

2010-2011 Course Catalog

The University Of Montana

Biology

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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, field ecology, and organismal biology, 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 medical school.

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.

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 Expectations 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), BIOE 371 (BIOL 341), BIOL 342, BIOL 499, BIOM 410 (MICB 404), BIOB 411 (MICB 411) and BIOM 499 (MICB 499). Courses that are approved as 1/3 partial writing include: BCH 482 (BIOC 482), BIOO 470 (BIOL 304), BIOO 475 (BIOL

306), BIOO 320 (BIOL 316), BIOE 428 (BIOL 366), BIOE 403 (BIOL 403), BIOE 406 (BIOL 406), BIOO 434 (BIOL 445), BIOL 483, BIOB 410 (MICB 410), and BIOM 402 (MICB 412).

Option in Ecology and Organismal Biology

Forty-three credits in biology, biochemistry, and microbiology including BIOB 170N-171N (BIOL 108N-109N), 160N (BIOL 110N), 260 (BIOL 221), 275 (BIOL 223), BIOE 371-371 (BIOL 340-341); one organismal course chosen from BIOB 301 (BIOL 301), BIOE 403 (BIOL 403), BIOL 435, BIOO 433/434 (BIOL 444/445), BIOL 468; one course with a focus on a group of organisms chosen from BIOO 471 (BIOL 304), BIO 475 (BIOL 306), BOO 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, BIOE 446 (BIOL 446), BIOE 447 (BIOL 447), BIOE 448 (BIOL 448), BIOM 415 (MICB 422), WBIO 470; one evolutionary biology course chosen from BIOE 404 (BIOL 405), BIOE 406 (BIOL 406), BIOB 480 (BIOL 480), 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 170N-171N (BIOL 108N-109N), 160N (BIOL 110), BIOB 260 (BIOL 221), BIOB 275 (BIOL 223), BIOL 342 or BIOE 370-371 (BIOL 340/341). Major courses chosen 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 being from each category 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 Evolutionary Biology, BIOE 404 (BIOL 405), BIOE 406 (BIOL 406), BIOB 480 (BIOL 480), 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, 221/222 and 223/224); 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 Cellular and Molecular Biology

Forty-four to forty-nine credits in biochemistry, biology and microbiology including BCH 480-482 (BIOC 481-482); BIOB 170N-171N (BIOL 108N-109N), BIOB 160N (BIOL 110N), BIOE 260 (BIOL 221), BIOB 275 (BIOL 223), BIOB 301 (BIOL 301), BIOE 370 (BIOL 340) 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), BIOC 433/434 (BIOL 444/454), BIOL 468, 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 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 170N-171N (BIOL 108N-109N), BIOB 160N (110N), BIOB 260 (BIOL 221), BIOB 275 (BIOL 223), BIOB 301 (BIOL 301), BIOL 312, 313, BIOE 370 (BIOL 340). 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, 460, BIOB 425 (BIOL 464), BIOE 482 (BIOL 482), BIOL 483, BIOL 499, BIOM 410 (MICB 404), BIOB 410 (MICB 410), BIOM 402 (MICB 412), 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-PHSX 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: COMM 111A, Introduction to Public Speaking; 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 Natural History

Forty-two to forty-four credits in biology including BIOB 170N-171N (BIOL 108N-109N), BIOB 160N (BIOL 110N), BIOB 260 (BIOL 221), BIOB 275 (BIOL 223), BIOC 320 (BIOL 316), BIOE 370-371 (BIOL 340-341), BIOC 335 (BIOL 350), BIOC 462 (BIOL 410); one course chosen from BIOC 470 (BIOL 304), BIOC 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

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 170N-171N (BIOL 108N-109N), BIOB 160N (BIOL 110N), BIOB 260 (BIOL 221), BIOB 275 (BIOL 223), BIOE 370-371 (BIOL 340-341), BIOO 433 (BIOL 444), 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); C&I 426; GEO 109N (GEOS 109N) and GEO 301 (GEOS 301) also are required.

For endorsement to teach biology, a student also must gain admission to 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 170N-171N (BIOL 108N-109N), BIOB 160N (BIOL 110N), BIOB 260 (BIOL 221), BIOB 275 (BIOL 223); BIOM 360-361 (MICB 300-301); C&I 426; GEO 109N or GEO 301; 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 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 170N-171N (BIOL 108N-109N), BIOB 160N (BIOL 110N), BIOB 260 (BIOL 221), BIOB 275 (BIOL 223), BIOE 371-371 (340-341); CHMY 123N, 141N-143N, 485 (CHEM 152N, 161N-162N, 485); GEO 101N-102N, 301 (GEOS 100N-101N, 301); M 162 or 171 (MATH 150 or 152), STAT 216 (MATH 241) and PHSX 205N/206N-PHSX 207N/208N (PHYS 111N/113N, 112N/114N). 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 Teacher Education Program, complete C&I 426 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		
BIOB 170N-171N (BIOL 108N-109N) Principles Biological Diversity and Laboratory	5	-
BIOB 160N (BIOL 110N) Principles of Living Systems	-	4
CHMY 121N (CHEM 151N) Introduction to General Chemistry	3	-
CHMY 123N (CHEM 152N) 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
General Education	-	3
	15	16
Second Year		
BIOB 260 (BIOL 221) Cellular and Molecular Biology	4	-
BIOB 275 (BIOL 223) General Genetics	-	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		
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	-	4
C&I 200 Exploring Teaching	1	-
C&I 303 Educational Psychology and Measurement	3	-
C&I 306 Instructional Media and Computer Applications	3	-
C&I 410 Exceptionality and Classroom Management	3	-
HHP 233 Health Issues of Children and Adolescents	-	3
Elective	-	2
	15	14
Fourth Year		
C&I 301 or 302 Field Experience	1	-
C&I 407E Ethics and Policy Issues	3	-
C&I 426 Teaching Science in the Middle and Secondary School	3	-
C&I 427 Literary Strategies in Content Areas	3	-
C&I 482 Student Teaching: Secondary	-	14
C&I 494 Professional Portfolio	-	1

BIOL 435 Comparative Animal Physiology	3	-
GEO 109N Environmental Geoscience (or GEO 301 Environmental Geology)	2	-
	15	15

Cellular and Molecular Biology Option

First Year

BIOB 170N-171N (BIOL 108N-109N) Principles of Biological Diversity and Laboratory	5	-
BIOB 160N (BIOL 110N) Principles of Living Systems	-	4
CHMY 141N-143N (CHEM 161N-162N) Introduction to General Chemistry	5	5
WRIT 101 (ENEX 101) College Writing I	-	3
M 162 (MATH 150) Applied Calculus	4	-
General Education Elective	- 1	3 -
	15	15

Second Year

BIOB 260 (BIOL 221) Cellular and Molecular Biology	4	-
BIOB 275 (BIOL 223) General Genetics	-	4
CHMY 221-222, 223-224 (CHEM 221-222, 223-224) Organic Chemistry and Laboratory	5	5
BIOM 360-361 (MICB 300-301) General Microbiology and Laboratory	-	5
Lower-division writing course	3	-
General Education Elective	3 -	- 1
	15	15

Third Year		
BCH 480-482 (BIOC 481-482) Advanced Biochemistry I, II	3	3
BIOM 410 (MICB 404) Microbial Genetics (or BIOL 345, BIOB 440 (BIOL 440), BIOC 433 (BIOL 444), BIOB 491 (BIOL 495); 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 483 (BIOC 486))	-	1
PHSX 205N-206N, 207N-208N (PHYS 111N/113N, 112N/114N) College Physics I, II & Lab	5	5
General Education	3	3
Electives	4	-
	15	15

Fourth Year		
BIOE 370 (BIOL 340) General Ecology	-	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	4	-
BIOB 410-411 (MICB 410-411) Immunology and Laboratory	5	-
Upper-division elective	3	3
General Education	3	3
	15	15

Ecology and Organismal Biology Option with One Year of Chemistry

First Year

BIOB 170N-171N (BIOL 108N-109N) Principles of Biological Diversity and Laboratory	5	-
BIOB 160N (BIOL 110N) Principles of Living Systems	-	4
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
	15	15
Second Year		
BIOB 260 (BIOL 221) Cellular and Molecular Biology	4	-
BIOB 275 (BIOL 223) General Genetics	-	4
PHSX 205N/206N-207N/208N (PHYS 111N/113N-112N/114N) College Physics I, II & Lab	5	5
Lower-division writing course	3	-
Elective	3	
General Education	3	6
	15	15
Third Year		
STAT 451/457 (MATH 444/447) Statistical Methods I and Comp. Lab	4	-

STAT 452/458 (MATH 445/448) Statistical Methods II and Comp. Lab	-	4
BIOE 370-371 (BIOL 340-341) General Ecology and Laboratory	5	-
BIOO 475 (BIOL 306) Mammalogy (or BIOO 470-471 (BIOL 304), BIOO 340 (BIOL 308), BIOO 320 (BIOL 316), BIOO 335 (BIOL 350), BIOM 427/428 (BIOL 400/401), BIOO 462 (BIOL 410) and BIOM 360/361 (MICB 300/301))	4	-
BIOE 406 (BIOL 406) Behavior and Evolution (or BIOE 404 (BIOL 405), BIOB 480 (BIOL 480), BIOE 482 (BIOL 482), BIOL 484)	-	4
BIOE 446 (BIOL 446) Wildlife Physiological Ecology (or BIOE 428 (BIOL 366), BIOE 449 (BIOL 430), BIOL 442, BIOE 447 (BIOL 447), BIOE 448 (BIOL 448), BIOM 415 (MICB 422), or WBIO 470)	-	3
General Education Requirement	-	3
Electives	3	-
	16	14
Fourth Year		
BIOO 320 (BIOL 316) General Botany	-	5
BIOE 403 (BIOL 403) Vertebrate Design and Evolution (or BIOB 301 (BIOL 301), BIOL 435, BIOO 433 (BIOL 444), BIOL 445)	5	-
Upper-division elective	5	-
General Education Requirement	3	3
Electives	1	8

14

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Ecology and Organismal Biology Option with Two Years of Chemistry

First Year		A		S
BIOB 170N-171N (BIOL 108N-109N) Principles of Biological Diversity Laboratory	5		-	
BIOB 160N (BIOL 110N) Principles of Living Systems	-		4	
CHMY 141N (CHEM 161N) College Chemistry	5		-	
CHMY 143N (CHEM 162N) College Chemistry Laboratory	-		5	
WRIT 101 (ENEX 101) College Writing I	-		3	
M 162 (MATH 150) Applied Calculus	4		-	
STAT 216 (MATH 241) Statistics	-		4	
	14		16	
Second Year		A		S
BIOB 260 (BIOL 221) Cellular and Molecular Biology	4		-	
BIOB 275 (BIOL 223) General Genetics	-		4	
CHMY 221-222-223-224 (CHEM 221-222-223-224) Organic Chemistry and Laboratory	5		5	
Writing course	3		-	
General Education	3		6	
	15		15	
Third Year		A		S
BCH 480-482 (BIOC 481-482) Biochemistry I and II	3		-	
BIOB 301 (BIOL 301) Developmental Biology(or BIOL 345, BIOE 406 (BIOL 403), BIOC 433 (BIOL 444), BIOL 445)	-		3	

BIOE 370-371 (BIOL 340-341) Ecology and Laboratory	5	-	
PHSX 205N/206N - PHSX 207N/208N (PHYS 111N/113N, 112N/114N) College Physics I, II & Lab	5	5	
General Education	-	3	
Elective	2	-	
Upper-division electives	-	4	
	15	15	
Fourth Year			A S
BIOE 404 (BIOL 405) Animal Behavior (or BIOE 406 (BIOL 406), BIOB 480 (BIOL 480), BIOE 482 (BIOL 482), BIOL 484)	-	5	
BIOE 448 (BIOL 448) Terrestrial Plant Ecology (or BIOE 428/429 (BIOL 366), BIOE 449 (BIOL 430), BIOE 446 (BIOL 446), BIOE 447 (BIOL 447), BIOB 491 (BIOL 495), BIOM 415 (MICB 422), WBIO 470)	4	-	
BIOM 360/361 (MICB 300/301) General Microbiology & Lab (or BIOC 470/471 (BIOL 304), BIOC 475 (BIOL 306), BIOC 340 (BIOL 308), BIOC 320 (BIOL 316), BIOC 335 (BIOL 350), BIOM 427/428 (BIOL 400/401), BIOC 462/463 (BIOL 410), BIOM 423 (BIOL 418))	-	5	
General Education Requirement	6	-	
Upper-division elective	4	5	
Elective	1	1	
	15	15	

Ecology Option for Teacher Preparation in General Science

First Year

BIOB 170N-171N (BIOL 108N-109N) Principles of Biological Diversity Laboratory	5	-
BIOB 160N (BIOL 110N) Principles of Living Systems	-	4
CHMY 141N-143N (CHEM 161N-162N) College Chemistry	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
	14	16
Second Year		
ASTR 131N, 134N Elementary Astronomy and Laboratory	4	-
BIOB 260 (BIOL 221) Cellular and Molecular Biology	4	-
BIOB 275 (BIOL 223) General Genetics	-	4
CHMY 123N (CHEM 152N) Introduction to Organic and Biochemistry	-	3
GEO 101N-102N (GEOL 100N-101N) Introduction to Physical Geology	-	3
STAT 216 (MATH 241) Statistics	4	-
General Education/Native American Studies course	-	3
Lower-division writing course	3	-
Elective	-	1
	15	14
Third Year		
CHMY 485 (CHEM 485) Laboratory Safety	1	-
C&I 200 Exploring Teaching	-	1

C&I 303 Educational Psychology and Measurement	-	3
C&I 306 Instructional Media and Computer Applications	-	3
C&I 410 Exceptionality and Classroom Management	-	3
GEO 301 (GEOS 301) Environmental Geology	3	-
PHSX 205N-206N & 207N-208N (PHYS 111N/113N-112N/114N) College Physics I, II & Lab	5	5
General Education	6	-
	15	15

Fourth Year

BIOE 370-371 (BIOL 340-341) General Ecology and Laboratory	5	-
C&I 301 or 302 Field Experience	1	-
C&I 407E Ethics and Policy Issues	3	-
C&I 426 Teaching Science in the Middle and Secondary School	3	-
C&I 427 Literary Strategies in Content Areas	3	-
HHP 233 Health Issues of Children and Adolescents	-	3
Upper-division biology writing course	-	4
General Education	-	3
Electives	-	5
	15	15

Fifth Year

C&I 482 Student Teaching: Secondary		14
C&I 494 Professional Portfolio		1

A

Field Ecology Option (Track A, two summers)

First Year	A	S
BIOB 170N-171N (BIOL 108N-109N) Principles of Biological Diversity 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	1	1
BIOB 160N (BIOL 110N) Principles of Living Systems	-	4
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
	16	16
Second Year		
BIOB 260 (BIOL 221) Cellular and Molecular Biology	4	-
STAT 451/457 (MATH 444/447) Statistical Methods/Computer Analysis	4	-
General Education Requirement	3	-
Electives	5	-
BIOB 275 (BIOL 223) General Genetics	-	4
STAT 452/458 (MATH 445/448) Statistical Methods/Computer Analysis	-	4

General Education Requirement	-	6
Elective	-	2
	16	16

Third Year

Summer (at Biological Station)		
BIOL 342 Field Ecology and Lab	5	
Upper Division Electives	5	10
BIOL 484 Planet Evolution	3	
PHSX 205N/206N (PHYS 111N/113N) College of Physics I & Lab	5	-
General Education Requirement	6	-
Electives	2	-
BIOO 320 (BIOL 316) General Botoan	-	5
PHSX 207N/208N (PHYS 112N/114N) College Physics II & Lab	-	5
Electives	-	7
	16	17

Second Summer (at Biological Station)

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

Field Ecology Option (Track B one summer)

First Year	A		S
BIOB 170N-171N (BIOL 108N-109N) Principles of Biological Diversity Laboratory	5	-	

CHMY 141N (CHEM 161N) College Chemistry I	5	-
M 162 (MATH 150) Applied Calculus	4	-
Elective	1	-
BIOB 160N (BIOL 110N) Principles of Living Systems	-	4
CHMY 143N (CHEM 162N) College Chemistry II	-	5
WRIT 101 (ENEX 101) College Writing I	-	3
General Education Requirement	-	3
	15	15
Second Year		
BIOB 260 (BIOL 221) Cellular and Molecular Biology	4	-
CHMY 221/222 (CHEM 221/222) Organic Chemistry I & Lab	5	-
STAT 216 (MATH 241) Introduction to Statistics	4	-
Lower Division Writing Requirement	3	-
BIOB 275 (BIOL 223) General Genetics	-	4
CHMY 222/224 (CHEM 222/224) Organic Chemistry II & Lab	-	5
General Education	-	6
	16	15
Third Year		
BIOE 370/371 (BIOL 340/341) General Ecology and Lab	5	-
PHSX 205N/206N (PHYS 111N/113N) College Physics I and Lab	5	-
Electives	2	-
PHSX 207N/208N (PHYS 112N/114N) College Physics II and Lab	-	5

General Education Requirements	-	6
Electives	-	1
	12	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		
BIOO 340 (BIOL 308) Biology and Management of Fishes	4	-
Upper Division electives	8	-
BIOL 406 Behavior and Evolution	-	4
Upper-division elective	-	5
General Education	-	3
	12	12

Human Biological Sciences Option with One Year of Chemistry

First Year		
BIOB 170N-171N (BIOL 108N-109N) Principles Biological Diversity and Laboratory	5	-
BIOB 106N (BIOL 110N) Principles of Living Systems	-	4
CHMY 121N (CHEM 151N) Introduction to General Chemistry	3	-
CHMY 123N/124N (CHEM 152N/154N) Introduction to Organic and Biochemistry	-	5

WRIT 101 (ENEX 101)	-	3
College Writing I		
M 162 (MATH 150)	4	-
Applied Calculus		
PSYX 100S (PSYC 100S)	-	4
Introduction to Psychology		
Elective	1	1
	16	15
Second Year		
BIBO 260 (BIOL 221)	4	-
Cellular and Molecular Biology		
BIOB 275 (BIOL 223)	-	4
General Genetics		
PHSX	5	5
205N/206N-207N/208N (PHYS 111N/113N-112N/114N)		
College Physics I,II & Lab		
PSYX 340S (PSYC 330S)	-	3
Abnormal Psychology		
STAT 216 (MATH 241)	4	-
Introduction to Statistics		
Lower-division writing course	3	-
Electives	-	3
	16	15
Third Year		
BIOL 312, 313 Anatomy and Physiology I and II	4	4
BIOB 301 (BIOL 301)	-	3
Developmental Biology		
BIOM 400 (MICB 302)	3	-
Medical Microbiology or BIOM 360/361 (MICB 300/301) General Microbiology & Lab		
BCH 380 (BIOC 380)	4	-
Biochemistry		
General Education	3	3
Upper-division elective	-	4
	14	15
Fourth Year		
BIOE 370-371 (BIOL 340-341) General Ecology and Laboratory	5	-

BIOE 403 (BIOL 403)	5	-
Vertebrate Design & Evolution or upper-division Biology or Microbiology elective that meets the UD biology writing requirement		
BIOL 460 Medical Physiology	-	3
HHP 377/378 Physiology of Exercise and Lab	-	4
General Education	-	3
Electives	5	5
	15	15

Human Biological Sciences Option with Two Years of Chemistry

First Year		
BIOB 170N-171N (BIOL 108N-109N) Principles Biological Diversity and Laboratory	5	-
BIOB 160N (BIOL 110N) Principles of Living Systems	-	4
CHMY 141N-143N (CHEM 161N-162N) College Chemistry	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
	14	16
Second Year		
BIOB 260 (BIOL 221) Cellular and Molecular Biology	4	-
BIOB 275 (BIOL 223) General Genetics	-	4
CHMY 221-222-223-224 (CHEM 221-222-223-224) Organic Chemistry and Laboratory	5	5
BIOM 360-361 (MICB 300-301) General	-	5

Microbiology and Laboratory		
Lower-division writing course	3	-
STAT 216 (MATH 241) Introduction to Statistics	4	-
	16	14
Third Year		
BIOL 312, 313 Anatomy and Physiology I and II	4	4
BIOB 301 (BIOL 301) Developmental Biology	-	3
PHSX 205N/206N-207N/208N (PHYS 111N/113N-112N/114N) College Physics I, II & Lab	5	5
Upper-division elective	3	-
General Education	3	-
	15	15
Fourth Year		
BIOE 370 (BIOL 340) General Ecology	3	-
BIOB 425 (BIOL 464) Advanced Cellular and Molecular Biology Biology	-	3
BCH 480-482 (BIOC 481-482) Advanced Biochemistry I, II	3	3
BCH 486 (BIOC 486) Biochemistry Research Lab (or another writing course)	-	3
General Education	6	3
Elective	3	1
Upper-division elective	-	2
	15	15

Natural History Option

First Year		
BIOB 170N-171N (BIOL 108N-109N) Principles Biological Diversity and Laboratory	5	-

BIOB 160N (BIOL 110N) - Principles of Living Systems	-	4
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 (or another math course for GER)	3	-
General Education	-	6
Elective	1	-
	15	15
Second Year		
BIOB 260 (BIOL 221) Cellular and Molecular Biology	4	-
BIBO 275 (BIOL 223) General Genetics	-	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	5	5
	16	15
Third Year		
BIOE 370 (BIOL 340) General Ecology	3	-
BIOE 371 (BIOL 341) General Ecology Laboratory	2	-

BIOO 320 (BIOL 316)	-	5
General Botany		
Cognate course	3	4
Upper-division cognate course	-	7
General Education	6	-
	14	16
Fourth Year		
BIOO 475 (BIOL 306)	4	-
Mammalogy or BIOO 470-471 (BIOL 304), BIOL 356		
BIOE 406 (BIOL 406)	-	4
Behavior and Evolution or BIOE 404 (BIOL 405)		
BIOO 462 (BIOL 410)	-	4
Entomology		
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 170N/171N (BIOL 108N-109N), BIOB 160N (BIOL 110N), BIOB 260/261 (BIOL 221) and BIOB 275 (BIOL 223) and 8 credits in Biology at the 300-400 level. All courses must be taken for a traditional letter grade.

Courses

U = for undergraduate credit only, UG = for undergraduate or graduate credit, G = for graduate credit. R after the credit 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)

U 112 Introduction to Human Form and Function I 3 cr. Offered autumn. Explores the fundamentals of structure and function at basic cellular and tissue levels, in addition to the anatomy and physiology of the integumentary, musculoskeletal, and nervous systems.

U 113 Introduction to Human Form and Function II 3 cr. Offered spring. Explores the fundamental structures and functions of the endocrine, cardiovascular, respiratory, digestive, urinary and reproductive systems.

U 130N Evolution and Society 3 cr. Offered spring. A focus on relationships between evolutionary biology and important social issues, including the evolution of drug-resistant diseases, the construction and use of genetically-modified organism, human evolutionary biology, and experimental laboratory evolution.

U 135N Biology of Yellowstone Hot Springs 3 cr. Offered autumn alternate years. A field and laboratory based exploration of the microbial diversity of the thermal features of our first national park. Topics to be discussed include how these communities are shaped by the physical and chemical conditions of the environment and how microorganisms can thrive at life's extremes. Includes a field trip to Yellowstone National Park.

U 265 Human Sexuality 3 cr. Offered autumn. Same as ANTH 201. Biological, behavioral, cross-cultural aspects of human sexuality to help students place their own sexuality and that of others in a broader perspective. Includes sexual anatomy, physiology, development, reproduction, diseases, determination, as well as gender development and current issues.

U 312 Anatomy and Physiology I 4 cr. Offered autumn. Prereq. or coreq., CHMY 121N (CHEM 151N) or CHMY 141N (CHEM 161N); BIOB 160N (BIOL 110N) or BIOL 112 or BIOL 113. Introduction to basic cellular structure and function. The fundamental facts and concepts of the anatomy and physiology of the integumentary, musculoskeletal, nervous and endocrine systems.

U 313 Anatomy and Physiology II 4 cr. Offered spring. Prereq., BIOL 312. The fundamental facts and concepts of the anatomy and physiology of the endocrine, circulatory, respiratory, digestive, urinary and reproductive systems.

UG 315 Peer Advising 1 cr. (R-6) Offered every term. Prereq., consent of instr. Supervised training and internship for peer advisors who will gain knowledge and ability to communicate degree requirements and relate the various degree offerings to professional and career goals. No more than two credits are allowed toward upper-division major requirements.

U 342 Field Ecology 5 cr. Offered summers only at Flathead Lake Biological Station. Prereq., BIOB 275 (BIOL 223) and one year of college math, including statistics. The principles and practices of the study of animals and plants in their natural environments, including human influences, with focus on the Crown of the Continent area of the Rock Mountains and taught entirely outdoors.

U 343 Ecological Methods and Analysis 5 cr. Offered summers only at Flathead Lake Biological Station. Prereq., BIOL 342 or BIOE 370/371 (BIOL 340/341). The methods and tools for conducting observational and experimental research in field ecology with emphasis on experimental design, hypothesis testing, data gathering and analysis and presentation of scientific research in ecology.

UG 356 Ecology of Birds 4 cr. Prereq., BIOB 275 (BIOL 223) or equiv. Offered summers only at Flathead Lake Biological Station. The identification, natural history, and behavior of western Montana birds.

UG 407 Global Biogeochemical Cycles 3 cr. Offered spring odd numbered years. Same as FOR 408, GEO/CCS 407. Exploration of how variations in the availability or utilization of critical Earth elements influences the atmosphere, the oceans, and the terrestrial biosphere including the natural and agricultural ecosystems on which we depend.

UG 415 Field Methods in Fisheries Biology and Management 1-4 cr. Offered autumn. Prereq., BIOC 340 (BIOL 308); Consent of instr. Same as WBIO 441. Field instruction by practicing biologists in techniques for evaluating and managing aquatic habitats and fish populations.

UG 435 Comparative Animal Physiology 3 cr. Offered autumn. Prereq., BIOB 260 (BIOL 221) or equivalent. Animal physiology with emphasis on diversity of functional processes, with strong links to broader ecological and evolutionary contexts.

UG 442 Ecology of Infectious Diseases 3 cr. Offered autumn (even-numbered years). Prereq., BIOB 275, BIOE 370 (BIOL 223, 340). Introduction to the field of disease ecology, focusing on diversity of parasites, parasite population biology and causes and consequences of host-parasite interactions.

UG 449 Plant-Animal Interactions 4 cr. Offered summers only at Flathead Lake Biological Station. Prereq., a college course in ecology. Concepts and techniques for understanding the interdependent relationships between plants and animals. Emphasis given to ecological and behavioral studies.

UG 451 Landscape Ecology 3 cr. Offered summers only at Flathead Lake Biological Station. Prereq., BIOL 342 or BIOE 370/371 (BIOL 340/341). Biophysical processes that determine landscape and ecosystem structure and function using remote sensing tools, geographic information systems and dynamic models to demonstrate landscape change.

UG 452 Conservation Ecology 3 cr. Offered summers only at Flathead Lake Biological Station. Prereq., BIOL 342 or BIOE 370/371 (BIOL 340/341). Concepts and approaches for sustaining biodiversity and other natural goods and services provided by terrestrial and aquatic systems.

UG 453 Lake Ecology 3 cr. Offered summers only at Flathead Lake Biological Station. Prereq., BIOL 342 or BIOE 370/371 (BIOL 340/341), CHMY 121N (CHEM 151N) and CHMY 123N (CHEM 152N). The physical, chemical and biological characteristics of lake ecosystems with an emphasis on nutrient cycling, food web interactions and water quality.

UG 454 Stream Ecology 3 cr. Offered summers only at Flathead Lake Biological Station. Prereq., BIOL 342 or BIOE 370/371 (BIOL 340/341), CHMY 121N (CHEM 151N). The biota and biogeochemical processes of running waters with unifying principles and contemporary research approaches.

UG 458 Ecology of Forests and Grasslands 3 cr. Offered summers only at Flathead Lake Biological Station. Prereq., BIOL 342 or BIOE 370/371 (BIOL 340/341). Patterns and processes of the forests and grasslands of the northern Rocky Mountains in the context of principles of population community and ecosystem ecology.

UG 459 Alpine Ecology 3 cr. Offered summers only at Flathead Lake Biological Station. Prereq., BIOL 342 or BIOE 370/371 (BIOL 340/341). Distribution, abundance and life cycles of plants and animals and their unique ecophysiological adaptations to life in the rigorous environments of the high mountains above the timberline, with emphasis on the Crown of the Continent area.

UG 460 Medical Physiology 3 cr. Offered spring. Prereq., C (2.00) or better in BIOL 312, 313, one year college chemistry or consent of instr. An advanced course in human physiology for students preparing for careers in health care.

U 468 Endocrinology 3 cr. Offered alternate springs. Prereq., BIOB 260 and 275 (BIOL 221 and 223). Integration of fundamental concepts of endocrinology (such as hormone release, hormone transport and receptor activation) into complex systems (such as reproduction).

U 471 Teaching Anatomy and Physiology I 3 or 4 cr. Offered autumn. Prereq., "A" or "B" in BIOL 312 and 313 or equiv. and consent of instr. This select group of students performs cadaver prosections; assists in preparation and grading of demonstrations and laboratory teaching materials; and provides laboratory anatomy and physiology instruction to undergraduate students enrolled in BIOL 312. Students enrolling for the 4 credit option will also provide occasional comparable assistance for BIOL 112.

U 472 Teaching Anatomy and Physiology II 3 or 4 cr. Offered spring. Prereq., "A" or "B" in BIOL 312 and 313 or equiv. and consent of instr. This select group of students performs cadaver prosections; assists in the preparation and grading of demonstrations and laboratory teaching materials; and provides laboratory anatomy and physiology instruction to undergraduate students enrolled in BIOL 313. Students enrolling for the 4 credit option will also provide occasional comparable assistance for BIOL 113.

U 483 Molecular Phylogenetics and Evolution 3 cr. Alternating spring semesters. Phylogenies, or evolutionary trees, provide insights into the history of life on Earth, including our own origins. This course focuses on the theoretical foundations of popular methods of reconstructing phylogenies from molecular sequence data and how to implement these methods with computational software for real data sets. Other current methods for testing evolutionary hypotheses with sequence data will also be introduced. Same as MICB 483.

UG 484 Plant Evolution 3 cr. Offered fall, alternate years. Prereq., BIOB 275 (BIOL 223). Lecture, reading and discussion on the evolutionary processes that shape major patterns of plant diversity. Topics include but are not restricted to: local adaptation, floral and mating system evolution, polyploidy, genome evolution, and speciation.

UG 492 Seminars in Ecology and Resource Management 1 cr. Offered summers only at Flathead Lake Biological Station. Prereq., BIOL 342 or BIOE 370/371 (BIOL 340/341) or taken concurrently with BIOL 342. Seminar course that meets weekly for 2 hours in the evening. Includes seminar speaker and discussion.

U 499 Undergraduate Thesis 3-6 cr. (R-6) Offered every term. Prereq., senior standing and consent of instr. Preparation of a thesis or manuscript based on undergraduate research for presentation and/or publication. Student must give oral or poster presentation at the Biological Sciences Undergraduate Research Symposium or a scientific meeting. Graded credit/no credit.

Biology-General (BIOB)

U 101N (BIOL 100N) Discover Biology 3 cr. Offered every term. Contemporary exploration of the organization and complexity of living organisms and the systems in which they live. The central question of biology--relationship between form and function, acquisition and use of energy, and continuity between generations will be addressed through lectures and laboratory investigations. Credit not allowed toward a major in biology. Credit not allowed for both BIOB 101N and BIOB 160N (BIOL 100N and 110N).

U 160N (BIOL 110N) Principles of Living Systems 4 cr. Offered spring and summer. Unifying principles of biological structure-function relationships at different levels of organization and complexity. Consideration of reproduction, genetics, development,

evolution, ecosystems, as well as the inter-relationships of the human species to the rest of life. Lab experiences illustrate biological principles underlying growth, reproduction, development, genetics and physiology. Credit not allowed for both BIOB 101N and 160N (BIOL 100N and 110N).

U 170N (BIOL 108N) Principles of Biological Diversity 3 cr. Offered autumn and summer. Survey of the diversity, evolution and ecology of life including prokaryotes, viruses, protista, fungi, plants and animals.

U 171N (BIOL 109N) Principles of Biological Diversity Laboratory 2 cr. Offered autumn and summer. Coreq., BIOB 170N (BIOL 108N). The diversity of life including prokaryotes, viruses, protista, fungi, plants and animals including structure and evolutionary relationships.

U 191 (BIOL 195) Special Topics Variable Credit (R-6) Offered intermittently. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.

U 198 (BIOL 198) Internship Variable Credit (R-6) Offered intermittently. Prereq., consent of Division. Extended classroom experience that provides practical application of learning during placement off campus. Prior approval must be obtained from the faculty supervisor and the Internship Services office. A maximum of 6 credits of Internship (198, 298, 398, 498) may count toward graduation.

U 240 (BIOL 240) Introduction to Biostatistics (Honors) 3 cr. Offered autumn even-numbered years. Prereq., calculus and consent of instr. Same as WBIO 240. Introduction to statistical ecology: distributions, hypothesis testing, and fitting models to data with emphasis on problems in ecological sampling.

U 260 (BIOL 221) Cell and Molecular Biology 4 cr. Offered autumn. Prereq., BIOB 160N (BIOL 110N) or equiv. and one year of college chemistry. Description and analysis of biological structures and processes at the cellular and subcellular levels including molecular genetics, energy, metabolism and cell differentiation.

U 275 (BIOL 223) General Genetics 4 cr. Offered spring. Prereq., BIOB 260 (BIOL 221). Principles and mechanisms of inheritance and evolution. Population genetics, fossil record, macroevolution, speciation, extinction, systematics, molecular evolution.

U 291 (BIOL 295) Special Topics Variable cr. (R-6) Offered intermittently. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.

U 298 (BIOL 298) Internship Variable cr. Offered intermittently. Prereq., consent of Division. Extended classroom experience that provides practical application of learning during placement off campus. Prior approval must be obtained from the faculty supervisor and the Internship Services office. A maximum of 6 credits of Internship (198, 298, 398, 498) may count toward graduation.

UG 301 Developmental Biology 3 cr. Offered spring. Prereq., BIOB 260 (BIOL 221); BIOB 275 (BIOL 223) recommended. An analysis of the origin and development of form and patterns in organisms, stressing the processes of growth and differentiation in plants and animals. Graded traditional letter grade only.

U 390 (BIOL 397) Research 1-10 cr. (R-10) Offered every term. Prereq., consent of instr. Independent research under the direction of a faculty member. Graded credit/no credit.

U 391 (BIOL 395) Special Topics Variable cr. (R-10) Offered intermittently. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.

U 398 (BIOL 398) Internship 1-6 cr. Offered intermittently. Prereq., consent of the Division. Extended classroom experience that provides practical application of learning during placement off campus. Prior approval must be obtained from the faculty supervisor and the Internship Services office. A maximum of 6 credits of Internship (198, 298, 398, 498) may count toward graduation.

UG 410 Immunology 3 cr. Offered autumn. Prereq., BIOM 360-361 (MICB 300-301). Modern concepts and methods in immunology.

UG 411 Immunology Laboratory 2 cr. Offered autumn. Coreq., BIOB 410 (MICB 410). Modern techniques for analysis of immune responses.

UG 425 (BIOL 464) Advanced Cell and Molecular Biology 3 cr. Offered spring. Prereq., BIOB 260 and 275 (BIOL 221 and 223); BCH 380 (BIOC 380) strongly recommended. Cell structure and function, cell cycle, cellular signaling, molecular basis of cancer, regulated cell death, membrane transport, organelle dynamics, cytoskeleton, cell adhesion, and the molecular basis of learning and memory.

UG 440 (BIOL 440) Biological Electron Microscopy 2 cr. Offered spring. Prereq., senior standing or consent of instr. Theory of electron microscopy, recent developments in transmission and scanning electron microscopy. Limited experience with the instruments.

UG 480 (BIOL 480) Conservation Genetics 3 cr. Offered autumn. Prereq., BIOB 275 (BIOL 223). Genetic basis for solving biological problems in conservation including the genetics of small populations, the application of molecular genetic techniques to conservation biology and case studies of the application of genetics to conservation problems.

UG 490 (BIOL 497) Advanced Undergraduate Research 1-10 cr. (R-10) Offered every term. Prereq., junior or senior standing and consent of instr. Independent research under the direction of a faculty member. Graded credit/no credit.

UG 491 (BIOL 495) Special Topics Variable cr. (R-10) Offered intermittently. Prereq., consent of instr. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.

U 492 (BIOL 493) Independent Study 1-10 cr. Offered intermittently. Prereq., consent of instr. Independent work under the University omnibus option. See index.

UG 494 (BIOL 494) Seminar in Biology 1 cr. (R-3) Offered intermittently. Prereq., consent of instr.

U 498 (BIOL 498) Internship 1-6 cr. Offered intermittently. Prereq., consent of the Division. Extended classroom experience that provides practical application of learning during placement off campus. Prior approval must be obtained from the faculty supervisor and the Internship Services office. A maximum of 6 credits of Internship (198, 298, 398, 498) may count toward graduation.

G 501 (BIOL 501) Graduate Issues and Policies 1 cr. Prereq., graduate standing in biological sciences. Discussion of issues of importance to new graduate students, including the philosophy of graduate education, the mentor-student relationship, the role of the teaching assistant, handling ethical quandaries, library resources and bibliographic searches, animal use policies and issues, proposal writing and the

publication process. Review of ongoing research by faculty in the organismal biology and ecology program.

G 510 (BIOL 510) Avian Ecology 3 cr. (R-6) Offered intermittently. Prereq., graduate standing in EVST, BIOL, WBIO; upper-division course in ecology; or consent of instr. Review of recent developments in avian ecology with special emphasis on scientific methodology.

G 513 (BIOL 513) Community Ecology 3 cr. Offered alternate years. Prereq., BIOE 370 (BIOL 340) or equiv., consent of instr. Current concepts of species interactions, succession, food webs, temporal and spatial patterns and quantitative characterization of community structure.

G 517 (BIOL 517) Advanced Plant Ecology 3 cr. Prereq., upper-division course in ecology or consent of instr. Offered alternate years. Review and discussion of recent advances in plant ecology.

G 518 (BIOL 518) Plant-Consumer Interactions 3 cr. Offered alternate years. Prereq. BIOE 370 (BIOL 340) or equiv. Ecology and evolution of plant-consumer interactions. Review of classic and contemporary literature on plant-consumer interactions.

G 519 (BIOL 519) Fire Ecology 3 cr. Offered autumn even-numbered years. Prereq., graduate standing or consent of instr. Review of fundamental principles and recent advances in fire ecology with the primary focus on biological effects.

G 522 (BIOL 522) Readings in Morphology, Physiology and Ecology 1 cr. (R-8) Prereq., graduate standing and consent of instr. Review and discussion of current literature in the fields of morphology, physiology, and ecology.

G 524 (BIOL 524) Physiological Plant Ecology 3 cr. Offered alternate years. Prereq., BIOE 370 and BIOO 433 (BIOL 340 and 444). The physiological basis of plant adaptation and response to the environment.

G 526 (BIOL 526) Current Trends in Plant Ecology 2 cr. (R-16) Prereq., graduate standing. Current concepts, theory, and experiments in plant ecology.

G 530 (BIOL 530) Advanced Topics in Physiology 1-4 cr. (R-8) Prereq., consent of instr. Offered alternate years. Topics vary but emphasize aspects of comparative or environmental physiology of animals and/or plants.

G 541 (BIOL 541) Electron Microscopy Laboratory Variable cr. (R-6) Prereq. or coreq., BIOB 440 (BIOL 440) or equiv. Practical laboratory experience in the preparation of various biological materials, hands-on operation of the transmission electron microscope.

G 551 (BIOL 551) Environmental Field Study 1-3 cr. (R-3) Prereq. or coreq., EVST 540 or 560. Same as EVST 551. Designing, executing, and interpreting environmental studies. Project oriented.

G 561 (BIOL 561) Population Genetics Seminar 1-2 cr. (R-12) Prereq., consent of instr. or graduate standing. Current topics in population genetics, evolutionary biology, molecular evolution and related topics.

G 575 (BIOL 575) Frontiers in Conservation Research 2 cr. (R-6) Same as WBIO 575. Exploration of current topics in conservation biology.

G 594 (BIOL 594) Seminar in Biology 1 cr. (R-6) Prereq., graduate standing or consent of instr. A review and discussion of current research in biology. Topics vary.

G 595 (BIOL 595) Special Topics 1-8 cr. (R-8) Prereq., graduate standing and consent of instr. Experimental offering of new courses by resident or visiting faculty.

G 596 (BIOL 596) Independent Study 1-8 cr. (R-8) Prereq., consent of instr. Credit for independent research project unrelated to thesis or dissertation.

G 597 (BIOL 597) Research 1-8 cr. (R-12) Prereq., consent of instr. Library work involved with preparation of a thesis or dissertation proposal.

G 598 (BIOL 598) Internship 1-8 cr. (R-8) Prereq., consent of the Division, graduate standing. Extended classroom experience that provides practical application of learning during placement off campus. Prior approval must be obtained from the faculty supervisor and the Internship Services office.

G 599 (BIOL 599) Thesis 1-10 cr. (R-10) Prereq., masters student in biology. Field and laboratory research on, and writing of, a student's master's thesis.

G 699 (BIOL 699) Dissertation 1-10 cr. (R-20) Prereq., doctoral student in biology. Credit for field and laboratory research on, and writing of, a student's doctoral dissertation.

Biology-Ecology (BIOE)

U 172N (BIOL 121N) Introductory Ecology 3 cr. Offered autumn. An introduction to ecological principles, stressing the structure and function of natural communities and examining human's role in these ecosystems.

UG 370 (BIOL 340) General Ecology 3 cr. Offered autumn and spring. Prereq., BIOB 275 (BIOL 223) and one year of college mathematics including STAT 216 (MATH 241) or equiv. Analysis of the distribution and abundance of plants and animals. Includes individual, population and community-level processes (e.g., population growth and regulation, competition, predation, succession, nutrient cycling, energy flow and community organization).

UG 371 (BIOL 341) General Ecology Laboratory 2 cr. Offered autumn and spring. Coreq., BIOE 370 (BIOL 340). Methods of describing and testing alternative explanations for patterns in nature. The use of scientific methodology in ecology.

U 394 (BIOL 339) Seminar/Workshop 2 cr. Offered autumn. Preparatory readings and attendance at seminars on a wide variety of ecological and wildlife management topics followed by critiques.

UG 403 (BIOL 403) Vertebrate Design and Evolution 5 cr. Offered autumn. Prereq., BIOB 170N, 171N and 275 (BIOL 108N, 109N and 223) and PHSX 205N/206N or 207N/208N (PHYS 111N/113N or 211N/213N). Evolutionary patterns of animal morphology and the importance of body size on life history patterns. Phylogenetic study of major extant and extinct vertebrate groups. Laboratory includes systematic study of organ systems and workshops in experimental functional morphology.

UG 404 (BIOL 405) Animal Behavior 3 cr. Offered spring alternate years. Prereq., BIOB 275 (BIOL 223), senior standing or consent of instr. The description and evolutionary interpretation of animal behavior under natural conditions. Laboratory involves observation and recording of animal behavior.

UG 406 (BIOL 406) Behavior and Evolution 4 cr. Offered spring. Prereq., BIOB 275 (BIOL 223). Diversity of animal behavior in an evolutionary context including inheritance of behavior, diets, avoidance responses, mating systems and sexual

selection, parental care, and evolution of animal groups and societies. Discussion sections examine both landmark and recent literature.

UG 428 (BIOL 366) Freshwater Ecology 5 cr. Offered autumn. Prereq., BIOB 170N, 171N (BIOL 108N, 109N) and one year of college chemistry. Physical and chemical dynamics of lakes and streams. Diversity, distribution and dynamics of freshwater organisms.

UG 446 Wildlife Physiological Ecology 3 cr. Offered autumn. Same as WBIO 446. Prereq., BIOB 260, 261 and BIOE 370 (BIOL 221, 223 and 340). How physiological and biochemical processes in animals influence behavior and ecology. Application of physiological approaches to wildlife conservation such as assessment of animal health, nutritional condition, and physiological performance.

UG 447 Terrestrial Ecosystem Ecology 3 cr. Offered autumn odd-numbered years. Prereq., BIOB 160N (BIOL 110N) and any ecology-themed course or consent of instr. Same as MICB 447. Introduction to systems thinking and the ecosystem concept, review of water and energy balance, carbon cycling and production processes, nutrient cycling, trophic dynamics, and species effects on ecosystem functioning.

UG 448 Terrestrial Plant Ecology 4 cr. Offered autumn. Prereq., an introductory college course in ecology. The interrelationships between plants and plant communities and their natural environment.

UG 449 (BIOL 430) Plant Biogeography 3 cr. Prereq., consent of instr. Offered alternate years. Description of the distribution of plants and animals at global, continental and regional scales. Analysis of ecological and historical factors influencing distribution and association.

UG 482 (BIOL 482) Evolution and Development 3 cr. Offered spring, alternate years. Prereq., BIOB 170N and 275 (BIOL 108N and 223). Lecture, reading and discussion of questions at the intersection of developmental and evolutionary biology. Questions include but are not restricted to: how novel traits arise; how diversity in animal form is generated; and how phenotypic plasticity (environment-sensitive expression of traits) is produced.

Biology- (BIOH)

U 360 (BIOL 347) Introduction to Neuroscience 3 cr. Offered autumn. Prereq., introductory chemistry and biology. Same as BMED 347. The molecular and cellular physiology of the human nervous system. Topics range from the basis of electrical and chemical signaling in neurons to the organization of the nervous system and its functions in generating behavior.

U 405 Hematology (BIOL 309) 3 cr. Offered autumn. Prereq., junior level or consent of instr., BIOM 360 (MICB 300). Study of blood and diseases of the circulatory system. Blood banking and serology.

Biology-Organismal (BIOO)

U 101N (BIOL 201N) Survey of Montana Wildlife & Habitats 3 cr. Offered autumn. Prereq., one course in biology. Interpreting biological patterns associated with selected Montana wildlife species, including mammals, birds, reptiles and amphibians.

U 105N (BIOL 120N) Introduction to Botany 3 cr. Offered spring. Prereq., consent of instr. Introduction to the plant kingdom including anatomy, physiology and ecology.

U 320 (BIOL 316) General Botany 5 cr. Offered spring. Prereq., BIOB 170N-171N, 260 (BIOL 108N-109N, 221). Prereq. or coreq., BIOB 275 (BIOL 223). Anatomy, morphology, ecology and physiology of photosynthetic organisms.

U 335 (BIOL 350) Rocky Mountain Flora 3 cr. Offered spring. Prereq., one college-level course in Biology or consent of instr. Elements of the evolution, geography and natural affinities of flowering plants. Identification using a manual of native plants of Montana.

UG 340 (BIOL 308) Biology and Management of Fishes 4 cr. Offered autumn. Prereq., BIOB 170N, 171N and 275 (BIOL 108N, 109N, 223) and one year of college mathematics. Diversity, adaptations and ecology of fishes. Analysis and management of fish populations and communities.

UG 409 (BIOL 408) Advanced Fisheries Science 2 cr. Offered spring. Prereq., BIOO 340 (BIOL 308). Quantitative analysis and interpretation of fish population and community data for use in management. Selection, application and evaluation of management techniques.

UG 433 (BIOL 444) Plant Physiology 3 cr. Offered spring. Prereq., BIOB 170N-171N, BIOO 105N or BIOO 320 (BIOL 108N-109N, 120N or 316). The chemical and physical basis of water relations, photosynthesis, mineral nutrition, respiration, vegetative and reproductive growth of plants.

UG 434 (BIOL 445) Plant Physiology Lab 1 cr. Offered spring. Prereq or coreq., BIOO 433 (BIOL 444). Laboratory exercises designed to familiarize students with concepts and techniques in plant physiology.

UG 462 (BIOL 410) Entomology 4 cr. Offered alternate springs. Prereq., BIOB 170N, 171N and 275 (BIOL 108N, 109N and 223). The classification, morphology, anatomy, development, life-history, behavior and ecology of insects. Labs include identification of major insect groups, internal and external anatomy and student collections.

UG 470 (BIOL 304) Ornithology 4 cr. Offered spring. Prereq., BIOB 170N, 171N and 275 (BIOL 108N, 109N and 223). The classification, structure, evolution, behavior and ecology of birds.

UG 475 (BIOL 306) Mammalogy 4 cr. Offered autumn. Prereq., BIOB 170N, 171N and 275 (BIOL 108N, 109N and 223). The evolution, systematics, anatomy, physiology and ecology of mammals.

UG 486 (BIOL 486) Field Techniques in Mammalogy 2 cr. Offered autumn. Prereq., BIOO 475 (BIOL 306) or equiv. and consent of instr. A "hands-on" approach to lab and field techniques employed for the study of mammals. Includes mark/recapture live trapping methods, remote cameras, and tracking plates of non-invasive censusing.