CAT, LOGIC & QR] (5.0 cr)
Chemistry I and II with labs
CHEM 1153 - General Chemistry I [LE CAT, NAT SCI] (4.0 cr)
CHEM 1154 - General Chemistry Lab I [LE CAT, NAT SCI] (1.0 cr)
CHEM 1155 - General Chemistry II (4.0 cr)
CHEM 1156 - General Chemistry Lab II (1.0 cr)
Organic Chemistry with lab
CHEM 2541 - Organic Chemistry I (3.0 cr)
CHEM 2543 - Organic Chemistry I Laboratory (1.0 cr)
Physics I
Physics I course
PHYS 1001 - Introduction to Physics I [LE CAT, NAT SCI] (5.0 cr)
or PHYS 2013 - General Physics I [LE CAT, NAT SCI] (4.0 cr)
or PHYS 2017 - Honors: General Physics I [NAT SCI] (4.0 cr)
Physics I lab
Students who take PHYS 2013 or 2017 MUST take PHYS 2014 to complete the Physics I requirement.
Students who take PHYS 1001 DO NOT have to take PHYS 2014.
PHYS 2014 - General Physics Lab I [NAT SCI] (1.0 cr)
Statistics
Take 3 or more credit(s) from the following:
•STAT 2xxx
•STAT 3xxx
•STAT 4xxx
•STAT 5xxx

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

Ecology, Evolution and Behavior
Students in the ecology, evolution, and behavior (EEB) sub-plan study the origin and maintenance of biodiversity and the interrelationship or organisms with each other and their physical environment. It prepares students for a wide range of careers including teaching, working on environmental problems for government agencies an industry, and for research positions at university and other institutions. It also provides excellent preparation for graduate school or professional programs including medicine and veterinary medicine. Student in the EEB sub-plan will choose from electives in the ecology, evolution, and behavior and diversity and taxonomy categories. These courses include inquiry based activities that explore the ecology, evolution and behavior of the diversity of life from microbes to moose.

Ecology, Evolution, & Behavior Core Courses (11 cr)
BIOL 2801 - General Ecology (3.0 cr)
BIOL 3401 - Evolution (3.0 cr)
BIOL 2110 - Cell and Molecular Biology (3.0 cr)
or BIOL 3100 - Cell Biology (3.0 cr)
BIOL 2102 - Cell Biology Laboratory (2.0 cr)
or BIOL 2202 - Genetics Laboratory (2.0 cr)
or BIOL 2802 - Ecology Laboratory (2.0 cr)
Chemistry Reqirements (3 - 4 cr)
CHEM 2212 - Environmental Chemistry [NAT SCI, SUSTAIN] (4.0 cr)
or GEOL 3710 *{Inactive}*(3.0 cr)
or CHEM 2222 - Quantitative Analysis (3.0 cr)
with CHEM 2223 - Quantitative Analysis Laboratory (1.0 cr)
or CHEM 2542 - Organic Chemistry II (3.0 cr)
with CHEM 2544 - Organic Chemistry II Laboratory (1.0 cr)
Quantitative Reasoning Requirement (3 -5 cr)
BIOL 4201, 5203 and 5809 can only be used if not taken for upper division biology credit.

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Take 1 or more course(s) from the following:
- BIOL 4201 - Leverage bioinformatic tools to manage big data and answer primary biology questions (3.0 cr)
- BIOL 5201 - Leverage bioinformatic tools to manage big data and answer primary biology questions (3.0 cr)
- BIOL 5809 - Ecological Statistics (3.0 cr)
- CS 1121 - Introduction to Programming in Visual BASIC.NET [LE CAT, LOGIC & QR] (3.0 cr)
- CS 1141 *{Inactive}*(3.0 cr)
- CS 1411 - Introduction to Programming in Matlab (4.0 cr)
- MATH 1297 - Calculus II [LOGIC & QR] (5.0 cr)
- MATH 5233 - Mathematical Foundations of Bioinformatics (3.0 cr)
- STAT 3612 - Introduction to Probability and Statistics II (3.0 cr)
- STAT 4060 - Introduction to Biostatistics (3.0 cr)
- STAT 5411 - Analysis of Variance (3.0 cr)
- **Physics II**

Physics II course

PHYS 1002 - Introduction to Physics II (5.0 cr)
or PHYS 2015 - General Physics II (4.0 cr)
or PHYS 2018 - Honors General Physics II (4.0 cr)

Physics II lab

Students who take PHYS 2015 or 2018 MUST take PHYS 2016 to complete the Physics I requirement.
Students who take PHYS 1002 DO NOT have to take PHYS 2016.
PHYS 2016 - General Physics Lab II (1.0 cr)

Upper Division Biology BS Electives (18 cr)

Must include at least 2 courses 4xxx or above and 3 laboratory courses.

Take 18 or more credit(s) from the following categories; a combination of credits are needed from both required electives - parts A and B. Supplemental biology electives may be used to complete the outstanding credits toward the total credits needed.

Required Electives - Part A

Courses must be from at least 2 different categories.

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

Diversity and Taxonomy (DT)

All courses in this list carry a lab component.

Take 1 or more course(s) from the following:
- BIOL 3502 - General Microbiology (4.0 cr)
- BIOL 3601 - Plant Diversity (3.0 cr)
- BIOL 3603 - Plant Taxonomy (3.0 cr)
- BIOL 3701 - Animal Diversity (4.0 cr)
- BIOL 4731 - Entomology (3.0 cr)
- BIOL 4761 - Ichthyology (3.0 cr)
- BIOL 4763 - Ornithology (3.0 cr)
- BIOL 4764 - Mammalogy (3.0 cr)
- BIOL 5515 - Microbial Diversity and Phylogeny (3.0 cr)
- **Ecology, Evolution and Behavior (EEB)**

BIOL 3761, 3811, 4839, and 5833 carry a lab component.

Take 1 or more course(s) from the following:
- BIOL 3402 *{Inactive}*(1.0 cr)
- BIOL 3760 - Marine Biology (3.0 cr)
- BIOL 3761 - Field Studies in Marine Biology (4.0 cr)
- BIOL 3811 *{Inactive}*(4.0 cr)
- BIOL 3830 *{Inactive}*(3.0 cr)
- BIOL 3835 - Freshwater Ecology (3.0 cr)
- BIOL 4201 - Leverage bioinformatic tools to manage big data and answer primary biology questions (3.0 cr)
- BIOL 4233 *{Inactive}*(3.0 cr)
- BIOL 4818 - Biotic Response to Climate Change (3.0 cr)
- BIOL 4839 - Coral Reef Field Studies [GLOBAL PER] (3.0 cr)
- BIOL 4850 - Food and Humans (3.0 cr)
- BIOL 4891 - Animal Behavior (3.0 cr)
- BIOL 4992 - Senior Seminar: Classic Readings in Natural History (1.0 cr)
- BIOL 5201 - Leverage bioinformatic tools to manage big data and answer primary biology questions (3.0 cr)
- BIOL 5240 - Ecological Genetics (3.0 cr)
- BIOL 5777 *{Inactive}*(2.0 cr)
- BIOL 5801 - Microbial Ecology (2.0 cr)
- BIOL 5805 - Fisheries Ecology and Management (3.0 cr)

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•BIOL 5808 *{Inactive}*(3.0 cr)
•BIOL 5809 - Ecological Statistics (3.0 cr)
•BIOL 5818 - Biotic Response to Climate Change (3.0 cr)
•BIOL 5833 - Stream Ecology (3.0 cr)
•BIOL 5861 - Lake Ecology (3.0 cr)
•BIOL 5865 - Conservation Biology (2.0 cr)
•BIOL 5870 - Wetland Ecology (3.0 cr)

Required Electives - Part B

Take 1 or more course(s) from the following:

Anatomy, Morphology, Physiology (AMP)

All courses except BIOL 5772 carry a lab component.

Take 0 or more course(s) from the following:
•BIOL 3703 - Animal Physiology (3.0 cr)
•BIOL 3771 - Human Anatomy (4.0 cr)
•BIOL 3772 - Human Physiology (4.0 cr)
•BIOL 4199 - Frontiers in Cell Biology (3.0 cr)
•BIOL 4604 - Plant Physiology (4.0 cr)
•BIOL 5772 - Neural Systems and Behavior (3.0 cr)

•**Cell Biology (CELL)**

BIOL 4361 and 5232 carry a lab component.

Take 0 or more course(s) from the following:
•BIOL 3100 - Cell Biology (3.0 cr)
•BIOL 3101 - Molecular Biology of Cancer (3.0 cr)
•BIOL 3102 - Cell Biology of Human Disease (3.0 cr)
•BIOL 3301 - Patterning the Embryo (3.0 cr)
•BIOL 3512 - Biology of HIV and AIDS (3.0 cr)
•BIOL 4199 - Frontiers in Cell Biology (3.0 cr)
•BIOL 4231 - Molecular Biology (3.0 cr)
•BIOL 4361 - Developmental Biology (3.0 cr)
•BIOL 4511 - Medical Microbiology (3.0 cr)
•BIOL 4631 *{Inactive}*(3.0 cr)
•BIOL 4232 - Molecular Biology Laboratory (2.0 cr)
•BIOL 5511 *{Inactive}*(3.0 cr)
•BMS 5545 - Immunology (3.0 cr)

•**Supplemental Biology Electives (SBE) (Optional)**

These courses can be used as additional electives only if they have not been used in the core. 2 cr of SSP 3002 TA Practicum (in Biology) may be substituted for BIOL 3993 as an upper division elective with departmental approval. A maximum of 2 cr of BIOL 3993, a maximum of 4 cr of BIOL 3994 and a maximum of 1 cr BIOL 3996 may be applied to the degree. BIOL 2102, 2202 and 2802 carry a lab component. BIOL 3011 can count if there has been a previous completion of either WRIT 3150 or BIO 3011.

Take 0 or more course(s) from the following:
•BIOL 2102 - Cell Biology Laboratory (2.0 cr)
•BIOL 2202 - Genetics Laboratory (2.0 cr)
•BIOL 2802 - Ecology Laboratory (2.0 cr)
•BIOL 3001 *{Inactive}*(3.0 cr)
•BIOL 3011 - Writing for the Duluth Journal of Undergraduate Biology (3.0 cr)
•BIOL 3993 - Laboratory Teaching Experience (1.0 - 2.0 cr)
•BIOL 3994 - Undergraduate Research (1.0 - 3.0 cr)
•BIOL 3996 - Internship in Biology (1.0 - 2.0 cr)
•BIOL 5001 - Teaching and Learning in the Life Sciences (1.0 cr)

Genetics, Cell and Development

The genetics, cell and development (GCD) subplan prepares students for graduate school and careers in cell biology, genetics, developmental biology, physiology, immunology, biotechnology, molecular biology and microbiology. It is also designed to prepare students for application to professional schools including medicine, dentistry, pharmacy and veterinary medicine. Students in the GCD sub-plan will choose at least 3 CELL electives exploring the structure and function of cells. Students will also incorporate courses from other elective categories to tailor their degrees to meet their goals.

Core Courses (13 cr)

BIOL 3100 - Cell Biology (3.0 cr)
BIOL 4231 - Molecular Biology (3.0 cr)
BIOL 4232 - Molecular Biology Laboratory (2.0 cr)
BIOL 2102 - Cell Biology Laboratory (2.0 cr)
or BIOL 2202 - Genetics Laboratory (2.0 cr)
BIOL 2410 - Ecology and Evolution (3.0 cr)

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or BIOL 3401 - Evolution (3.0 cr)

Upper Division Biology BS Electives (14 cr)

Must include at least 1 course 4xxx or above and 1 laboratory course.

Take 14 or more credit(s) from the following categories. Additional required electives or optional electives may be used to complete the outstanding credits toward the total credits needed.

Required Electives

Courses must be from at least 2 of the 3 categories.

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

Cell Biology (CELL)

BIOL 4361 and 5232 carry a lab component.

Take 0 or more course(s) from the following:

- BIOL 3512 - Biology of HIV and AIDS (3.0 cr)
- BIOL 3101 - Molecular Biology of Cancer (3.0 cr)
- BIOL 3102 - Cell Biology of Human Disease (3.0 cr)
- BIOL 3301 - Patterning the Embryo (3.0 cr)
- BIOL 4199 - Frontiers in Cell Biology (3.0 cr)
- BIOL 4361 - Developmental Biology (3.0 cr)
- BIOL 4511 - Medical Microbiology (3.0 cr)
- BIOL 4631 *{Inactive}*(3.0 cr)
- BIOL 4232 - Molecular Biology Laboratory (2.0 cr)
- BIOL 5511 *{Inactive}*(3.0 cr)
- BMS 5545 - Immunology (3.0 cr)

- **Anatomy, Morphology, Physiology (AMP)**

All courses except BIOL 5772 carry a lab component.

Take 0 or more course(s) from the following:

- BIOL 3703 - Animal Physiology (3.0 cr)
- BIOL 3771 - Human Anatomy (4.0 cr)
- BIOL 3772 - Human Physiology (4.0 cr)
- BIOL 4604 - Plant Physiology (4.0 cr)
- BIOL 5772 - Neural Systems and Behavior (3.0 cr)

- **Diversity and Taxonomy (DT)**

All courses in this category carry a lab component.

Take 0 or more course(s) from the following:

- BIOL 3502 - General Microbiology (4.0 cr)
- BIOL 3601 - Plant Diversity (3.0 cr)
- BIOL 3603 - Plant Taxonomy (3.0 cr)
- BIOL 3701 - Animal Diversity (4.0 cr)
- BIOL 4731 - Entomology (3.0 cr)
- BIOL 4761 - Ichthyology (3.0 cr)
- BIOL 4763 - Ornithology (3.0 cr)
- BIOL 4764 - Mammalogy (3.0 cr)
- BIOL 5515 - Microbial Diversity and Phylogeny (3.0 cr)

Optional Electives

Courses in the following two categories may be used to complete the outstanding credits towards the 14 total credits needed.

Take 0 or more course(s) from the following:

Ecology, Evolution and Behavior (EEB)

BIOL 3761, 3811, and 4839 carry a lab component.

Take 0 or more course(s) from the following:

- BIOL 3401 - Evolution (3.0 cr)
- BIOL 3402 *{Inactive}*(1.0 cr)
- BIOL 3760 - Marine Biology (3.0 cr)
- BIOL 3761 - Field Studies in Marine Biology (4.0 cr)
- BIOL 3811 *{Inactive}*(4.0 cr)
- BIOL 3830 *{Inactive}*(3.0 cr)
- BIOL 3835 - Freshwater Ecology (3.0 cr)
- BIOL 4201 - Leverage bioinformatic tools to manage big data and answer primary biology questions (3.0 cr)
- BIOL 4233 *{Inactive}*(3.0 cr)
- BIOL 4818 - Biotic Response to Climate Change (3.0 cr)
- BIOL 4839 - Coral Reef Field Studies [GLOBAL PER] (3.0 cr)
- BIOL 4850 - Food and Humans (3.0 cr)
- BIOL 4891 - Animal Behavior (3.0 cr)

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- BIOL 4992 - Senior Seminar: Classic Readings in Natural History (1.0 cr)
- BIOL 5201 - Leverage bioinformatic tools to manage big data and answer primary biology questions (3.0 cr)
- BIOL 5240 - Ecological Genetics (3.0 cr)
- BIOL 5777 *{Inactive}*(2.0 cr)
- BIOL 5801 - Microbial Ecology (2.0 cr)
- BIOL 5805 - Fisheries Ecology and Management (3.0 cr)
- BIOL 5808 *{Inactive}*(3.0 cr)
- BIOL 5809 - Ecological Statistics (3.0 cr)
- BIOL 5818 - Biotic Response to Climate Change (3.0 cr)
- BIOL 5833 - Stream Ecology (3.0 cr)
- BIOL 5861 - Lake Ecology (3.0 cr)
- BIOL 5865 - Conservation Biology (2.0 cr)
- BIOL 5870 - Wetland Ecology (3.0 cr)

•Supplemental Biology Electives (SBE)

These courses can be used as additional electives only if they have not been used in the core. 2 cr of SSP 3002 TA Practicum (in Biology) may be substituted for BIOL 3993 as an upper division elective with departmental approval. A maximum of 2 cr BIOL 3993, a maximum of 4 cr BIOL 3994 and a maximum of 1 cr BIOL 3996 may be applied to the degree. BIOL 2102, 2202 and 2802 carry a lab component. BIOL 3011 can count if there has been a previous completion of either WRIT 3150 or BIO 3011.

Take 0 or more course(s) from the following:

- BIOL 2102 - Cell Biology Laboratory (2.0 cr)
- BIOL 2202 - Genetics Laboratory (2.0 cr)
- BIOL 2802 - Ecology Laboratory (2.0 cr)
- BIOL 3001 *{Inactive}*(3.0 cr)
- BIOL 3011 - Writing for the Duluth Journal of Undergraduate Biology (3.0 cr)
- BIOL 3993 - Laboratory Teaching Experience (1.0 - 2.0 cr)
- BIOL 3994 - Undergraduate Research (1.0 - 3.0 cr)
- BIOL 3996 - Internship in Biology (1.0 - 2.0 cr)
- BIOL 5001 - Teaching and Learning in the Life Sciences (1.0 cr)

Courses Required From Other Programs (13 - 17 cr)

Biochemistry

CHEM 3322 - Biochemistry (3.0 cr)
CHEM 3324 - Biochemistry Laboratory (1.0 cr)
or CHEM 4351 - Biochemistry I (3.0 cr)
CHEM 4352 - Biochemistry II (3.0 cr)
CHEM 4363 - Biochemistry Laboratory (2.0 cr)

Organic Chemistry II with lab

CHEM 2542 - Organic Chemistry II (3.0 cr)
CHEM 2544 - Organic Chemistry II Laboratory (1.0 cr)

Physics II

Physics I course

PHYS 1002 - Introduction to Physics II (5.0 cr)
or PHYS 2015 - General Physics II (4.0 cr)
or PHYS 2018 - Honors General Physics II (4.0 cr)

Physics II lab

Students who take PHYS 2015 or 2018 MUST take PHYS 2016 to complete the Physics I requirement.
Students who take PHYS 1002 DO NOT have to take PHYS 2016.
PHYS 2016 - General Physics Lab II (1.0 cr)

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