

Upper-Division Courses

Admission to 300-level or above courses requires successful completion of the prerequisites.

Major-Minor Status

Completed change of major forms along with college transcripts must be turned in to the department when declaring computer science as a major or minor.

Special Degree Requirements

To locate graduation requirements in addition to those of the Computer Science Department, see "graduation requirements" in the index of this catalog.

Bachelor of Science degree with a major in Computer Science

A B.S. degree in computer science requires completion of the following requirements with at least a "C-" in each course (2.00 grade point average required):

Computer Science Core Courses. CSCI 106 (CS 121), CSCI 135-136 (CS 131-132), CSCI 232 (CS 241), CSCI 205 (CS 242), CSCI 361 (CS 281), CSCI 332 (CS 332), CSCI 323 (CS 346), CSCI 315E (CS 415E), CSCI 426 (CS 441), and CSCI 427 (CS 442).

Every major must choose either the Professional track or the Interdisciplinary track.

Professional Track Requirements. Eighteen credits of CSCI (CS) electives selected from courses numbered 300 and above.

Interdisciplinary Track Requirements:

- Six credits of CSCI (CS) electives selected from courses numbered 300 and above.
- In addition, students must complete all requirements for a minor or additional major in any field other than computer science. This minor or additional major must include at least twelve credits at the 200-level or above.

Mathematics. M 171-172, 221 or 325, 225 & STAT 341 (MATH 152-153, 221 or 325, 225, and 341).

Writing/Communication. Students must take a University approved lower-division writing course. Students must also take COMX 111A or COMX 242 (COMM 111A or COMM 242).

Science. Students must take one of the sequences BIOB 170N-171N, 160N (BIOL 108N-109N, 110N); CHMY 141N, 143N (CHEM 161N, 162N); or PHSX 215N/216N and PHSX 217N/218N (PHYS 211N/213N and 212N/214N).

Students also must take two additional courses selected from the following list (two numbers separated by a / means that the second number is a lab for the first and the two together only count as one course for this requirement):

- ASTR 131N/134N, ASTR 132N/135N
- BIOM 250N/251N (BIOL 106N/107N), BIOB 170N/171N (BIOL 108N/109N), BIOB 160N (BIOL 110N)
- CHMY 141N, 143N (CHEM 161N, CHEM 162N)
- FOR 201
- GEO 101N, 102N (GEOS 100N/101N), GEO 226 (GEOS 226)
- PHSX 215N/216N (PHYS 211N/213N), PHSX 217N/218N (PHYS 212N/214N), PHSX 343 (PHYS 341), PHSX 444 (PHYS 444)

NOTE: 100-level CSCI (CS) courses other than CSCI 106 (CS 121), CSCI 135-136 (CS 131-132), and 200-level CSCI (CS) courses other than CSCI 205 (CS 242) and CSCI 232 (CS 241) do not count toward the degree or track requirements. However, they do count in the 60 credit limit in the major.

Upper-division Writing Expectation

Upper-division Writing Expectation for Computer Science majors is CSCI 315E (CS 415E).

Social Science, Humanities, Arts and Other Disciplines

Students must take 30 credits in social science, humanities, arts or disciplines other than computer science, mathematics and science. The courses taken to meet the Writing/Communication requirement can also count towards this requirement.

Bachelor of Science degree with a combined major in Computer Science-Mathematical Sciences

The purpose for the combined program is to provide a thorough background in both allied disciplines and to inculcate a deeper understanding of their goals and methods. A student must complete 60 credits in the two disciplines: 30 of these credits in computer science courses and 30 of these credits in mathematical sciences courses. A minimum grade of "C-" and a 2.0 grade point average is required in all courses which follow:

The computer science requirements are: CSCI 106, 135-136, 205, 232, 361, 332 (CS 121, 131-132, 242, 241, 281, 332), and nine credits of CSCI (CS) electives selected from courses numbered 300 and above. A total of at most three of the nine credits of CSCI (CS) electives may be in CSCI 398 or 498 (CS 398 or 498).

The mathematical sciences requirements are: M 171 (or 181), 172 (or 182), 221, 273, 307 (or 225) (MATH 152, 153, 221, 251, 305 (or 225)), and twelve credits of mathematical sciences electives selected from the following list: M 311, 325, 326, 361, 362, 381, 412, 414, 429, 431, 432, 439, 440, 445, 472, 473, 485 and STAT 341, 421, 422, 451, 452 (MATH 311, 325, 326, 341, 351, 381, 382, 406, 412, 414, 421, 422, 431, 441, 442, 444, 445, 451, 452, 471, 475, 485).

The combined nine additional credits of computer science electives and twelve additional credits of mathematical sciences electives must include at least three 3- or 4-credit courses numbered 400 or above, with at least one chosen from each department (not including M 429 (MATH 406), STAT 451 and 452 (MATH 444, and 445)).

Other requirements are: One of the sequences BIOB 160N,170N, 171N (BIOL 110N, 108N-109N); or CHMY 141N, 143N (CHEM 161N, 162N); or PHSX 215N/216N and 217N/218N (PHYS 211N/213N and 212N/214N). In addition, a university approved lower-division writing course, and either COMX 111A or COMX 242 (COMM 111A or COMM 242).

Each student plans a program in consultation with a computer science and a mathematical sciences advisor. Students planning to attend graduate school in computer science or the mathematical sciences should consult with their respective advisors.

The upper-division writing requirement is one of the following: CSCI 315E (CS 415E), M 429 (MATH 406), any other approved General Education upper-division writing course, or a senior thesis (CSCI 499 (CS 499) or M 499 (MATH 499)).

Suggested Curricula:

Applied Math-Scientific Programming: M 311, 412, 414 (MATH 311, 412, 414), and one course chosen from STAT 341 (MATH 341), M 381, 473, 472, 440 (MATH 351, 451, 452, 471). Three courses chosen from CSCI 441, 444, 460, and 477 (CS 446, 486, 344 and 477).

Combinatorics and Optimization-Artificial Intelligence: M 361, 362 (MATH 381, 382); two courses chosen from M 325, 414, 485, and STAT 341 (MATH 325, 414, 485, 341); and CSCI 460, 446 and 447 (CS 344, 455, and 457).

Statistics-Machine Learning: STAT 341, 421 (MATH 341, 441), and two courses chosen from M 325, 362, 485, and STAT 422 (MATH 325, 382, 485, 442); three courses chosen from CSCI 340, 446, 447, 451, and 444 (CS 365, 455, 457, 458 and 486).

Algebra-Analysis: M 381, 431 (MATH 351, 421), and two courses chosen from M 326, 432, 473, 472 (MATH 326, 422, 451, 452); CSCI 460, 426 (CS 344, 441), and one other course.

Suggested Course of Study for Computer Science Major

First Year	A S
CSCI 106 (CS 121) Careers in Computer Science	1 -
CSCI 135-136 (CS 131-132) Fundamentals of Computer Science I, II	3 3

COMX 111A (COMM 111A) Introduction to Public Speaking	3	-
WRIT 101 (ENEX 101) College Writing I	-	3
M 171, 172 (MATH 152-153) Calculus I, II	4	4
Electives and General Education	3	6
Total	14	16
Second Year		
	A	S
CSCI 232 (CS 241) Data Structures and Algorithms	4	-
CSCI 205 (CS 242) Programming Languages w/C/C++	-	4
CSCI 323 (CS 346) Software Science	3	-
CSCI 361 (CS 281) Computer Architecture	-	3
M 225 (MATH 225) Discrete Math I	3	-
M 221 (MATH 221) Linear Algebra	-	4
Science sequence	5	5
Total	15	16
Third Year**		
	A	S
CSCI 332 (CS 332) Design/Analysis of Algorithms	-	3
CSCI (CS) track Courses and Electives*	3	6
STAT 341 (MATH 341) Introduction to Probability and Statistics	3	-
University approved lower-division writing course	-	3
Science Electives	3	3
Electives and General Education	6	-
Total	15	15
Fourth Year**		
	A	S
CSCI 315E (CS 415) Computers, Ethics, and Society***	3	-
CSCI 426 (CS 441) Adv Prgrmg Theory and Practice I	3	-
CSCI 427 (CS 442) Adv Prgrmg Theory and Practice II	-	3
CSCI (CS) track courses and electives*	3	6
Electives and General Education	6	6
Total	15	15

*Students completing the Interdisciplinary track may substitute CSCI elective courses or courses related to their Minor or Additional Major in Another field.

**CSCI (CS) core courses at the 300- and 400-level may not always be offered in the sequence shown but will be offered every year.

***Students must pass the upper-division writing proficiency assessment and a university approved lower-division writing course before taking CSCI 315E (CS 415E).

Requirements for a Minor

There are two minors offered by the Department of Computer Science: the traditional minor in computer science emphasizes computer programming and related skills, while the minor in computer applications emphasizes use of applications such as programming languages, word processors, spreadsheets, and data bases in the management and manipulation of electronic information.

Computer Science: To earn a minor in computer science the student must complete (with at least a "C-" in each course and a 2.00 grade average) 18 CS credits including:

1. CSCI 135-136 (CS 131-132) (6 credits).
2. 12 credits of elective courses chosen from CS 181, CSCI 100, 250, 232, 205, 361 (CS 101, 177, 181, 241, 242, 281) and courses numbered 300 and above with the restrictions: both CSCI 100 and 250 (CS 101 and 177) cannot be counted, and at least 6 credits of electives must be at the 300 level or above.
3. M 115 or M 121 and M 122 or M 151 (MATH 117 or Math 111 and MATH 112 or MATH 121)

Computer Applications: To earn a minor in computer applications, a student must complete (with at least a "C-" grade in each course and a 2.00 grade average) 21 CSCI (CS) credits including:

1. Either CSCI 100 (CS 101), CSCI 135 (CS 131) or both.
2. At least one and no more than three of CSCI 105 (CS 111), CAPP 171 (CS 171), CSCI 172 (CS 172), CSCI 250 (CS 177), and CS 181.
3. Remaining courses must be selected from CSCI 135-136 (CS 131-132), CSCI 232 (CS 241), CSCI 205 (CS 242), CSCI

444 (CS 486), other CS major courses, pre-approved CSCI 191 (CS 195), CSCI 291 (CS 295), CSCI 391 (CS 395), or CSCI 491 (CS 495) special topics courses, or up to six credits of pre-approved classes outside the department.

Courses

R- before the course description indicates the course may be repeated for credit to the maximum indicated after the R. Credits beyond this maximum do not count toward a degree.

Computer Science (CSCI) - Course Descriptions

100, 104, 105, 106, 135, 136, 172, 181, 191, 192, 198, 205, 216E, 232, 250, 291, 292, 298, 315E, 323, 332, 340, 361, 390, 391, 392, 394, 398, 411, 426, 427, 438, 441, 443, 444, 446, 447, 448, 451, 460, 466, 473, 477, 478, 490, 491, 492, 494, 498, 499, 511, 512, 521, 531, 541, 542, 548, 555, 557, 558, 565, 573, 576, 577, 578, 580, 594, 595, 596, 597, 598, 599

Faculty

Professors

Ray Ford, Ph.D., University of Pittsburgh, 1980

Joel E. Henry, Ph.D., Virginia Polytechnic Institute and State University, 1993

Jesse V. Johnson, Ph.D., University of Maine, Orono, 2002

Yolanda J. Reimer, Ph.D., University of Oregon, 2002 (Chair)

Associate Professor

Min Chen, Ph.D., Florida International University, Miami, 2007

Assistant Professor

Doug Raiford, Ph.D., Wright State University, Dayton, Ohio, 2008

Research Professor

Alden H. Wright, Ph.D., University of Wisconsin, 1969

Lecturer

Mike O'Conner, M.S., University of Montana, 1996

Michael Cassens, M.S. University of Montana, 2003

College of Arts and Sciences

Christopher M. Comer, Dean

Jenny McNulty, Associate Dean

S. Melanie Hoell, Director of Advising

Homepage: www.cas.umt.edu

The College of Arts and Sciences is the intellectual core of The University of Montana. We fulfill the central purpose for which the University was chartered in 1893: To provide a liberal education and integrated knowledge of the humanities and the sciences.

A liberal arts education gives students the means to think broadly and test the value of diverse ideas, beliefs and facts. It empowers them to continue the learning process throughout life. By studying the ways of thinking and expression that are characteristic of the, humanities, and the social and natural sciences, students will be educated citizens. They are enabled to think critically about scientific methods and findings, social analysis, creativity in the arts and humanities, aesthetics and values. Equally important is effective expression of one's understandings. Clear thinking, cogent expression, and solid values provide the foundation of successful careers.

A particular strength of the College is the breadth of its disciplines and programs. This breadth makes possible a varied and flexible curriculum that advances both general programs and specialized education on the undergraduate and graduate levels. Another strength is the quality of the faculty. Its members have a distinguished record of teaching, research and creation of new knowledge, and service to our communities. Their commitment to undergraduate liberal arts education is demonstrated by the quality of the graduates the College has produced. The pre professional education received here has enabled The University of Montana graduates to compete successfully for admission to graduate schools across the nation. A third strength of the College is its commitment to students as they pursue their academic studies at the University. This is reflected in close student/faculty relationships and in the continuous attention given by the College to the effect that policies, procedures, and administrative practices have on students' educational experience.

Biology

- Special Degree Requirements
- Suggested Course of Study
- Courses

The Division offers an undergraduate degree in biology that provides a solid foundation in core areas of the biological sciences and in supporting physical sciences and mathematics. Several options are provided within the biology degree. Options in cellular and molecular biology, ecology, organismal biology, field ecology, and human biological sciences allow specialization in biological subdisciplines and are appropriate background for certain employment opportunities and for continued graduate or professional study:

Cellular and molecular biology: For students interested in the cellular and molecular aspects of biology. This option is also appropriate for students interested in health-related professions.

Ecology and organismal biology: For students interested in the biology of organisms (plants and animals) and populations. This option is also appropriate for students interested in veterinary school.

Field ecology: For students interested in field-based ecology. Students with this option spend one or two summers at the Flathead Lake Biological Station.

Genetics and evolution: For students interest in all aspects of genetics, as well as evolutionary biology. This option is also appropriate for student interested in health-related professions.

Human biological sciences: Provides a strong background in the biological sciences for students interested in pursuing further study in a health sciences professional program.

Natural history: Designed especially for students wishing to combine basic natural history and biological sciences with another field such as art, journalism, or creative writing. Option is not suitable for students planning a traditional career in the biological sciences.

Teacher preparation in biology, Teacher preparation in general science: Two separate options designed for students interested in a career teaching biology or broad-field science at the secondary level.

High School Preparation: In addition to general University admission requirements, chemistry, mathematics through pre-calculus, and a modern foreign language are recommended.

Special Degree Requirements

Refer to graduation requirements listed previously in the catalog. See index.

Upper-Division Writing Expectation: To meet the Upper-Division Writing Expectation for the major, biology students must take two or three partial writing courses (either three 1/3 writing courses or one 2/3 writing course plus one 1/3 writing course). Courses that are approved as 2/3 partial writing include: BCH 486 (BIOC 486), BCH 499 (BIOC 499), BIOB 411 (MICB 411), BIOB 499 (BIOL 499), BIOE 371 (BIOL 341), BIOE 342 (BIOL 342), BIOH 462 (BIOL 460), BIOM 410 (MICB 404), and BIOM

499 (MICB 499). Courses that are approved as 1/3 partial writing include: BCH 482 (BIOC 482), BIOB 410 (MICB 410), BIOB 425 (BIOL 464), BIOE 403 (BIOL 403), BIOE 406 (BIOL 406), BIOE 428 (BIOL 366), BIOL 483, BIOL 484, BIOM 402 (MICB 412), BIOO 320 (BIOL 316), BIOO 434 (BIOL 445), BIOO 470 (BIOL 304), and BIOO 475 (BIOL 306).

Option in Cellular and Molecular Biology

Forty-four to forty-nine credits in biochemistry, biology, and microbiology including BCH 480-482 (BIOC 481-482); BIOB 160N (BIOL 110N), BIOB 170N-171N (BIOL 108N-109N), BIOB 260 (BIOL 221), BIOB 272 (BIOL 223), BIOB 301 (BIOL 301), BIOB 375, and BIOB 425 (BIOL 464); BIOM 360-361 (MICB 300-301); one course chosen from BIOB 410 (MICB 410) or BIOM 435 (MICB 420); one course chosen from BIOL 435, BIOB 440 (BIOL 440), BIOO 433/434 (BIOL 444/445), BIOB 468 (BIOL 468), BIOB 486, BIOL 483, BIOM 410 or 450 (MICB 404 or 450); and two lab courses chosen from BCH 486 (BIOC 486), BIOM 411 (MICB 405), BIOB 411 (MICB 411), BIOM 451 (MICB 451), or BIOM 490 (MICB 497). M 162 (MATH 150); CHMY 141N-143N, 221-222-223-224 (CHEM 161N-162N, 221-222-223-224); one course chosen from CHMY 311, 360, 373 (CHEM 341, 370, 371); PHSX 205N/206N-PHSX 207N/208N (PHYS 111N/113N, 112N/114N) are also required.

Option in Ecology and Organismal Biology

Forty-three credits in biology, biochemistry, and microbiology including BIOB 160N (BIOL 110N), BIOB 170N-171N (BIOL 108N-109N), BIOB 260 (BIOL 221), BIOB 272 (BIOL 223), BIOE 370-371 (BIOL 340-341); one organismal course chosen from BIOB 301 (BIOL 301), BIOB 375, BIOB 468 (BIOL 468), BIOE 403 (BIOL 403), BIOL 435, BIOO 433/434 (BIOL 444/445); one course with a focus on a group of organisms chosen from BIOO 470 (BIOL 304), BIOO 475 (BIOL 306), BIOO 340 (BIOL 308), BIOO 320 (BIOL 316), BIOO 335 (BIOL 350), BIOM 427-428 (BIOL 400-401), BIOO 462 (BIOL 410), BIOM 423 (BIOL 418), BIOM 360-361 (MICB 300-301); one ecology course chosen from BIOE 428 (BIOL 366), BIOE 449 (BIOL 430), BIOL 442, WILD 346 (BIOE/BIOL 446), BIOE 447 (BIOL 447), BIOE 448 (BIOL 448), BIOM 415 (MICB 422), WILD 470 (WBIO 470); one evolutionary biology course chosen from BIOE 404 (BIOL 405), BIOE 406 (BIOL 406), BIOB 480 (BIOL 480), BIOB 486, BIOE 482 (BIOL 482), BIOL 483, BIOL 484. Other recommended courses include BCH 380 or 480-482 (BIOC 380 or 481-482), BIOM 430 (MICB 423).

Also required: M 162 (MATH 150) or M 171 (MATH 152); one semester of statistics STAT 216 (MATH 241) or a full year of statistics STAT 451-457;452-458 (MATH 444-447, 445-448); one year of chemistry CHMY 121N, 123N-124N (CHEM 151N, 152N-154N) or two years of chemistry CHMY 141N, 143N, 221-222, 223-224 (CHEM 161N, 162N, 221-223, 222-224); PHSX 205N/206N-PHSX 207N/208N (PHYS 111N/113N, 112N/114N).

Option in Field Ecology

Forty-three credits in biology and microbiology including BIOB 160N (BIOL 110), BIOB 170N-171N (BIOL 108N-109N), BIOB 260 (BIOL 221), BIOB 272 (BIOL 223), BIOL 342 or BIOE 370-371 (BIOL 340/341). Choose FLBS courses from the Aquatic Emphasis, BIOL 451, 453, 454, 452, 492; or the Terrestrial Emphasis, BIOL 451, 458, 459, 452, 492. Choose an additional 8 credits of upper division Biology or Microbiology, with at least one from each category: course with a focus on a group of organisms from BIOO 470 (BIOL 304), BIOO 475 (BIOL 306), BIOO 340 (BIOL 308), BIOO 320 (BIOL 316), BIOO 335 (BIOL 350), BIOM 427-428 (BIOL 400-401), BIOO 462 (BIOL 410), BIOM 423 (BIOL 418), BIOM 360-361 (MICB 300/301); and an evolutionary biology course from BIOE 404 (BIOL 405), BIOE 406 (BIOL 406), BIOB 480 (BIOL 480), BIOB 486, BIOE 482 (BIOL 482), BIOL 483 or BIOL 484. One of these classes must be an Upper Division Writing course. Other required courses are M 162 (MATH 150), STAT 216 (MATH 241) or STAT 451/457 and STAT 452/458 (MATH 444/447 and MATH 445/448); CHMY 121N & 123N/124N (CHEM 151N and 152N/154N) or CHMY 141N, 143N, 221-222 and 223-224 (CHEM 161N, 162N, 221/223 and 222/224); and PHSX 205N/206N-PHSX 207N/208N (PHYS 111N/113N, 112N/114N).

Students in Track A will also spend two summers at the Flathead Lake Biological Station

Option in Human Biological Sciences

Forty-four to forty-eight credits in biology, biochemistry, and microbiology including BCH 380 or 480-482 (BIOC 380 or 480-482); BIOB 160N (BIOL 110N), BIOB 170N-171N (BIOL 108N-109N), BIOB 260 (BIOL 221), BIOB 272 (BIOL 223), BIOB 301 (BIOL 301), BIOB 375, BIOH 365-370 (BIOL 312, 313). BIOM 360-361 (MICB 300-301) (or BIOM 400 (MICB 302)) and two

courses chosen from BCH 486 (BIOC 486), BIOE 403 (BIOL 403), BIOE 406 (BIOL 406), BIOL 435, 442, BIOH 462 (BIOL 460), BIOB 425 (BIOL 464), BIOB 468 (BIOL 468), BIOE 482 (BIOL 482), BIOL 483, BIOB 486, BIOB 499 (BIOL 499), BIOM 410 (MICB 404), BIOB 410 (MICB 410), BIOM 402 (MICB 412), BIOM 427/428 (BIOL 400/401), BIOM 435 (MICB 420), BIOM 450 (MICB 450).

One year of chemistry CHMY 121N, 123N-124N (CHEM 151N, 152N-154N) or two years of chemistry CHMY 141N, 143N, 221-222-223-224 (CHEM 161N, 162N, 221-223-222-224); M 162 (MATH 150), STAT 216 (MATH 241); PHSX 205N/206N-207N/208N (PHYS 111N/113N, 112N/114N); PSYX 100S (PSYC 100S) also are required.

Recommended Courses: Some graduate schools in the health professions may require additional course work, for example, in these areas: COMX 111A (COMM 111A), Introduction to Public Speaking; NUTR 221N (HHP 236N), Nutrition; HHP 377-378, Physiology of Exercise and Laboratory; SOCI 101S (SOC 110S) Principles of Sociology, PSYX 230S (PSYC 240S), Developmental Psychology; PSYX 340S (PSYC 330S), Abnormal Psychology.

Option in Genetics and Evolution

Forty-four to forty-nine credits in biochemistry, biology and microbiology including BCH 380 (BIOC 380) or 480-482 (BIOC 481-482); BIOB 160N (BIOL 110N), BIOB 170N-171N (BIOL 108N-109N), BIOB 260 (BIOL 221), BIOB 272 (BIOL 223), BIOB 375, BIOB 486, BIOE 370/371 (BIOL 340/341), three genetics/evolution courses chosen from: BIOB 480 (BIOL 480), BIOE 403 (BIOL 403), BIOE 406 (BIOL 406), BIOE 482 (BIOL 482), BIOL 483, BIOL 484, BIOM 410 (MICB 404), BIOM 415 (MICB 422), CSCI 451 (CS 458); one physiology course chosen from: BIOB 425 (BIOL 464), BIOL 435, BIOM 450/451 (MICB 450/451), BIOO 433/434 (BIOL 444/445). M 162 (MATH 150) or M 171 (MATH 152); STAT 216 (MATH 241) or STAT 451/457-452/458 (MATH 444/447-445/448); CHMY 121N, 123N/124N (CHMY 151N, 152N/154N) or CHMY 141N-143N, 221-222-223-224 (CHEM 161N-162N, 221-222-223-224); PHSX 205N/206N-207N/208N (PHYS 111N/113N, 112N/114N) are also required.

Option in Natural History

Forty-two to forty-four credits in biology including BIOB 160N (BIOL 110N), BIOB 170N-171N (BIOL 108N-109N), BIOB 260 (BIOL 221), BIOB 272 (BIOL 223), BIOO 320 (BIOL 316), BIOE 370-371 (BIOL 340-341), BIOO 335 (BIOL 350), BIOO 462 (BIOL 410); one course chosen from BIOO 470 (BIOL 304), BIOO 475 (BIOL 306), or BIOL 356; one course chosen from BIOE 404 or 406 (BIOL 405 or 406).

CHMY 121N, 123N-124N (CHEM 151N-152N, 154N) and GEO 101N-102N (GEOS 100N-101N) are required. Students also must complete at least 20 credits in cognate areas of anthropology, chemistry (excluding CHMY 121N, 123N-124N (CHEM 151N-152N, 154N)), geography, geology (excluding GEO 101N-102N (GEOS 100N-101N)), forestry, mathematics, physics/astronomy, and wildlife biology. No more than 10 credits from any one of these areas can be applied toward the 20-credit requirement. Students interested in combining this option with another subject area may, with the advisor's permission, substitute 20 credits in English-writing, journalism, photography, art, foreign language, business management, or other appropriate field.

Teacher Preparation in Biology (Biological Education)

Option in Biological Education Major Teaching Field of Biology: This option is designed for students seeking an endorsement in the major teaching field of biology.

A student must complete thirty-four credits in biology and microbiology including BIOB 160N (BIOL 110N), BIOB 170N-171N (BIOL 108N-109N), BIOB 260 (BIOL 221), BIOB 272 (BIOL 223), BIOE 370-371 (BIOL 340-341), BIOO 433/434 (BIOL 444/445), BIOM 360-361 (MICB 300-301) and one course chosen from BIOB 301 (BIOL 301) or BIOL 435.

M 162 or M 171 (MATH 150 or 152) and STAT 216 (MATH 241) are required; CHMY 121N-123N, 124N, 485 (CHEM 151N-152N, 154N, 485); PHSX 205N/206N (PHYS 111N/113N); EDU 497 (C&I 426); GEO 105N (GEOS 105N) or GEO 108N (GEOS 108N) also are required.

For endorsement to teach biology, a student also must gain admission to the Teacher Education Program and meet all the requirements for teaching licensure (see the College of Education section of this catalog).

Biology qualifies for a single-field endorsement. However, there is a limited demand in most Montana high schools for teachers with a single endorsement in biology and students are advised to complete the requirements for a second teaching endorsement (major or minor).

Minor Teaching Field of Biology: For an endorsement in the minor teaching field of biology, a student must complete BIOB 160N (BIOL 110N), BIOB 170N-171N (BIOL 108N-109N), BIOB 260 (BIOL 221), BIOB 272 (BIOL 223); BIOM 360-361 (MICB 300-301); EDU 497 (C&I 426); GEO 105N or 108N (GEOS 105N or 108N), M 162 or 171 (MATH 150 or 152), STAT 216 (MATH 241); and CHMY 121N-123N, 485 (CHEM 151N-152N, 485). A student also must gain admission to the Teacher Education Program and must meet the requirements for teaching licensure (see the College of Education section of this catalog).

Teacher Preparation in General Science

Extended Major Teaching Field of General Science: A student is awarded a B.A. with a major in biology with an ecology option by completing the following 60 credits in astronomy, biology, chemistry, geology, mathematics, and physics: ASTR 131N, 134N; BIOB 160N (BIOL 110N), BIOB 170N-171N (BIOL 108N-109N), BIOB 260 (BIOL 221), BIOB 272 (BIOL 223), BIOE 370-371 (340-341); CHMY 123N, 141N-143N, 485 (CHEM 152N, 161N-162N, 485); GEO 101N-102N (GEOS 100N-101N), and either GEO 105N or 108N (GEOS 105N or 108N); M 162 or 171 (MATH 150 or 152), STAT 216 (MATH 241) and PHSX 205N/206N-PHSX 207N/208N (PHYS 111N/113N, 112N/114N). EDU 497 (C&I 426) also is required.

Highly recommended are BIOL 435, BIOM 360-361 (MICB 300-301), and CHMY 101N (CHEM 101N).

For an endorsement in the extended major teaching field of General Science, a student must gain admission to the Teacher Education Program, and meet the requirements for teaching licensure (see the College of Education section of this catalog.)

Suggested Course of Study

Biological Education Option

	First Year	A	S
BIOB 160N (BIOL 110N) Principles of Living Systems	4	-	
BIOB 170N/171N (BIOL 108N/109N) Principles Biological Diversity and Laboratory	-	5	
CHMY 121N (CHEM 151N) Introduction to General Chemistry	3	-	
CHMY 123N (CHEM 152N) Intro to Organic and Biochemistry	-	3	
CHMY 124N (CHEM 154N) Intro to Organic and Biochemistry Laboratory	-	2	
+WRIT 101 (ENEX 101) College Writing I	3	-	
+M 162 (MATH 150) Applied Calculus	4	-	
PSYX 100S (PSYC 100S) Introduction to Psychology	-	4	
Elective	-	1	
+Depends on Placement Exam		14	15
	Second Year	A	S
BIOB 260 (BIOL 221) Cellular and Molecular Biology	4	-	
BIOB 272 (BIOL 223) Genetics and Evolution	-	4	
CHMY 485 (CHEM 485) Laboratory Safety	1	-	
STAT 216 (MATH 241) Introduction to Statistics	4	-	
BIOM 360/361 (MICB 300/301) General Microbiology & Laboratory	-	5	
Lower-division writing course	-	3	
General Education/Native American Studies Course	6	3	
		15	15
	Third Year	A	S
BIOE 370/371 (BIOL 340/341) General Ecology and Laboratory	-	5	
PHSX 205N/206N (PHYS 111N/113N) Fundamentals of Physics I and Laboratory	5	-	
BIOO 433/434 (BIOL 444/445) Plant Physiology and Laboratory	-	4	
EDU 202 (C&I 200) Early Field Experience	1	-	
EDU 221 (C&I 303) Educational Psychology and Measurement	3	-	
EDU 370 (C&I 306) Integrating Technology into Education	3	-	
EDU 345 (C&I 410) Exceptionality and Classroom Management	3	-	
HHP 233 Health Issues of Children and Adolescents	-	3	
General Education Requirements	-	3	
		15	15
	Fourth Year	A	S
EDU 395 (C&I 301 or 302) Field Experience	1	-	
EDU 407E (C&I 407E) Ethics and Policy Issues	3	-	

EDU 497 (C&I 426) Methods: 5-12 Science	3 -
EDU 481 (C&I 427) Content Area Literacy	3 -
EDU 495 (C&I 482) Student Teaching: Secondary	- 14
EDU 494 (C&I 494) Professional Portfolio	- 1
BIOL 435 Comparative Animal Physiology (or BIOB 301)	3 -
GEO 108N Climate Change or GEO 105N Oceanography (GEOS 108N or GEOS 105N)	3 -
	16 15

Cellular and Molecular Biology Option

First Year		A S
BIOB 160N (BIOL 110N) Principles of Living Systems		4 -
BIOB 170N/171N (BIOL 108N/109N) Principles of Biological Diversity and Laboratory		- 5
CHMY 141N, 143N (CHEM 161N, 162N) College Chemistry I, II		5 5
+WRIT 101 (ENEX 101) College Writing I		- 3
+M 162 (MATH 150) Applied Calculus		4 -
General Education		- 3
Elective		1 -
+Depends on Placement Exam		14 16
Second Year		A S
BIOB 260 (BIOL 221) Cellular and Molecular Biology		4 -
BIOB 272 (BIOL 223) Genetics and Evolution		- 4
CHMY 221/222, 223/224 (CHEM 221/223, 222/224) Organic Chemistry I, II and Laboratories		5 5
BIOM 360/361 (MICB 300/301) General Microbiology and Laboratory		- 5
Lower-division writing course		3 -
General Education		3 -
Elective		- 1
		15 15
Third Year		A S
BCH 480, 482 (BIOC 481, 482) Advanced Biochemistry I, II		3 3
BIOM 410 (MICB 404) Microbial Genetics (or BIOL 435, BIOL 483, BIOB 440 (BIOL 440), BIOO 433/434 (BIOL 444/445), BIOB 468, BIOB 486, BIOM 450 (MICB 450))		- 3
BIOM 411 (MICB 405) Experimental Microbial Genetics Laboratory (or BIOB 411 (MICB 411), BIOM 451 (MICB 451), BIOM 490 (MICB 497), or BCH 486 (BIOC 486))		- 1
PHSX 205N/206N, 207N/208N (PHYS 111N/113N, 112N/114N) College Physics I, II & Labs		5 5
General Education		3 3
Electives		4 -
		15 15
Fourth Year		A S
BIOB 375 General Genetics		- 3
BIOB 301 (BIOL 301) Developmental Biology		- 3
BIOB 425 (BIOL 464) Advanced Cellular & molecular Biology		- 3
CHMY 311 (CHEM 341) Analytic Chemistry-Quantitative Analysis (or CHMY 360, 373 (CHEM 370, 371))		4 -
BIOB 410/411 (MICB 410/411) Immunology and Laboratory (or BIOM 435 (MICB 420) plus another laboratory course)		5 -
Upper-division elective		3 3
General Education		3 3
		15 15

Ecology and Organismal Biology Option with One Year of Chemistry

First Year		A S
BIOB 160N (BIOL 110N) Principles of Living Systems		4 -
BIOB 170N/171N (BIOL 108N/109N) Principles of Biological Diversity and Laboratory		- 5
CHMY 121N (CHEM 151N) Introduction to General Chemistry		3 -
CHMY 123N (CHEM 152N) Introduction to Organic and Biochemistry		- 3
CHMY 124N (CHEM 154N) Introduction to Organic and Biochemistry Laboratory		- 2
+WRIT 101 (ENEX 101) College Writing I		3 -
+M 162 (MATH 150) Applied Calculus		4 -
General Education Requirement		- 3
Electives		- 3
+Depends on Placement Exam		14 16
Second Year		A S
BIOB 260 (BIOL 221) Cellular and Molecular Biology		4 -
BIOB 272 (BIOL 223) Genetics and Evolution		- 4
PHSX 205N/206N, 207N/208N (PHYS 111N/113N-112N/114N) College Physics I, II & Labs		5 5
Lower-division writing course		3 -
Elective		3 -
General Education		- 6
		15 15
Third Year		A S

STAT 451/457, 452,458 (MATH 444/447, 445/448) Statistical Methods I and Comp. Lab (or STAT 216 (MATH 241))	4	4
BIOE 370-371 (BIOL 340-341) General Ecology and Laboratory	-	5
BIOO 475 (BIOL 306) Mammalogy (or BIOO 470 (BIOL 304), BIOO 340 (BIOL 308), BIOO 320 (BIOL 316), BIOO 335 (BIOL 350), BIOM 427/428 (BIOL 400/401), BIOO 462 (BIOL 410), BIOM 360/361 (MICB 300/301))	4	-
BIOM 415 Microbial Diversity, Ecology, Evolution (or WILD 346 (BIOL 446), BIOE 428 (BIOL 366), BIOE 449 (BIOL 430), BIOL 442, BIOE 447 (BIOL 447), BIOE 448 (BIOL 448), WILD 470 (WBIO 470))	-	3
General Education Requirement	3	3
Electives	3	-
	14	15

Fourth Year

BIOM 360/361 General Microbiology and Laboratory (or another UD biology elective)	-	5
BIOE 406 (BIOL 406) Behavior and Evolution (or BIOB 480 (BIOL 480), BIOB 486, BIOE 404 (BIOL 405), BIOE 482 (BIOL 482), BIOL 483, BIOL 484)	4	-
BIOE 403 (BIOL 403) Vertebrate Design and Evolution (or BIOB 301 (BIOL 301), BIOB 375, BIOB 468, BIOL 435, BIOO 433/434 (BIOL 444/445))	5	-
Upper-division elective	5	-
General Education Requirement	-	3
Electives	1	8
	15	16

Ecology and Organismal Biology Option with Two Years of Chemistry**First Year**

BIOB 160N (BIOL 110N) Principles of Living Systems	4	-
BIOB 170N/171N (BIOL 108N/109N) Principles of Biological Diversity and Laboratory	-	5
CHMY 141N, 143N (CHEM 161N, 162N) College Chemistry I, II	5	5
+WRIT 101 (ENEX 101) College Writing I	3	-
+M 162 (MATH 150) Applied Calculus	4	-
STAT 216 (MATH 241) Introduction to Statistics	-	4
+Depends on Placement Exam	16	14

Second Year

BIOB 260 (BIOL 221) Cellular and Molecular Biology	4	-
BIOB 272 (BIOL 223) Genetics and Evolution	-	4
CHMY 221/222, 223/224 (CHEM 221/222, 223/224) Organic Chemistry I, II and Laboratories	5	5
Writing course	3	-
General Education	3	6
	15	15

Third Year

BCH 480,482 (BIOC 481,482) Advanced Biochemistry I and II (or another UD biology, microbiology or biochemistry elective)	3	3
BIOE 370/371 General Ecology and Laboratory	-	5
BIOE 406 (BIOL 406) Behavior and Evolution (or BIOE 404 (BIOL 405), BIOB 480 (BIOL 480), BIOE 482 (BIOL 482), BIOL 483, BIOL 484)	4	-
PHSX 205N/206N & PHSX 207N/208N (PHYS 111N/113N, 112N/114N) College Physics I, II & Labs	5	5
General Education	-	3
Elective	2	-
	14	16

Fourth Year

BIOL 435 Comparative Animal Physiology (or BIOB 301 (BIOL 301), BIOB 375, BIOE 403 (BIOL 403), BIOO 433/434 (BIOL 444/445), BIOB 468 (BIOL 468))	3	-
BIOE 448 (BIOL 448) Terrestrial Plant Ecology (or BIOE 428/429 (BIOL 366), BIOL 442, BIOE 449 (BIOL 430), WILD 346 (BIOL 446), BIOE 447 (BIOL 447), BIOM 415 (MICB 422), WILD 470 (WBIO 470))	4	-
BIOO 470 Ornithology (or BIOO 475 (BIOL 306), BIOO 340 (BIOL 308), BIOO 320 (BIOL 316), BIOO 335 (BIOL 350), BIOM 427/428 (BIOL 400/401), BIOO 462 (BIOL 410), BIOM 360/361 (MICB 300/301), BIOM 423 (BIOL 418))	-	4
General Education Requirement	3	3
Upper-division elective	5	8
	15	15

Option for Teacher Preparation in General Science**First Year**

BIOB 160N (BIOL 110N) Principles of Living Systems	4	-
BIOB 170N/171N (BIOL 108N/109N) Principles of Biological Diversity and Laboratory	-	5
CHMY 141N, 143N (CHEM 161N, 162N) College Chemistry I, II	5	5
+WRIT 101 (ENEX 101) College Writing I	3	-
+M 162 (MATH 150) Applied Calculus	4	-
PSYX 100S (PSYC 100S) Introduction to Psychology	-	4
+ Depends on placement exam	16	14

Second Year

ASTR 131N/134N Elementary Astronomy and Laboratory	4	-
BIOB 260 (BIOL 221) Cellular and Molecular Biology	4	-
BIOB 272 (BIOL 223) Genetics and Evolution	-	4
CHMY 123N (CHEM 152N) Introduction to Organic and Biochemistry	-	3
GEO 101N/102N (GEOL 100N/101N) Introduction to Physical Geology	-	4

STAT 216 (MATH 241) Introduction to Statistics	4 -
General Education/Native American Studies course	- 3
Lower-division writing course	3 -
Elective	- 1

15 15

Third Year**A S**

CHMY 485 (CHEM 485) Laboratory Safety	1 -
EDU 202 (C&I 200) Early Field Experience	- 1
EDU 221 (C&I 303) Educational Psychology and Measurement	- 3
EDU 370 (C&I 306) Integrating Technology into Education	- 3
EDU 345 (C&I 410) Exceptionality and Classroom Management	- 3
GEO 105N or 108N (GEOS 105N or 108N) Oceanography or Climate Change	3 -
PHSX 205N/206N & 207N/208N (PHYS 111N/113N, 112N/114N) College Physics I, II & Labs	5 5
General Education	6 -

15 15

Fourth Year**A S**

BIOE 370/371 (BIOL 340/341) General Ecology and Laboratory	5 -
EDU 395 (C&I 301 or 302) Field Experience	1 -
EDU 407E (C&I 407E) Ethics and Policy Issues	3 -
EDU 497 (C&I 426) Methods: 5-12 Science	3 -
EDU 481 (C&I 427) Content Area Literacy	3 -
HHP 233 Health Issues of Children and Adolescents	- 3
Upper-division biology writing course (suggested course: BIOC 433/434)	- 4
General Education	- 3
Electives	- 5

15 15

Fifth Year**A S**

EDU 495 (C&I 482) Student Teaching: Secondary	14 -
EDU 494 (C&I 494) Professional Portfolio	1 -

Field Ecology Option (Track A, two summers)**First Year****A S**

BIOB 160N (BIOL 110N) Principles of Living Systems	4 -
BIOB 170N/171N (BIOL 108N/109N) Principles of Biological Diversity and Laboratory	- 5
CHMY 121N (CHEM 151N) Introduction to General Chemistry	3 -
+M 162 (MATH 150) Applied Calculus	4 -
+WRIT 101 (ENEX 101) College Writing I	3 -
Elective	2 -
CHMY 123N (CHEM 152N) Introduction to Organic and Biochemistry	- 3
CHMY 124N (CHEM 154N) Introduction to Organic and Biochemistry Lab	- 2
General Education Requirement	- 3
Lower Division Writing Requirement	- 3
+ Depends on placement exam	16 16

Second Year**A S**

BIOB 260 (BIOL 221) Cellular and Molecular Biology	4 -
STAT 451/457 (MATH 444/447) Statistical Methods I/Computer Analysis	4 -
General Education Requirement	3 -
Electives	5 -
BIOB 272 (BIOL 223) Genetics and Evolution	- 4
STAT 452/458 (MATH 445/448) Statistical Methods II/Computer Analysis	- 4
General Education Requirement	- 6
Elective	- 2
	16 16

Summer (at Biological Station)

BIOL 342 Field Ecology	5 -
Upper Division Electives	5 -

Third Year**A S**

BIOE 406 (BIOL 406) Behavior and Evolution (or BIOB 480 (BIOL 480), BIOB 486, BIOE 404 (BIOL 405), BIOE 482 (BIOL 482), BIOL 483, BIOL 484)	4 -
PHSX 205N/206N (PHYS 111N/113N) College Physics I & Lab	5 -
General Education Requirement	6 -
Electives	2 -
BIOO 470 (BIOL 304) Ornithology (or BIOO 320 (BIOL 316), BIOO 475 (BIOL 306), BIOO 340 (BIOL 308), BIOO 335 (BIOL 350), BIOM 427/428 (BIOL 400/401), BIOO 462 (BIOL 410), BIOM 423 (BIOL 418), BIOM 360/361 (MICB 300/301))	- 4
PHSX 207N/208N (PHYS 112N/114N) College Physics II & Lab	- 5
Electives	- 7
	17 16

Second Summer (at Biological Station)

BIOL 451 Landscape Ecology	3
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BIOL 458 Ecology of Forests & Grasslands	3
BIOL 459 Alpine Ecology	3
BIOL 452 Conservation Ecology	3
BIOL 492 Seminars in Ecology & Resource Management	1
	13

Field Ecology Option (Track B one summer)

First Year	A S
BIOB 160N (BIOL 110N) Principles of Living Systems	4 -
BIOB 170N/171N (BIOL 108N/109N) Principles of Biological Diversity and Laboratory	- 5
CHMY 141N (CHEM 161N) College Chemistry I	5 -
+M 162 (MATH 150) Applied Calculus	4 -
Elective	1 -
CHMY 143N (CHEM 162N) College Chemistry II	- 5
+WRIT 101 (ENEX 101) College Writing I	- 3
General Education Requirement	- 3
+ Depends on placement exam	14 16

Second Year	A S
BIOB 260 (BIOL 221) Cellular and Molecular Biology	4 -
CHMY 221/222 (CHEM 221/223) Organic Chemistry I & Lab	5 -
STAT 216 (MATH 241) Introduction to Statistics	4 -
Lower Division Writing Requirement	- 3
BIOB 272 (BIOL 223) Genetics and Evolution	- 4
CHMY 223/224 (CHEM 222/224) Organic Chemistry II & Lab	- 5
General Education	- 3
	13 15

Third Year	A S
BIOE 370/371 (BIOL 340/341) General Ecology and Lab	5 -
PHSX 205N/206N (PHYS 111N/113N) College Physics I and Lab	5
General Education	3 -
PHSX 207N/208N (PHYS 112N/114N) College Physics II and Lab	- 5
General Education Requirements	- 6
Electives	- 1
	13 12

Summer Semester at Flathead Lake Biological Station

BIOL 451 Landscape Ecology	3
BIOL 453 Lake Ecology	3
BIOL 454 Stream Ecology	3
BIOL 452 Conservation Ecology	3
BIOL 492 Seminar in Ecology & Res. Management	1
	13

Fourth Year	A S
BIOO 462 (BIOL 410) Entomology (or BIOO 340 (BIOL 308), BIOO 470 (BIOL 304), BIOO 475 (BIOL 306), BIOO 320 (BIOL 316), BIOO 335 (BIOL 350), BIOM 427,428 (BIOL 400-401), BIOM 423 (BIOL 418), BIOM 360-361 (MICB 300/301)	- 4
Upper Division electives	8 -
BIOE 406 (BIOL 406) Behavior and Evolution (or BIOB 480 (BIOL 480), BIOB 486, BIOE 404 (BIOL 405), BIOE 482 (BIOL 482), BIOL 483, BIOL 484)	4 -
Upper-division elective	- 5
General Education	- 3
	12 12

Genetics and Evolution Option with One Year of Chemistry

First Year	A S
BIOB 160N (BIOL 110N) Principles of Living Systems	4 -
BIOB 170N/171N (BIOL 108N/109N) Principles Biological Diversity and Laboratory	- 5
CHMY 121N (CHEM 151N) Introduction to General Chemistry	3 -
CHMY 123N/124N (CHEM 152N/154N) Introduction to Organic and Biochemistry and Laboratory	- 5
+WRIT 101 (ENEX 101) College Writing I	3 -
+M 162 (MATH 150) Applied Calculus	4 -
General Education	- 3
Elective	- 3
+ Depends on placement exam	14 16

Second Year	A S
BIOB 260 (BIOL 221) Cellular and Molecular Biology	4 -
BIOB 272 (BIOL 223) Genetics and Evolution	- 4
PHSX 205N/206N & 207N/208N (PHYS 111N/113N-112N/114N) College Physics I,II & Labs	5 5
General Education	- 6
Lower-division writing course	3 -

Electives	3 -
	15 15
Third Year	
	A S
STAT 451/457, 452/458 (MATH 444/447, 445/448) Statistical Methods I and Comp. Lab (or STAT 216 (MATH 241))	4 4
BIOE 370-371 (BIOL 340-341) General Ecology and Laboratory	- 5
BIOE 406 Behavior and Evolution (or BIOB 480 (BIOL 480), BIOE 403 (BIOL 403), BIOE 482 (BIOL 482), BIOL 483, BIOL 484, BIOM 410 (MICB 404), BIOM 415 (MICB 422), CSCI 451)	4 -
BIOB 375 General Genetics	- 3
BCH 380 (BIOC 380) Biochemistry	4 -
General Education	3 3
	15 15
Fourth Year	
	A S
BIOB 480 (BIOL 480) Conservation Genetics (or BIOE 403 (BIOL 403), BIOE 406 (BIOL 406), BIOE 482 (BIOL 482), BIOL 483, BIOL 484, BIOM 410 (MICB 404), BIOM 415 (MICB 422), CSCI 451)	3 -
BIOH 486 Genomics	3 -
BIOL 435 Comparative Animal Physiology (or BIOB 425 (BIOL 464), BIOM 450/451 (MICB 450/451), BIOC 433/434 (BIOL 444/445))	3 -
BIOM 415 Microbial Diversity, Ecology, & Evolution (or BIOB 480 (BIOL 480), BIOE 403 (BIOL 403), BIOE 406 (BIOL 406), BIOE 482 (BIOL 482), BIOL 483, BIOL 484, BIOM 410 (MICB 404), CSCI 451)	- 3
Upper-division Elective	- 3
General Education	- 3
Electives	6 6
	15 15

Genetics and Evolution Option with Two Years of Chemistry

First Year	
	A S
BIOB 160N (BIOL 110N) Principles of Living Systems	4 -
BIOB 170N/171N (BIOL 108N/109N) Principles Biological Diversity and Laboratory	- 5
CHMY 141N, 143N (CHEM 161N, 162N) College Chemistry I, II	5 5
+WRIT 101 (ENEX 101) College Writing I	3 -
+M 162 (MATH 150) Applied Calculus	4 -
STAT 216 (MATH 241) Introduction to Statistics	- 4
+ Depends on placement exam	16 14
Second Year	
	A S
BIOB 260 (BIOL 221) Cellular and Molecular Biology	4 -
BIOB 272 (BIOL 223) Genetics and Evolution	- 4
CHMY 221/222, 223/224 (CHEM 221/222, 223/224) Organic Chemistry I, II and Laboratories	5 5
Writing course	3 -
General Education	3 6
	15 15
Third Year	
	A S
BCH 480, 482 (BIOC 481, 482) Advanced Biochemistry I and II (or another UD biology, microbiology or biochemistry elective)	3 3
BIOE 370/371 General Ecology and Laboratory	5 -
BIOE 375 General Genetics	- 3
PHSX 205N/206N & 207N/208N (PHYS 111N/113N, 112N/114N) College Physics I, II & Labs	5 5
General Education	- 3
Elective	1 1
	14 15
Fourth Year	
	A S
BIOE 486 Genomics	3 -
BIOE 403 (BIOL 403) Vertebrate Design and Evolution (or BIOB 480 (BIOL 480), BIOE 406 (BIOL 406), BIOE 482 (BIOL 482), BIOL 483, BIOL 484, BIOM 410 (MICB 404), BIOM 415 (MICB 422), CSCI 451)	5 -
BIOB 425 (BIOL 464) Advanced Cell & Molecular Biology (or BIOL 435, BIOM 450/451 (MICB 450/451), BIOC 433/434 (BIOL 444/445))	- 3
BIOL 483 Molecular Phylogenetics and Evolution (or BIOB 480 (BIOL 480), BIOE 403 (BIOL 403), BIOE 406 (BIOL 406), BIOE 482 (BIOL 482), BIOL 484, BIOM 410 (MICB 404), BIOM 415 (MICB 422), CSCI 451)	- 3
BIOE 482 (BIOL 482) Evolution and Development (or BIOB 480 (BIOL 480), BIOE 403 (BIOL 403), BIOE 406 (BIOL 406), BIOL 483, BIOL 484, BIOM 410 (MICB 404), BIOM 415 (MICB 422), CSCI 451)	- 3
General Education Requirement	3 3
Upper-division elective	4 4
	15 16

Human Biological Sciences Option with One Year of Chemistry

First Year	
	A S
BIOB 160N (BIOL 110N) Principles of Living Systems	4 -
BIOB 170N/171N (BIOL 108N/109N) Principles Biological Diversity and Laboratory	- 5
CHMY 121N (CHEM 151N) Introduction to General Chemistry	3 -
CHMY 123N/124N (CHEM 152N/154N) Introduction to Organic and Biochemistry and Laboratory	- 5
+WRIT 101 (ENEX 101) College Writing I	3 -
+M 162 (MATH 150) Applied Calculus	4 -

PSYX 100S (PSYC 100S) Introduction to Psychology	- 4
Elective	1 1
+ Depends on placement exam	15 15

Second Year

BIOB 260 (BIOL 221) Cellular and Molecular Biology	4 -
BIOB 272 (BIOL 223) Genetics and Evolution	- 4
PHSX 205N/206N & 207N/208N (PHYS 111N/113N-112N/114N) College Physics I,II & Labs	5 5
General Education	- 3
STAT 216 (MATH 241) Introduction to Statistics	4 -
Lower-division writing course	3 -
Electives	- 3
	16 15

Third Year

BIOH 365, 370 (BIOL 312, 313) Human A&P I and II for Health Professions	4 4
BIOB 301 (BIOL 301) Developmental Biology	- 3
BIOM 400 (MICB 302) Medical Microbiology (or BIOM 360/361 (MICB 300/301) General Microbiology & Lab)	3 -
BCH 380 (BIOC 380) Biochemistry	4 -
General Education	3 3
Upper-division elective	- 4
Elective	- 1
	14 15

Fourth Year

BIOE 403 (BIOL 403) Vertebrate Design & Evolution (or another upper-division course from list that meets the UD biology writing requirement)	5 -
BIOH 462 (BIOL 460) Principles of Medical Physiology (or another upper-division course from list that meets the UD biology writing requirement)	- 3
Upper Division Elective	3 3
General Education	3 3
Electives	4 3
	15 15

Human Biological Sciences Option with Two Years of Chemistry**First Year**

BIOB 160N (BIOL 110N) Principles of Living Systems	4 -
BIOB 170N/171N (BIOL 108N/109N) Principles Biological Diversity and Laboratory	- 5
CHMY 141N, 143N (CHEM 161N, 162N) College Chemistry I, II	5 5
+WRIT 101 (ENEX 101) College Writing I	3 -
+M 162 (MATH 150) Applied Calculus	4 -
PSYX 100S (PSYC 100S) Introduction to Psychology	- 4
+ Depends on placement exam	16 14

Second Year

BIOB 260 (BIOL 221) Cellular and Molecular Biology	4 -
BIOB 272 (BIOL 223) Genetics and Evolution	- 4
CHMY 221/222, 223/224 (CHEM 221/222, 223/224) Organic Chemistry I, II and Laboratories	5 5
BIOM 360/361 (MICB 300/301) General Microbiology and Laboratory (or BIOM 400 and 2 credits of upper division elective)	- 5
Lower-division writing course	3 -
STAT 216 (MATH 241) Introduction to Statistics	4 -
	16 14

Third Year

BCH 480, 482 (BIOC 481, 482) Advanced Biochemistry I, II (or BCH 380 plus 2 credits of UD elective)	3 3
BIOB 301 (BIOL 301) Developmental Biology	- 3
PHSX 205N/206N-207N/208N (PHYS 111N/113N-112N/114N) College Physics I, II & Labs	5 5
Upper-division elective	3 3
Elective	1 -
General Education	3 -
	15 14

Fourth Year

BIOE 375 General Genetics	- 3
BIOB 425 (BIOL 464) Advanced Cellular and Molecular Biology (or another upper-division course from list that meets the UD biology writing requirement)	- 3
BIOH 365, 370 (BIOL 312, 313) Human A&P I and II for Health Professions	4 4
BIOB 410 (MICB 410) Immunology (or another upper-division course from list that meets the UD biology writing requirement)	3 -
General Education	6 6
UD Elective	2 -
	15 16

Natural History Option**First Year**

BIOB 160N (BIOL 110N) Principles of Living Systems	A S
	4 -

BIOB 170N/171N (BIOL 108N/109N) Principles Biological Diversity and Laboratory	- 5
CHMY 121N (CHEM 151N) Introduction to General Chemistry	3 -
CHMY 123N (CHEM 152N) Introduction to Organic and Biochemistry	- 3
CHMY 124N (CHEM 154N) Introduction to Organic and Biochemistry Laboratory	- 2
+WRIT 101 (ENEX 101) College Writing I	3 -
+M 121 (MATH 111) College Algebra	3 -
General Education	- 6
Elective	1 -
+ Depends on placement exam	14 16
Second Year	A S
BIOB 260 (BIOL 221) Cellular and Molecular Biology	4 -
BIBO 272 (BIOL 223) Genetics and Evolution	- 4
BIOO 335 (BIOL 350) Rocky Mountain Flora	- 3
GEO 101N/102N (GEOL 100N/101N) Introduction to Physical Geology and Laboratory	4 -
Lower-division writing course	3 -
General Education	- 3
Modern/Classic Language I, II	5 5
	16 15
Third Year	A S
BIOE 370 (BIOL 340) General Ecology	- 3
BIOE 371 (BIOL 341) General Ecology Laboratory	- 2
BIOO 320 (BIOL 316) General Botany	5 -
STAT 216 (MATH 241) Statistics (cognate course and prerequisite to BIOE 371)	4 -
Cognate course	- 3
Upper-division cognate course	- 7
General Education	6 -
	14 16
Fourth Year	A S
BIOO 470 (BIOL 304) Ornithology (or BIOO 475 (BIOL 306), BIOL 356)	- 4
BIOE 406 (BIOL 406) Behavior and Evolution (or BIOE 404 (BIOL 405))	4 -
BIOO 462 (BIOL 410) Entomology	- 4
Cognate course	3 -
Upper-division electives	3 4
General Education	3 -
Electives	1 3
	14 15

Requirements for a Minor

To earn a minor in biology, the student must complete a minimum of 25 credits in biology including BIOB 160N (BIOL 110N), BIOB 170N/171N (BIOL 108N-109N), BIOB 260 (BIOL 221) and BIOB 272 (BIOL 223) and 8 credits in Biology at the 300-400 level. All courses must be taken for a traditional letter grade.

Courses

R- before the course description indicates the course may be repeated for credit to the maximum indicated after the R. Credits beyond this maximum do not count toward a degree.

Biology (BIOL) - Course Descriptions

265, 315, 342, 343, 356, 407, 415, 435, 442, 449, 451, 452, 453, 454, 458, 459, 483, 484, 492

Biology (BIOB) - Course Descriptions

101N, 130N, 160N, 170N, 171N, 191, 198, 240, 260, 272, 291, 298, 301, 375, 390, 391, 398, 410, 411, 425, 440, 468, 480, 490, 486, 491, 492, 494, 495, 498, 499, 501, 510, 513, 517, 518, 519, 522, 524, 526, 530, 541, 547, 551, 561, 565, 575, 594, 595, 597, 598, 599, 699

Biology-Ecology (BIOE) - Course Descriptions

172n, 370, 371, 394, 403, 404, 406, 428, 447, 448, 449, 482

Biology-Human (BIOH) - Course Descriptions

112, 113, 291, 330, 360, 365, 370, 405, 423, 424, 456, 457, 461, 462, 463, 480, 481

Biology-Organismal (BIOO) - Course Descriptions

101N, 105N, 320, 335, 340, 433, 434, 462, 470, 475, 486

Biology-Systems Ecology (BIOS) - Course Descriptions

532, 534

Biological Station

Jack A. Stanford (Bierman Professor of Ecology), Director

The University of Montana-Missoula operates its Flathead Lake Biological Station as a year-round research facility and academic center in ecological sciences. The Station is located on 80 acres at Yellow Bay on Flathead Lake, some 85 miles north of Missoula near Kalispell and Glacier National Park. Up to 110 students can room in cabins and the G. W. Prescott dorm/apartment facility; board is provided by the station's commissary. Several large academic and office structures complement the state-of-the-art Freshwater Research Laboratory at this field campus.

During the annual 8-week summer session, formal courses are offered which emphasize field investigations of the rich flora and fauna of the diverse aquatic and terrestrial habitats found at or near the Station. Faculty from UM and other universities throughout the United States and Canada teach the field-oriented courses of the summer program. The formal courses each carry three to five semester credits for either advanced undergraduate or graduate academic programs.

A Bachelor of Arts in Biology with an Option in Field Ecology is available through the Division of Biological Sciences which requires summer courses offered at the Flathead Lake Biological Station. This Field Ecology Option requires students to take advantage of at least one summer of courses at the Biological station, while allowing additional summers of coursework to apply to degree requirements as well. The required coursework includes Landscape Ecology, Conservation Ecology and either the Aquatic Emphasis (Stream Ecology, Lake Ecology) or the Terrestrial Emphasis (Ecology of Forests and Grasslands, Alpine Ecology). Students may complete BIOE 370/371 (BIOL 340/341) General Ecology and Lab on the UM campus or take BIOL 342 Field Ecology at the Biological Station. Students who plan their academic years and summer programs carefully and who enroll for two summer sessions at the Biological Station may be able to complete degree requirements in three years.

Biological Station courses can also substitute for major program requirements in the Division of Biological Sciences and Wildlife Biology. Credits are transferable to most universities in the United States and Canada. Students must have completed introductory courses in biology, mathematics, ecology, and chemistry before enrolling in courses of the program.

Biological Station courses are offered for two or four-weeks during the eight-week session.

- BIOL 342 Field Ecology
- BIOL 343 Ecological Methods & Analysis
- BIOL 451 Landscape Ecology
- BIOL 452 Conservation Ecology
- BIOL 453 Lake Ecology
- BIOL 454 Stream Ecology
- BIOL 458 Ecology of Forests and Grasslands
- BIOL 459 Alpine Ecology
- BIOL 492 Seminar in Ecology and Resource Management
- BIOB 490 (BIOL 497) Advanced Undergraduate Research
- BIOB 499 (BIOL 499) Undergraduate (Senior) Thesis in Field Ecology
- BIOB 596 (BIOL 596) Independent Study

In addition to these summer courses, the Biological Station offers opportunities for graduate studies in aquatic biology and ecology. After formal admission to a graduate degree-granting program, research programs leading to M.S. or Ph.D. degrees can be designed by the student, academic departments at the University, and the faculty of the Station. Research assistantships are often available for students working on advanced degrees at FLBS. Numerous scholarships are also

available annually for students enrolled at UM/FLBS.

Enrollment Procedures

Students interested in participating in the annual summer academic program must apply by mid-May. Application forms are available from the Biological Station website (www.umt.edu/flbs) or may be obtained in the Division of Biological Sciences office at UM.

Students interested in pursuing graduate work at FLBS should apply in writing to Graduate Admissions, Division of Biological Sciences, The University of Montana-Missoula, 32 Campus Drive #4824, Missoula, MT 59812-4824, or contact the Director.

For detailed information about academic and research opportunities at the Flathead Lake Biological Station, please visit the station web page (www.umt.edu/flbs) or contact:

Flathead Lake Biological Station

University of Montana

32125 Bio Station Lane

Polson, MT 59860-6815

Phone: (406) 982-3301

Fax: (406) 982-3201

E-Mail: flbs@flbs.umt.edu

Web Page: www.umt.edu/flbs/

Division of Biological Sciences

Charles H. Janson, Associate Dean for the Biological Sciences

The Division of Biological Sciences offers undergraduate and graduate programs representing the full range of the biological sciences. The Division offers bachelor degrees in Biology (with a broad array of formal options including cellular and molecular biology, ecology and organismal biology, field ecology, genetics and evolution, human biological sciences, natural history, teacher preparation in biology, and teacher preparation in general science), Medical Technology, Microbiology including microbial ecology, and Wildlife Biology (a cooperative program administered by the College of Forestry and Conservation) and Biochemistry (an interdepartmental degree administered by the Chemistry Department). The Division also advises students in pre-health sciences and offers a series of courses during the summer at the University's Flathead Lake Biological Station (see separate listing in this section). The Division is one of the leading research units in the University. Research programs in the Division provide abundant opportunities for students to enhance their educational experience by participating in mentored research. Several sources of funding are available to support undergraduate student research, and the Division participates in the University of Montana Conference on Undergraduate Research each spring.

Graduate degrees offered by the Division of Biological Sciences include Master of Science degrees in Biochemistry, Microbiology, Organismal Biology and Ecology, and Systems Ecology. Doctor of Philosophy degrees are offered in Integrative Microbiology and Biochemistry, in Organismal Biology and Ecology, and in Systems Ecology. The Division participates in the graduate (M.S. and Ph.D.) program in Wildlife Biology, administered by the College of Forestry and Conservation and in the Ph.D. program in Biochemistry, administered by the Chemistry Department. Information on graduate study and program requirements is available from the Graduate School or the Division of Biological Sciences.

The Division of Biological Sciences is committed to providing coursework and experiences for non-science majors. The world faces many problems and opportunities that include significant biological components. Courses for non-science majors have the goal of fostering understanding of the process of science and enhancing biological knowledge as it relates to environmental, medical, social, and other issues. A number of introductory courses are open both to majors and non-majors. In addition, the Division offers courses designed specifically for non-majors: Microbiology for Health Sciences, Introductory Ecology, Survey of Montana Wildlife and Habitats, and others.

Degree requirements and courses are described below (see the College of Forestry and Conservation for information about

Wildlife Biology).

Faculty

Professors

Fred W. Allendorf, Ph.D., University of Washington, 1975 (Regents Professor, Emeritus)

Joel Berger, Ph.D., University of Colorado, Boulder, 1978 (John J. Craighead Endowed Chair)

Ragan M. Callaway, Ph.D. University of California at Santa Barbara, 1990

Kenneth P. Dial, Ph.D., Northern Arizona University, 1984

Douglas Emlen, Ph.D., Princeton University, 1994

Kerry R. Foresman, Ph. D., University of Idaho, 1977

James E. Gannon, Ph.D., University of Houston, 1981

Willard O. Granath, Ph.D., Wake Forest University, 1982

Erick P. Greene, Ph.D., Princeton University, 1989

F. Richard Hauer, Ph.D., North Texas State University, 1980

Jesse C. Hay, Ph.D., University of Wisconsin, Madison, 1994

Walter E. Hill, Ph.D., University of Wisconsin, 1967 (Emeritus)

William E. Holben, Ph.D., University of New York, Buffalo, 1985

Richard L. Hutto, Ph.D., University of California at Los Angeles, 1977 (Director, Avian Science Center)

Charles H. Janson, Ph.D., University of Washington, 1985 (Associate Dean, DBS)

Ralph C. Judd, Ph.D., University of Montana, 1979

J. Stephen Lodmell, Ph.D., Brown University, 1996

John L. Maron, Ph.D., University of California-Davis, 1996

Michael F. Minnick, Ph.D., Washington State University, 1987

Jack H. Nunberg, Ph.D., Stanford University, 1979 (Director for the Montana Biotechnology Center)

Frank Rosenzweig, Ph.D., University of Pennsylvania, 1991

Anna Sala, Ph.D., University of Barcelona, 1992

D. Scott Samuels, Ph.D., University of Arizona, 1991

Stephen Sprang, Ph.D., University of Wisconsin, Madison, 1977 (Director, Center for Biomolecular Structure and Dynamics)

Jack A. Stanford, Ph.D., University of Utah, 1975 (Bierman Professor; Director of the Biological Station)

H. Maurice Valett, Ph.D., Arizona State University, Tempe, 1991

Associate Professors

Creagh W. Breuner, Ph.D., University of Washington, 1998

Lila Fishman, Ph.D., Princeton University, 1998

Mark L. Grimes, Ph.D., University of Oregon, 1986

Winsor H. Lowe, Ph.D., Dartmouth College, 2002

Gordon Luikart, Ph.D., University of Montana, 1997

Michele A. McGuirl, Ph.D., Montana State University, 1999

Scott Miller, Ph.D., University of Oregon, 1999

Bret W. Tobalske, Ph.D., University of Montana, 1994 (Director of the Field Station at Fort Missoula)

Scott A. Wetzel, Ph.D., Oregon Health and Science University, 2001

H. Arthur Woods, Ph.D., University of Washington, 1998

Assistant Professors

Sarah J. Certel, Ph.D., The University of Iowa, 1999

Jeffrey Good, Ph.D., University of Arizona, 2007

John P. McCutcheon, Ph.D., Washington University, 2006

Brent J. Ryckman, Ph.D., The University of Iowa, 2003

Ekaterina Voronina, Ph.D., Brown University, 2003

Lecturers

Heather Davis Labbe, M.S., University of Montana, 2005

Laurie A. Minns, Ph.D., Dartmouth College, 2005

Kevin J. Murray, Ph.D., University of Nevada-Reno, 1994

Research Faculty

Jerry J. Bromenshenk, Ph.D., Montana State University, 1973

Dan Drecktrah, Ph.D., Cornell University, 1999

Bonnie Ellis, Ph.D., University of Montana, 2006

John Kimball, Ph.D., Oregon State University, 1995

Evgueny Kroll, Ph.D., Hopkins School of Medicine, USA

Penny Kukuk, Ph.D., University of Kansas, 1980

Jean-Marc Lanchy, Ph.D., University; Louis Pasteur, StrasBourg, France

Tung-Chung Mou, Ph.D., The University of Texas at Dallas, 2001

Celestine Thomas, Ph.D., Indian Institute of Science, Bangalore, India, 2001

Associated Faculty

Thomas E. Martin, Ph.D., University of Illinois, 1982

Medical Technology

Michael Minnick (Professor of Microbiology), Advisor

Medical Technology or clinical laboratory sciences is a combined study of chemistry, physiology and microbiology (see <http://www.umt.edu/medtech/>). A medical technologist performs chemical, microscopic, and microbiological procedures used in the diagnosis, study and treatment of disease, under the supervision of a qualified physician or lab director. Medical technologists are in high demand in hospital labs, clinical labs, research institutions and government health departments. Although certification is required for clinical practice, individuals with a B.S. degree in Medical Technology are qualified microbiologists and can obtain positions in research labs as technicians. The degree is also an excellent foundation for students planning to attend professional schools in the health sciences or graduate school in the molecular biosciences.

Four years are required to earn a B. S. degree in Medical Technology. The curriculum is devoted to development of a sound foundation in chemistry, biology, microbiology and clinical methods. The student is also encouraged to obtain an understanding of social science and cultural subjects.

To be certified by the Board of Registry, a student, after satisfying the minimum course requirements, serves a clinical internship of at least 12 consecutive months in an approved school of medical technology endorsed by the National Accrediting Agency for Clinical Laboratory Sciences (NAACLS) or American Society of Clinical Pathology (ASCP) of the American Medical Association. After completing a clinical internship and passing the Registry exam, the student receives a diploma from the Board of Registry with the professional designation of Medical Technologist M.T. ASCP.

The University of Montana has two coursework options for the medical technology degree:

Option A is a 4+1 curriculum in which the student completes the B.S. degree and subsequently does a one-year clinical internship if desired. Students who choose the 4+1 curriculum may do a clinical internship by applying in the fall of their senior year. Details and application forms can be obtained online at the following: <http://www.umt.edu/Medtech/>. Internship applications are typically due in the fall for enrollment the following summer.

Option B is a 3+1 curriculum designed to fast-track students who definitely want to become medical technologists. The first three years are completed at UM. The fourth year is applied and incorporates both classroom learning and a clinical internship at one of our affiliates (e.g. the Montana Medical Laboratory Science Training Program) in cooperation with several clinical sites located in Montana and the Midwest. Internship information is available online at <http://www.umt.edu/medtech/>. The B.S. degree and certification are granted after successful completion of the fourth year.

High School Preparation: In addition to the general University requirements for admission, it is recommended that high school preparation include algebra, geometry, trigonometry, chemistry, and a foreign language.

Special Degree Requirements

Refer to graduation requirements listed previously in the catalog. See index.

In addition to the General Education requirements, the following courses are required for either option leading to a Bachelor of Science in Medical Technology: Thirty or more credits (300-level or above) in biology, biochemistry and microbiology including BIOM 360-361 (MICB 300/301), BIOH 405 (MICB 309), BIOB 410 (MICB 410), BIOM 402/403 (MICB 412/413), BIOM 435 (MICB 420), BCH 380 (BIOC 380); BIOB 260, 272 (BIOL 221, 223), BIOH 365 (BIOL 312), BIOM 427/428 (BIOL 400/401); CHMY 141N, 143N, 221/222 (CHEM 161N-162N, 221/223) and M 162 or 171 (MATH 150 or 152) and STAT 216 (MATH 241). The 4+1 option also requires CHMY 223/224, 311 (CHEM 222/224,341); BIOM 407-408 (MICB 406-407); and BIOB 411 (MICB 411); and PHSX 205N/206N, 207N/208N (PHYS 111N/113N, 112N/114N). The 3+1 option also requires 37 credits of BIOM 498 (MICB 490) (Med Tech Internship).

Upper-Division Writing Expectation: To meet the Upper-Division Writing Expectation for the major, medical technology 4+1 students take BIOB 410 (MICB 410) and BIOB 411 (MICB 411); 3+1 students take BIOB 410 (MICB 410), BIOM 402 (MICB 412), and one class chosen from: BCH 482 (BIOC 482), BIOB 411 (MICB 411), or BIOM 499 (MICB 499).

Suggested Course of Study**Option A (4+1)**

First Year		A	S
CHMY 141N,143N (CHEM 161N-162N) College Chemistry I, II		5	5
+M 162 (MATH 150) Applied Calculus		4	-
+WRIT 101 (ENEX 101) College Writing I		3	-
BIOB 160N Principles of Living Systems (prerequisite for BIOB 260)		4	-
General Education		-	9
Total		16	14
+Depends on placement exam			
Second Year		A	S
BIOB 260 (BIOL 221) Cellular and Molecular Biology		4	-
BIOB 272 (BIOL 223) Genetics and Evolution		-	4
CHMY 221/222, 223/224 (CHEM 221/222, 223/224) Organic Chemistry I, II and Laboratories		5	5
BIOM 360/361 (MICB 300/301) General Microbiology and Laboratory		-	5
Lower-Division Writing Course		3	-
General Education		3	-
Elective		-	1
Total		15	15
Third Year		A	S
BIOH 365 (BIOL 312) Human A&P I for Health Professions		4	-
BCH 380 (BIOC 380) Biochemistry		4	-
BIOB 410-411 (MICB 410-411) Immunology and Laboratory		5	-
BIOM 402-403 (MICB 412-413) Medical Bacteriology and Mycology and Laboratory		-	5
General Education		-	6
STAT 216 (MATH 241) Introduction to Statistics		-	4
Electives		2	-
Total		15	15
Fourth Year		A	S
CHMY 311 (CHEM 341) Analytical Chemistry-Quantitative Analysis		4	-
BIOM 427/428 (BIOL 400/401) General Parasitology and Lab		4	-
BIOH 405 (MICB 309) Hematology		3	-
BIOM 407/408 (MICB 406/407) Clinical Diagnosis and Laboratory		-	3
BIOM 435 (MICB 420) Virology		-	3
PHSX 205N/206N & 207N/208N (PHYS 111N/113N, 112N/114N) Fundamentals of Physics I, II and Labs		5	5
Elective		-	3
Total		16	14

Suggested Course of Study**Option B (3+1)**

First Year		A	S
CHMY 141N,143N (CHEM 161N,162N) College Chemistry I, II		5	5
+WRIT 101 (ENEX 101) College Writing I		3	-
+M 162 (MATH 150) Applied Calculus		4	-
BIOB 160N Principles of Living Systems (prerequisite for BIOB 260)		4	-
General Education		-	9
Electives		-	1
Total		16	15
+Depends on placement exam			
Second Year		A	S
BIOB 260 (BIOL 221) Cellular and Molecular Biology		4	-
BIOB 272 (BIOL 223) Genetics and Evolution		-	4
BIOH 365 (BIOL 312) Human A&P I for Health Professions		4	-
CHMY 221/222 (CHEM 221/223) Organic Chemistry I and Laboratory		5	-
BIOM 360/361 (MICB 300/301) General Microbiology and Laboratory		-	5
Lower-Division Writing Course		-	3
General Education		3	3
Total		16	15
Third Year		A	S
BCH 380 (BIOC 380) Biochemistry		-	4
BIOM 427/428 (BIOL 400/401) General Parasitology and Lab		4	-
BIOH 405 (MICB 309) Hematology		3	-
BIOB 410/411 (MICB 410/411) Immunology and Laboratory		5	-
BIOM 402/403 (MICB 412/413) Medical Bacteriology & Mycology and Laboratory		-	5
BIOM 435 (MICB 420) Virology		-	3

STAT 216 (MATH 241) Introduction to Statistics	4 -
General Education	- 3
Total	16 15
Fourth Year - Summer	Su -
BIOM 498 (MICB 490) Medical Technology Internship	12 -
Fourth Year	A S
BIOM 498 (MICB 490) Medical Technology Internship	13 12

Microbiology

- ⌄ Special Degree Requirements
- ⌄ Suggested Course of Study
- ⌄ Courses

Microbiology is the study of microorganisms, including the bacteria, yeasts, molds, viruses, protozoa and other microscopic parasites. A B.S. in Microbiology is offered as a general degree or with an option in microbial ecology. The microbiology general option emphasizes microbial structure, function, and interactions and relationships with humans. The microbial ecology option emphasizes microbial structure, function, and interactions and relationships with the environment and other organisms including plants and animals.

Initial work provides the student with a working knowledge of the basic principles of the physical and biological sciences and mathematics. The remaining study is devoted to a more intense and broadened training in microbiology and allied fields, and may include independent study which offers the student an opportunity to prepare for graduate work.

Special Degree Requirements

Refer to the graduation requirements listed previously in the catalog. See index.

In accordance with American Society for Microbiology recommendations, the following courses must be completed in addition to the General Education requirements for the Bachelor of Science in Microbiology: Thirty-two upper-division credits (300-level or above) in biology, biochemistry and microbiology including BIOE 370 (BIOL 340); BCH 380 or 480-482 (BIOC 380 or 481-482); BIOM 360/361, 410/411, 415, 450/451 (MICB 300-301, 404-405, 422, 450/451); and at least 7-9 credits chosen from the following courses (with lab if available):

BIOH 405 (MICB 309), BIOM 427/428 (MICB 400/401), BIOM 407-408 (MICB 406-407), BIOB 410-411 (MICB 410/411), BIOM 402/403 (MICB 412/413), BIOM 423 (MICB 418), BIOM 435 (MICB 420), BIOM 430 (MICB 423), BIOM 490 (MICB 497), MICB 483.

Also required: BIOB 160N, 170N/171N, 260, 272 (BIOL 110N, 108N/109N, 221, 223); M 162 (MATH 150), STAT 216 (MATH 241); CHMY 141N-143N, 221/222, 223/224, 311 (CHEM 161N-162N, 221/223, 222/224, 341); PHSX 205N/206N, 207N/208N (PHYS 111N/113N, 112N/114N).

Microbial Ecology Option: In addition to the General Education requirements and the Upper-Division Writing Expectation described below, the following must be completed for the Bachelor of Science in Microbiology with an option in microbial ecology: Thirty-two or more credits (300-level or above) in biology, biochemistry, microbiology including BIOE 370 (BIOL 340); BCH 380 or 480-482 (BIOC 380 or 481-482); BIOM 360/361, 410/411, 415, 450/451 (MICB 300/301, 404/405, 422, 450/451), and at least 7-9 credits chosen from the following courses (with lab if available): BIOM 427/428 (MICB 400/401), BIOB 410/411 (MICB 410/411), BIOM 423 (MICB 418), BIOM 435 (MICB 420), BIOM 430, 490 (MICB 423, 497); BIOE 371 (BIOL 341), BIOE 428 (BIOL 366), BIOB 440 (BIOL 440), BIOO 433/434 (BIOL 444/445), BIOL 453, 454.

Also required are: BIOB 160N, 170N/171N, 260, 272, (BIOL 110N, 108N/109N, 221, 223); M 162 or 171, STAT 216 (MATH 150 or 152, 241); CHMY 141N-143N, 221/222, 223/224 or CHMY 121N, 123N, 124N, (CHEM 161N-162N, 221/223, 222/224 or CHEM 151N, 152N, 154N); PHSX 205N/206N (PHYS 111N/113N). In addition, choose at least 6 credits from: CHMY 311 (CHEM 341); CSCI 135 (CS 131); ENSC 245N (FOR 210N); GEO 482, 420 (GEOS 382, 480); M 172, 273 (MATH 153, 251) and STAT 451, 452, 457, 458 (MATH 444, 445, 447, 448); PHSX 207N/208N (PHYS 112N/114N).

Upper-Division Writing Expectation: To meet the Upper-Division Writing Expectations for the major, Microbiology students must take BIOM 410 (MICB 404) (required), plus one more course chosen from: BCH 482 (BIOC 482), BCH 486 (BIOC 486), BIOE 428 (BIOL 366), BIOO 434 (BIOL 445), BIOB 410, 411 (MICB 410, 411), BIOM 402, or 499 (MICB 412 or 499).

Suggested Course of Study

Microbiology

First Year		A S
BIOB 160N (BIOL 110N) Principles of Living Systems		4 -
BIOB 170N/171N (BIOL 108N/109N) Principles Biological Diversity and Laboratory		- 5
CHMY 141N, 143N (CHEM 161N/162N) College Chemistry I, II		5 5
+M 162 (MATH 150) Applied Calculus		4 -
+WRIT 101 (ENEX 101) College Writing I		3 -
STAT 216 (MATH 241) Introduction to Statistics		- 4
Total		16 14
+Depends on placement exam.		
Second Year		A S
BIOB 260 (BIOL 221) Cellular and Molecular Biology		4 -
BIOB 272 (BIOL 223) Genetics and Evolution		- 4
CHMY 221/222, 223/224 (CHEM 221/222, 223/224) Organic Chemistry I, II and Laboratories		5 5
BIOM 360/361 (MICB 300/301) General Microbiology and Laboratory		- 5
Lower-Division Writing Course		3 -
General Education		3 -
Elective		- 1
Total		15 15
Third Year		A S
BCH 480, 482 (BIOC 481, 482) (or 380 and two upper-division Biology or Microbiology*)		3 3
BIOB 410/411 (MICB 410/411) Immunology and Laboratory*		5 -
BIOM 415 (MICB 422) Microbial Diversity, Ecology & Evolution		- 3
PHSX 205N/206N & 207N/208N (PHYS 111N/113N & 112N/114N) College Physics I, II and Labs		5 5
General Education		- 3
Upper Division Electives		3 -
Total		16 14
Fourth Year		A S
BIOE 370 (BIOL 340) General Ecology		- 3
CHMY 311 (CHEM 341) Analytical Chemistry-Quantitative Analysis		4 -
BIOM 410/411 (MICB 404/405) Microbial Genetics and Experimental Microbial Genetics Laboratory		- 4
BIOM 435 (MICB 420) Virology*		- 3
BIOM 450/451 (MICB 450/451) Microbial Physiology and Laboratory		4 -
General Education		6 6
Total		14 16

*Choose 7-9 credits from BIOH 405 (MICB 309), BIOM 427/428 (MICB 400/401), BIOM 407/408 (MICB 406/407), BIOB 410/411 (MICB 410/411), BIOM 402/403 (MICB 412/413), BIOM 423 (MICB 418), BIOM 435 (MICB 420), BIOM 430, 490 (MICB 423, 497).

Microbiology with Microbial Ecology Option

First Year		A S
BIOB 160N (BIOL 110N) Principles of Living Systems		4 -
BIOB 170N/171N (BIOL 108N/109N) Principles Biological Diversity and Laboratory		- 5
CHMY 141N, 143N (CHEM 161N/162N) College Chemistry I, II		5 5
+M 162 (MATH 150) Applied Calculus		4 -
+WRIT 101 (ENEX 101) College Writing I		3 -
STAT 216 (MATH 241) Introduction to Statistics		- 4
Total		16 14
+Depends on placement exam.		
Second Year		A S
BIOB 260 (BIOL 221) Cellular and Molecular Biology		4 -
BIOB 272 (BIOL 223) Genetics and Evolution		- 4
CHMY 221/222, 223/224 (CHEM 221/222, 223/224) Organic Chemistry I, II and Laboratories		5 5
BIOM 360/361 (MICB 300/301) General Microbiology and Laboratory		- 5
Lower-Division Writing Course		3 -
General Education		3 -
Elective		- 1
Total		15 15

Third Year		A	S
BCH 480, 482 (BIOC 481, 482) (or 380 and two more upper-division Biology or Microbiology*) Advanced Biochemistry I, II		3	3
BIOE 370 (BIOL 340) General Ecology		3	-
ENSC 245N (FOR 210N) Soils+		-	3
BIOM 427/428 (MICB 400/401) General Parasitology and Laboratory		4	-
BIOM 415 (MICB 422) Microbial Diversity, Ecology, & Evolution		-	3
General Education		3	3
Upper-division elective		-	4
Elective		1	-
Total		14	16
Fourth Year		A	S
GEO 482 Global Change		-	3
BIOM 410/411 (MICB 404/405) Microbial Genetics and Experimental Microbial Genetics Laboratory		-	4
BIOM 430 (MICB 423) Applied and Environmental Microbiology*		-	3
BIOM 450/451 (MICB 450/451) Microbial Physiology and Laboratory		4	-
PHSX 205N/206N (PHYS 111N/113N) College Physics I and Lab		5	-
General Education		3	6
Elective		2	-
Total		14	16

*Choose 7 credits from BIOE 371, 366 (BIOL 341, 366), BIOB 440 (BIOL 440), BIOO 433 (BIOL 444); BIOM 427/428 (MICB 400/401), BIOB 410/411 (MICB 410/411), BIOM 423 (MICB 418), BIOM 435 (MICB 420), BIOM 430, 490 (MICB 423, 497).

+Choose 6 credits from CHMY 311 (CHEM 341); CSCI 135 (CS 131); FOR 210N; GEO 301, 382, 420 (GEOS 301; 382 or 480); M 172, 273 (MATH 153, 251) Stat 451, 452, 457, 458 (MATH 444/447, 445/448); PHYS 207N/208N.

Requirements for a Minor

To earn a minor in microbiology, the student must complete BIOM 360/361, 410/411, 415, 450/451 (MICB 300/301, 404/405, 422, and 450/451), as well as at least three additional credits at the 300 or 400-level in Microbiology.

Courses

R- before the course description indicates the course may be repeated for credit to the maximum indicated after the R. Credits beyond this maximum do not count toward a degree.

Microbiology (MICB) - Course Descriptions

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Biology-Microbiology (BIOM) - Course Descriptions

135N, 227, 250N, 251, 291, 360, 361, 390, 400, 402, 403, 407, 408, 410, 411, 415, 423, 427, 428, 430, 435, 450, 451, 490, 491, 494, 498, 502, 509, 520, 530, 540, 545, 546, 570, 580, 594, 595, 597, 599, 699

Department of Economics

- ◌ Special Degree Requirements
- ◌ Suggested Course of Study
- ◌ Courses
- ◌ Faculty

Derek Kellenberg, Chairperson

The department considers its teaching goals to be three-fold: (1) To present to students the basic theoretical tools of economic analysis, relevant facts and institutional material, which will assist them as civic leaders. (2) To introduce students majoring in economics to the various special fields of study within economics. This training, along with extensive work in the other liberal arts and sciences, is intended to instill breadth of intellectual interest, critical habits of thought, a problem-solving attitude and facility of expression. (3) To help meet, through graduate work, the increasing demands for competent professional economists in industry, commerce, government and education.

Courses cover general economic theory, environmental economics, monetary theory, international economics, public finance, labor economics, economic development, comparative economic systems, econometrics, and industrial organization.

Students major in economics leading to a Bachelor of Arts degree. Graduate work leads to a Master of Arts degree in economics (see Graduate School catalog).

Special Degree Requirements

Refer to graduation requirements listed previously in the catalog. See index.

Thirty-six credits in economics must be earned. Within the 36 credits the student must include ECNS 201S, 202S, 301, 302, 403, 488, 494, 499 (ECON 111S, 112S, 311, 313, 460, 488, 487, 489), and fourteen elective economics credits numbered 300 or above. Three credits of ECNS 101S (ECON 100S) may be counted toward the additional fourteen credits of upper-division economics courses if taken before attaining junior status. A maximum of four credits of ECNS 486 and none of the ECNS 398 credits may count toward the 36-credit requirement. The following courses may be counted as part of the 36 economics credits required for the undergraduate degree: GPHY 323S, PSCI 365 (GEOG 315, PSC 365), FOR 320, FOR 425, FOR 520.

The student should take ECNS 301 and 302 (ECON 311 and 313) before the senior year.

Non-economics courses required for the undergraduate degree are: M 115 (MATH 117), M 162 (MATH 150) or M 171 and 172 (MATH 152 and 153) and STAT 216 (MATH 241) or equivalent. The student must pass WRIT 101 (ENEX 101) with a grade of "C" or above. M 115 (MATH 117) and M 162 (MATH 150) should be taken before ECNS 301. Students planning graduate study in economics should take M 171-172 (MATH 152-153) and consider M 221 (MATH 221), M 307 (MATH 305) and ECNS 511, 513 and 560 (ECON 511, 513, and 560).

The Upper-division Writing Expectation must be met by successfully completing the Senior Economics Thesis, ECNS 488 and 499 (ECON 488 and 489).

Teacher Preparation in Economics

Students who want to be licensed to teach economics at the high-school level must complete the BA degree requirements in economics. They also must complete a teaching major or minor in a second field of their choice and the professional licensure program in the College of Education. Students may also earn a teaching minor in economics. See the Department of Curriculum & Instruction for information about admission to the Teacher Education Program and completion of these licensure programs.

Suggested Course of Study

	First Year	A	S
ECNS 201S, 202S (ECON 111S, 112S) Principles of Micro- and Macroeconomics	3	3	
WRIT 101 (ENEX 101) Composition		3	-
M 115 (MATH 117) Probability and Linear Math		3	-
M 162 (MATH 150) Applied Calculus		-	4
Electives and General Education		6	8
		15	15
	Second Year	A	S
ECNS 301 (ECON 311) Intermediate Microeconomics with Calculus		3	-
ECNS 302 (ECON 313) Intermediate Macroeconomics		-	3
STAT 216 (MATH 241) Introduction to Statistics		4	-
Upper-division economics elective		-	3
Electives and General Education		8	9
		15	15
	Third Year	A	S
ECNS 403 (ECON 460) Introduction to Econometrics		4	-
Upper-division economics electives		3	3
Electives & General Education		8	12
		15	15
	Fourth Year	A	S
ECNS 488 Research Methods & Thesis Design		2	
ECNS 494 (ECON 487) Senior Seminar		-	2
ECNS 499 (ECON 489) Senior Thesis		-	2