Biology

Bruce A. Bowerman, Department Head
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Biologists investigate a broad spectrum of questions about living organisms and life processes—the physical and chemical bases of life, how organisms and their component parts are structured, how they function, how they interact with their environment, and how they have evolved.

Departmental teaching and research emphases in cellular and molecular biology, developmental biology, ecology and evolution, human biology, marine biology, and neuroscience and behavior offer students opportunities to learn and work with scientists who are making important contributions to knowledge in these areas.

Faculty

Yashar Ahmadian, assistant professor (theoretical neuroscience). BSc, 2001, Sharif University of Technology; MA, 2003, Columbia, PhD, 2007, Columbia. (2014)

Alice Barkan, professor (molecular genetics). BS, 1978, Massachusetts Institute of Technology; PhD, 1983, Wisconsin, Madison. (1991)

Brendan J. M. Bohannan, professor (microbial ecology and evolution). BS, 1991, Humboldt State; PhD, 1997, Michigan State. (2006)

Bruce A. Bowerman, professor (developmental genetics, regulation of the cytoskeleton in C. elegans). BA, 1981, Kansas State; PhD, 1989, California, San Francisco. (1992)

William E. Bradshaw, professor (evolutionary genetics, population biology, evolutionary physiology). BA, 1964, Princeton; MS, 1965, PhD, 1969, Michigan. (1971)

Scott D. Bridgham, professor (ecosystem ecology, plant community dynamics). BA, 1980, BA, 1982, Maine; MS, 1986, Minnesota; PhD, 1991, Duke. (2002)

Mark C. Carrier, senior instructor (developmental biology and physiology). BS, BA, 1987, Massachusetts; MS, 1998, California, Berkeley. (2000)

John S. Conery, professor (computational biology, parallel processing). BA, 1976, California, San Diego; PhD, 1983, California, Irvine. (1983)

William A. Cresko, associate professor (evolutionary developmental genetics). BA, 1992, Pennsylvania; PhD, 2000, Clark. (2005)

Alan Dickman, senior instructor with title of research associate professor (forest ecology, science education). BA, 1976, California, Santa Cruz; PhD, 1984, Oregon. (1986)

Chris Q. Doe, professor (development of the nervous system, neural stem cells, asymmetric cell division). BA, 1981, New College, Sarasota; PhD, 1987, Stanford. (1998)

Judith S. Eisen, professor (development and function of the nervous system). BS, 1973, MS, 1977, Utah State; PhD, 1982, Brandeis. (1985)

Richard B. Emlet, professor (evolution and development of marine invertebrates). BS, 1977, Duke; PhD, 1985, Washington (Seattle). (1992)

Jessica L. Green, Alec and Kay Keith Professor in Biology; associate professor (applied theoretical ecology). BS, 1992, University of California, Los Angeles; MS, 1994, PhD, 2001, University of California, Berkeley. (2007)

Karen J. Guillemin, professor (bacterial pathogenesis, bacterial-host interactions in development). BA, 1991, Harvard-Radcliffe; PhD, 1998, Stanford. (2001)

Victoria Herman, associate professor (development and function of nervous system in Drosophila). BA, 1989, Harvard-Radcliffe; PhD, 1998, Massachusetts Institute of Technology. (2003)

Janet Hodder, senior lecturer (ecology of marine birds and mammals, science education). BS, 1977, Liverpool; PhD, 1986, Oregon. (1986)

Cristin L. Hulslander, senior instructor (behavioral ecology). BA, 1992, Bryn Mawr; PhD, 2003, Clark. (2003)

Santiago Jaramillo, assistant professor (neuronal circuits underlying behavioral flexibility). BS, 1998, Universidad Pontificia Boliviariana; MS, 2002, New Mexico; PhD, 2007, National University of Ireland. (2013)

Eric A. Johnson, associate professor (Drosophila genetics, genomics and cellular physiology). BA, 1990, Grinnell; PhD, 1996, Iowa. (2001)

Alan J. Kelly, senior instructor (molecular and transmission genetics, microbiology). BS, 1981, California, Irvine; PhD, 1994, Oregon. (1994)

Diana E. Libuda, assistant professor (molecular genetics, DNA repair, chromosome dynamics during meiosis). BSc, 2003, California, Los Angeles; PhD, 2008, Harvard. (2014)

Shawn R. Lockery, professor (invertebrate neurobiology and neural networks). BA, 1981, Yale; PhD, 1989, California, San Diego. (1993)

V. Patteson Lombardi, senior instructor with title of research assistant professor (human biology, medical physiology); director, undergraduate advising. BA, 1977, MAT, 1979, North Carolina, Chapel Hill; PhD, 1984, Oregon. (1984)

Svetlana Maslakova, associate professor (evolution, development and systematics of marine invertabrates). BA, 1998, MS, 1999, Moscow State; PhD, 2005, George Washington. (2008)

Cristopher M. Neill, assistant professor (development and function of neural circuits for visual processing). BS, 1995, PhD, 2004, Stanford. (2011)

Peter M. O'Day, senior lecturer with title of outreach research training director–associate professor (cellular signaling). BA, 1970, Canisius; MS, 1972, Maine, Orono; PhD, 1977, State University of New York, Albany. (1985)

Patrick C. Phillips, professor (evolution, genetics, complex traits). BA, 1986, Reed; PhD, 1991, Chicago. (2000)

John H. Postlethwait, professor (molecular genetic regulation and evolution of development and vertebrate genome evolution). BS, 1966, Purdue; PhD, 1970, Case Western Reserve. (1971)

Anne Powell, assistant professor (intestinal stem cell biology, adult homeostasis disease states). BA, 2003, Concordia ; PhD, 2010, Oregon Health and Science. (2014)

Jana Prikryl, instructor (molecular genetics). BS, 1999, Colorado, Boulder; PhD, 2009, Oregon. (2010).

William Roberts, professor (calcium signaling). BA, 1970, Harvard; PhD, 1979, California, San Diego. (1989)

Bitty A. Roy, professor (evolution, pathogen-host interactions, plant population ecology). BS, 1982, Evergreen State; MS, 1985, Southern Illinois; PhD 1992, Claremont Graduate School. (2001)

Debbie Schlenoff, senior instructor (animal behavior and evolution, conservation biology). BS, 1979, State University of New York, Binghampton; PhD, 1983, Massachusetts, Amherst. (2001)

Eric Selker, professor (epigenetic mechanisms). BA, 1975, Reed; PhD, 1980, Stanford. (1985)

Alan Shanks, professor (marine and intertidal ecology, larval biology, zooplankton). BA, 1977, California, Santa Cruz; PhD, 1985, California, San Diego. (1993)

George F. Sprague Jr., professor (genetic regulatory mechanisms in yeast). BS, 1969, North Carolina State; PhD, 1977, Yale. (1981)

Karen U. Sprague, professor (control of gene expression in eukaryotes). BA, 1964, Bryn Mawr; PhD, 1970, Yale. (1977)

Kryn Stankunas, assistant professor (chromatin and regulators as dynamic sources of epigenetic information during heart development). BS, 1997, British Columbia; PhD, 2003, Stanford. (2009)

Carl A. Stiefbold, senior instructor (science laboratory education). BS, 1971, Portland State. (1987)

Matthew A. Streisfeld, assistant professor (adaptation in natural plant populations) BS, 1998, Emory; PhD, 2005, California, San Diego. (2009).

Terry Takahashi, professor (analysis of neural circuitry). BS, 1975, California, Irvine; PhD, 1981, State University of New York, Downstate Medical Center. (1988)

Nathan J. Tublitz, professor (peptidergic regulation of behavior in insects and cephalopod mollusks). BA, 1975, Reed; PhD, 1984, Washington (Seattle). (1986)

Eleanor Vandegrift, senior instructor (science education); associate director, science literacy program. BA, 1997, Earlham College; MS, 2002, Oregon State. (2012).

George R. von Dassow, assistant professor (cell biology of development). PhD, 2000, Washington (Seattle). (2014)

Philip E. Washbourne, associate professor (molecular neurobiology, synapse formation). BSc, 1995, Imperial College; PhD, 2000, Padua. (2004)

Janis C. Weeks, professor (neurophysiology, endocrinology, and development). BS, 1975, Massachusetts Institute of Technology; PhD, 1980, California, San Diego. (1989)

Monte Westerfield, professor (molecular genetics of nervous system development). AB, 1973, Princeton; PhD, 1977, Duke. (1981)

Peter B. Wetherwax, senior instructor with title of research assistant professor (pollination ecology, tropical ecology, science education). BA, 1980, California, Los Angeles; MA, 1985, Humboldt State; PhD, 1993, Oregon State. (1991)

A. Michelle Wood, professor (microbial ecology and evolution, biological oceanography). BA, 1973, Corpus Christi; PhD, 1980, Georgia. (1990)

Craig M. Young, professor (marine ecology, deep-sea biology, invertebrate embryology); director, Oregon Institute of Marine Biology. BS, 1975, MS, 1978, Brigham Young. PhD, 1982, Alberta. (2002)

Courtesy

Steven S. Rumrill, courtesy research associate (estuarine ecology and management, larval biology of marine invertebrates). BA, 1981, MS, 1983, California, Santa Cruz; PhD, 1987, Alberta. (1991)

David H. Wagner, courtesy associate professor (plant taxonomy, ecology, evolution of bryophytes and pteridophytes). BA, 1968, Puget Sound; MS, 1974, PhD, 1976, Washington State. (1976)

Emeriti

Andrew S. Bajer, professor emeritus. PhD, 1950, DSc, 1956, Cracow. (1964)

Howard T. Bonnett Jr., professor emeritus. BA, 1958, Amherst; PhD, 1964, Harvard. (1965)

Roderick A. Capaldi, professor emeritus. BS, 1967, London; PhD, 1970, York. (1973)

George C. Carroll, professor emeritus. BA, 1962, Swarthmore; PhD, 1966, Texas. (1967)

Richard W. Castenholz, professor emeritus. BS, 1952, Michigan; PhD, 1957, Washington State. (1957)

Charles B. Kimmel, professor emeritus. BA, 1962, Swarthmore; PhD, 1966, Johns Hopkins. (1969)

Frederick W. Munz, professor emeritus. BA, 1950, Pomona; MA, 1952, PhD, 1958, California, Los Angeles. (1959)

Paul P. Rudy, professor emeritus. BA, 1955, MA, 1959, PhD, 1966, California, Davis. (1968)

Eric Schabtach, senior instructor emeritus. BS, 1963, McGill. (1969)

Lynda P. Shapiro, professor emerita. BA, 1960, MS, 1963, Arkansas; PhD, 1974, Duke. (1990)

Franklin W. Stahl, professor emeritus. AB, 1951, Harvard; PhD, 1956, Rochester. (1959)

Nora B. Terwilliger, professor emerita. BS, 1963, Vermont; MS, 1965, Wisconsin, Madison; PhD, 1981, Oregon. (1972)

Daniel Udovic, professor emeritus. BA, 1970, Texas; PhD, 1973, Cornell. (1973)

Norman K. Wessells, professor emeritus; provost emeritus, academic affairs. BS, 1954, PhD, 1960, Yale. (1988)

James A. Weston, professor emeritus. BA, 1958, Cornell; PhD, 1963, Yale. (1970)

Herbert P. Wisner, senior instructor emeritus. BA, 1949, MA, 1950, Syracuse. (1966)

The date in parentheses at the end of each entry is the first year on the University of Oregon faculty.

- **Bachelor of Arts: Biology**
- **Bachelor of Arts: Marine Biology**
- **Bachelor of Science: Biology**
- **Bachelor of Science: Marine Biology**

Undergraduate Studies

Students may enter the program with a high school education or transfer from a community college or university. The curriculum includes courses for majors in biology, marine biology, and related disciplines; preprofessional courses; and courses that serve as important elements in a liberal education for students in other majors. Course work for the biology major provides an exceptional foundation for students who plan to pursue graduate programs in biomedicine and research, and jobs in health services, private industry, and education.

Biology Advising Center for Undergraduates

541-346-4525
65 Klamath Hall
bioadvis@uoregon.edu
biology.uoregon.edu/advising

In the Biology Advising Center, students can meet with members of the biology advising staff to receive help in planning an individualized program of study.

The center provides multiple resources and services including contacts for local, national, and international internships; evaluation of biology-specific transfer equivalencies; and advising for biology students and those interested in biomedicine. Transfer students should consult the university's website for estimated transfer evaluations—registrar.uoregon.edu/transfer-articulation —and should confirm with each individual department advisor when questions arise.

Nonmajors

Courses for nonmajors, offered at the 100 level, are intended for students with little or no college background in biology, chemistry, or mathematics. Course topics vary from year to year, but all focus on the biological basis of animal behavior, cancer, ecology, evolution, genetics, and human physiology.

Students who are contemplating a major in biology or a related science are advised to begin their biology course work with one of the lower-division sequences, General Biology I–IV or Honors Biology I–III. Both sequences include rigorous laboratories and have chemistry and mathematics prerequisites.

Majors

Preparation

Modern biology is a quantitative interdisciplinary science. Students planning to specialize in biology should include in their high school preparation as much mathematics, chemistry, and physics as possible. International baccalaureate and advanced placement course work and testing are encouraged.

Transfer Students

Students who intend to transfer as majors from a community college or four-year institution should carefully plan the program of course work they take before transferring. Students who transfer after one year of college should have completed a year of general chemistry with laboratories and a year of college-level mathematics. Satisfactory completion of a yearlong biology major's introductory sequence that includes laboratories and features strong components of genetics, evolution, and physiology, most often enables transfer students to earn credit for three of four courses in the General Biology sequence. If this is the case, to complete the 200-level, lower-division biology requirement, students must successfully (with a grade of P or C– or better) complete General Biology IV: Mechanisms (BI214). In addition to these biology courses, transfer students can complete major requirements by taking a year of general chemistry with laboratories, two terms of organic chemistry, mathematics through two terms of calculus, and a year of general physics for science majors. Students who plan on applying to graduate programs in medicine or allied health are encouraged to take a full year of organic chemistry with the first two terms of laboratories and a full year of physics with laboratories to satisfy graduate program admissions requirements. Organic chemistry course work completed at a community or junior college may not be used to satisfy upper-division credit requirements at the University of Oregon unless an American Chemical Society exam is passed.

Lower-Division Biology Sequences

The standard, four-course sequence includes General Biology I: Cells (BI211), General Biology II: Organisms (BI212), General Biology III: Populations (BI213), and General Biology IV: Mechanisms (BI214).

The three-course honors sequence for those with a strong background in chemistry and mathematics includes Honors Biology I: Cells, Biochemistry and Physiology (BI281H), Honors Biology II: Genetics and Molecular Biology (BI282H), and Honors Biology III: Evolution, Diversity and Ecology (BI283H).

Either sequence is appropriate for students with interests in any area of biology. Students should consult the department website or visit the Biology Advising Center to seek advice on which sequence is most appropriate for them, and for the most up-to-date information.

Careers

The biology major prepares students for many outstanding fields. Biology professions have been ranked among the top ten jobs in the United States for more than fifteen years. A *U.S. News and World Report*article on best careers reported that studying biology is the gateway to at least ten of the top thirty professions, and that being a biologist is the number-one ranked and most satisfying profession out of the top 100 in the United States.

Many graduates have gone on to top U.S. and International schools in medicine, dentistry, pharmacy, veterinary medicine, optometry, physical therapy, nursing, and teacher education. Others have pursued PhD and MS degrees in molecular biology, neuroscience, ecology and evolution, and marine biology, or have found employment with government agencies, private industry, or nonprofit organizations.

Biology majors are encouraged to become involved in a variety of learning experiences in addition to their college course work. More than two-thirds of our students are actively involved in research, and many assist with tutoring or teaching laboratories. Local, national, and international internships are available for those interested in a wide variety of specialty areas. Sample international programs established

by the UO's overseas program include neotropical ecology in Ecuador, tropical marine biology in Panama, and tropical diseases and service learning placements in Ghana. Selected job listings are available online at uocareer.uoregon.edu, in the Biology Advising Center, and in the Career Center, 244Hendricks Hall.

Major Requirements

A major in biology or marine biology leads to a bachelor of science (BS) or to a bachelor of arts (BA) degree. The BA requires completion of the foreign-language requirement. More than 95 percent of biology and marine biology majors seek the bachelor of science (BS) degree, while those with double majors or those emphasizing languages choose to pursue a bachelor of arts (BA) degree.

Bachelor of Arts Degree Requirements: Biology

Core Courses

Math [1]		8
MATH246	Calculus for the Biological Sciences I	
orMATH251	Calculus I	
MATH247	Calculus for the Biological Sciences II	
orMATH252	Calculus II	
General Chemistry		18
CH221–223	General Chemistry	
orCH224H–226H	Honors General Chemistry	
CH227–229	General Chemistry Laboratory	
orCH237–239	Advanced General Chemistry Laboratory	
Organic Chemistry [2]		8
CH331	Organic Chemistry I	
CH335	Organic Chemistry II	
Physics [3]		12
PHYS201–203	General Physics	
orPHYS251–253	Foundations of Physics I	
Lower-Division Biology		15-16
BI211–214	General Biology I-IV	
orBI281H–283H	Honors Biology I-III	
Upper-Division Biology [4]		44
At least one course needs to be completed from each area (I, II, and III):		
Area I: 300-level molecular, cellular, and developmental biology course		
Area II: 300-level systems-organisms course		
Area III: 300-level ecology and evolution course		
Two or more 300- or 400-level courses with significant laboratory or fieldwork		
12 credits of courses numbered BI410, 420–499		
Total Credits		**105-106**

1. A course in statistics is required if an ecology and evolution or neuroscience and behavior emphasis area is selected.
2. Students planning to apply to graduate programs in medicine and allied health should complete additional organic chemistry (CH 336) with two laboratories (CH 337, 338) and biochemistry (CH 360). A course in genetics is also required or preferred by many programs. Please consult specific graduate admissions programs for further details.
3. Students planning to apply to graduate programs in medicine and allied health should complete additional physics laboratories (PH 204, 205, 206) or three terms of Foundations of Physics Laboratory (PHYS 290). Please consult specific graduate admissions programs for further details.
4. Students must complete a minimum of 44 upper-division biology credits. For a complete list of approved courses, and other details about upper-division requirements, see *Requirements for the Biology Major*, found on the biology advising web page at biology.uoregon.edu/undergraduate-program/requirements.

Bachelor of Science Degree Requirements: Biology

Core Courses

Math [1]		8
MATH246	Calculus for the Biological Sciences I	
orMATH251	Calculus I	
MATH247	Calculus for the Biological Sciences II	
orMATH252	Calculus II	
General Chemistry		18
CH221–223	General Chemistry	
orCH224H–226H	Honors General Chemistry	
CH227–229	General Chemistry Laboratory	
orCH237–239	Advanced General Chemistry Laboratory	
Organic Chemistry [2]		8
CH331	Organic Chemistry I	
CH335	Organic Chemistry II	
Physics [3]		12
PHYS201–203	General Physics	
orPHYS251–253	Foundations of Physics I	
Lower-Division Biology		15-16
BI211–214	General Biology I-IV	
orBI281H–283H	Honors Biology I-III	
Upper-Division Biology [4]		44
At least one course needs to be completed from each area (I, II, and III):		
Area I: 300-level molecular, cellular, and developmental biology course		
Area II: 300-level systems-organisms course		
Area III: 300-level ecology and evolution course		
Two or more 300- or 400-level courses with significant laboratory or fieldwork		
12 credits of courses numbered BI410, 420–499		
Total Credits		**105-106**

1 A course in statistics is required if an ecology and evolution or neuroscience and behavior emphasis area is selected.

2 Students planning to apply to graduate programs in medicine and allied health should complete additional organic chemistry (CH 336) with two laboratories (CH 337, 338) and biochemistry (CH 360). A course in genetics is also required or preferred by many programs. Please consult specific graduate admissions programs for further details.

3 Students planning to apply to graduate programs in medicine and allied health should complete additional physics laboratories (PH 204, 205, 206) or three terms of Foundations of Physics Laboratory (PHYS 290). Please consult specific graduate admissions programs for further details.

4 Students must complete a minimum of 44 upper-division biology credits. For a complete list of approved courses, and other details about upper-division requirements, see *Requirements for the Biology Major*, found on the biology advising web page at biology.uoregon.edu/undergraduate-program/requirements.

Students are urged to contact specific institutions to confirm admission requirements.

Please contact the Biology Advising Center at biology.uoregon.edu/advising or 541-346-4525 for additional limitations and allowances.

Emphasis Areas for the Biology Major

Fulfilling the requirements for an undergraduate degree in biology provides a solid, general foundation in the discipline. Some biology majors choose to concentrate their upper-division course work in one of five emphasis areas:

- ecology and evolution
- human biology
- marine biology
- molecular, cellular, and developmental biology
- neuroscience and behavior

The requirements listed for each emphasis may be fulfilled as the student completes the biology major. Upon graduation, students who complete the requirements for an emphasis area receive a written recognition from the department.

Visit biology.uoregon.edu/undergraduate-program/requirements for the current requirements for each emphasis area, or contact the Biology Advising Center at 541-346-4525 for more information.

Major in Marine Biology

Bachelor of Arts Degree Requirements: Marine Biology

Core Courses

Math [1]		8
MATH246	Calculus for the Biological Sciences I	
orMATH251	Calculus I	
MATH247	Calculus for the Biological Sciences II	
orMATH252	Calculus II	
General Chemistry		18
CH221–223	General Chemistry	
orCH224H–226H	Honors General Chemistry	
CH227–229	General Chemistry Laboratory	
orCH237–239	Advanced General Chemistry Laboratory	
Organic Chemistry		8
CH331	Organic Chemistry I	
CH335	Organic Chemistry II	
Physics		12
PHYS201–203	General Physics	
orPHYS251–253	Foundations of Physics I	
Lower-Division Biology		15-16
BI211–214	General Biology I-IV	
orBI281H–283H	Honors Biology I-III	
Upper-Division Biology [2]		44
At least one course needs to be completed from each area (I, II, and III)		
Area I: 300-level molecular, cellular, and developmental biology course		
Area II: 300-level systems-organisms course		
Area III: 300-level ecology and evolution course		
Three terms of full-time enrollment in courses at OIMB (at least 12 credits) [3]		
12 credits of courses numbered BI420–499		
Total Credits		**105-106**

1 A course in statistics is required if an ecology and evolution or neuroscience and behavior emphasis area is selected.

2 Students must complete a minimum of 44 upper-division biology credits. For a complete list of approved courses and other details about upper-division requirements, see *Requirements for the Marine Biology Major*, found on the biology advising web page at biology.uoregon.edu/undergraduate-program/requirements.

3 Courses at the Oregon Institute of Marine Biology (OIMB) are offered summer session and spring and fall terms. Some students may arrange research credits during winter term. See oimb.uoregon.edu for details of OIMB courses.

Students are required to spend three terms completing upper-division course work (taking at least 12 credits per term) at the Oregon Institute of Marine Biology. A program plan for the marine biology major is available in the Biology Advising Center or on the OIMB website.

Bachelor of Science Degree Requirements: Marine Biology

Core Courses

Math [1]		8
MATH246	Calculus for the Biological Sciences I	
orMATH251	Calculus I	
MATH247	Calculus for the Biological Sciences II	
orMATH252	Calculus II	
General Chemistry		18
CH221–223	General Chemistry	
orCH224H–226H	Honors General Chemistry	
CH227–229	General Chemistry Laboratory	

	orCH237–239 Advanced General Chemistry Laboratory	
Organic Chemistry		8
	CH331 Organic Chemistry I	
	CH335 Organic Chemistry II	
Physics		12
	PHYS201–203 General Physics	
	orPHYS251–253 Foundations of Physics I	
Lower-Division Biology		15-16
	BI211–214 General Biology I-IV	
	orBI281H–283H Honors Biology I-III	
Upper-Division Biology [2]		44
At least one course needs to be completed from each area (I, II, and III)		
	Area I: 300-level molecular, cellular, and developmental biology course	
	Area II: 300-level systems-organisms course	
	Area III: 300-level ecology and evolution course	
Three terms of full-time enrollment in courses at OIMB (at least 12 credits) [3]		
12 credits of courses numbered BI420–499		
Total Credits		**105-106**

1. A course in statistics is required if an ecology and evolution or neuroscience and behavior emphasis area is selected.
2. Students must complete a minimum of 44 upper-division biology credits. For a complete list of approved courses and other details about upper-division requirements, see *Requirements for the Marine Biology Major*, found on the biology advising web page at biology.uoregon.edu/undergraduate-program/requirements.
3. Courses at the Oregon Institute of Marine Biology (OIMB) are offered summer session and spring and fall terms. Some students may arrange research credits during winter term. See oimb.uoregon.edu for details of OIMB courses.

Students are required to spend three terms completing upper-division course work (taking at least 12 credits per term) at the Oregon Institute of Marine Biology. A program plan for the marine biology major is available in the Biology Advising Center or on the OIMB website.

Animal Use in Teaching Laboratories

Students should be aware that the biology and marine biology majors require courses in which a variety of organisms, including vertebrate animals, are used in laboratory dissections and experiments.

Prospective majors who are concerned about this should discuss it with their advisors before beginning either program. Students are encouraged to review the syllabuses for laboratory courses before enrolling. Syllabuses are available on the department's website.

Department and university policies require that the use of live vertebrate animals be minimized in teaching laboratories and be approved by the curriculum committee of the Department of Biology and by the Institutional Animal Care and Use Committee of the University of Oregon. Students who have ethical objections to animal use in a course that requires it should consult the director of undergraduate advising before enrolling.

Recommended Program

Students are encouraged to regularly consult their degree audit and transfer evaluation reports, academic transcripts, and other information available on DuckWeb. Students should consult with an advisor in the Biology Advising Center at least once a year to refine their program of study.

Each student should consult an advisor in the Biology Advising Center for help with determining a program of study. Freshman majors enrolled in a calculus course typically take general chemistry with laboratories.

Upper-division biology electives and General Physics (PHYS201), General Physics (PHYS202), General Physics (PHYS203) are typically taken after successful completion of an introductory biology sequence.

By the end of the sophomore year, each student should have met with a biology advisor to develop a program that satisfies both the interests of the student and the major requirements.

Courses with the BI subject code that are taken to meet major requirements must be passed with grades of P or C– or better. Students should choose the pass/no pass (P/N) option sparingly or not at all. Some biomedical graduate programs do not allow transfer credit from courses taken pass/no pass.

Students meet the general-education group requirement in science by fulfilling the requirements for a major in biology. Transfer students should consult their advisors when selecting courses to meet the group requirements in arts and letters and in social science. For more information, see the **Bachelor's Degree Requirements** section of this catalog.

Oregon Institute of Marine Biology

Located in Charleston on Coos Bay, the Oregon Institute of Marine Biology (OIMB), in conjunction with the biology department, offers an undergraduate marine biology major and a coordinated program of study for undergraduates in biology, general science, and environmental science or environmental studies. During fall and spring terms and the summer session, 300- and 400-level courses take advantage of the institute's unique coastal setting. Typical offerings include the following:

BI390	Animal Behavior	4
BI451	Invertebrate Zoology	8
BI454	Estuarine Biology	5
BI455	Marine Birds and Mammals	1-6
BI457	Marine Biology: [Topic] (Comparative Embryology and Larval Biology, Environmental Issues, Molecular Biology for Marine Sciences, Subtidal and Deep Sea Ecology)	4-5
BI458	Biological Oceanography	5
BI474	Marine Ecology	1-8

A seminar series, Seminar: [Topic] (BI407), features weekly invited speakers who are active researchers in the marine sciences. Undergraduate research is encouraged.

The summer program offers additional 400-level courses emphasizing field studies and includes a variety of eight- and two-week courses as

well as weekend workshops. Information and applications are available from the Biology Advising Center, from the director of the institute, or from the OIMB website. See also the **Research Centers and Institutes** section of this catalog.

Malheur Field Station

The University of Oregon is a member of the Malheur Field Station consortium. Located in southeastern Oregon in the heart of the Great Basin desert, the field station provides an excellent opportunity for students to study terrestrial and aquatic systems. Credits earned in courses at the field station may be transferred to the university and are included in the total credits required for a University of Oregon degree. Courses that have been preapproved by the department may be counted for the biology major. Detailed course information and applications may be obtained from the field station website.

Second Bachelor's Degree

Students may obtain a second bachelor's degree in biology after earning a bachelor's degree in another field. These students are admitted as postbaccalaureate nongraduates. For the second degree, all departmental and university requirements must be met. For more information, see Second Bachelor's Degree in the **Bachelor's Degree Requirements** section of this catalog.

Preprofessional Students

Preprofessional health science students who want to major in biology need to plan carefully to complete major requirements and meet entrance requirements of professional schools. These students should consult a biology advisor as well as the advisor for the professional area of their choice. See Preparatory Programs in the **Academic Resources** section of this catalog for more information about these requirements.

Although Organic Chemistry Lecture (CH 336), Organic Chemistry Laboratory (CH337), Organic Chemistry Laboratory (CH338) and Introductory Physics Laboratory (PHYS204), Introductory Physics Laboratory (PHYS205), Introductory Physics Laboratory (PHYS206) are not required for the biology major, they are required for programs at most professional schools including biomedicine at Oregon Health and Science University in Portland.

Honors Program in Biology

The honors program requires substantial laboratory or field research supervised by a faculty member. Biology majors who satisfy the following requirements are eligible to graduate with honors:

1. Registration for the honors program through the Biology Advising Center, which includes obtaining an acceptance signature from the faculty research advisor, *before* beginning research
2. Completion of all requirements for the major in biology
3. Attainment of a minimum 3.30 GPA in all upper-division biology courses (including 300- and 400-level approved courses outside the department; see a biology advisor for a list)
4. Completion of a minimum of 6 credits in Research: [Topic] (BI401) under the supervision of a single faculty advisor
5. Completion of a minimum of three terms of intensive research (summer session counts as a term); at least four terms and summer research experience are strongly encouraged
6. Enrollment in Thesis (BI403) for all three terms of senior year, for a total of 4 credits; these credits may be applied toward the 44 required upper-division biology credits
7. Completion of a thesis, with the following requirements:
   a. Oversight by a thesis committee comprising two faculty members —a primary advisor and one faculty member on the Biology Undergraduate Affairs Committee
   b. A final version of the thesis must be provided to the committee one week prior to the thesis defense
   c. Both committee members must sign the thesis within one week of the thesis defense, and a final signed copy must be submitted to the Biology Advising Office
8. Defense of the thesis in a public forum in which the thesis committee is in attendance, taking place at least two weeks prior to the end of the term in which the student is graduating. The thesis defense is open seminar, and other faculty members, trainees, and staff members are encouraged to attend

A student of this program should e-mail the chair of the Biology Undergraduate Affairs Committee at the beginning of the term in which he or she intends to defend the thesis. The chair will help students find the appropriate member of the committee to serve as their second thesis committee member.

Special Opportunities for Biology Undergraduates

Majors may participate in research; attend department research seminars; work as a computer laboratory assistant, biology undergraduate laboratory assistant, or peer advisor; spend a term at OIMB; or participate in related activities.

The Biology Undergraduate Lab Assistant program provides students with opportunities to gain teaching experience while deepening their knowledge of a particular field. Participants enroll in and receive credit for BI402 Supervised College Teaching, which may be applied to the biology major upper-division credit requirements. Students who are considering a career in education are especially encouraged to consider this option.

Credit may be earned for conducting research under the supervision of a faculty member by enrolling in Research: [Topic] (BI401). For more information, visit the Scientific Mentorship and Research Training (SMART) website: smart.uoregon.edu .

Students are invited to attend seminars that feature visiting and local scientists.

Students may assist in teaching laboratory sections of some biology courses. Applications may be filed with the department for the limited number of assistantships available.

Peer advising is another way for students to become involved in the department. Interested students are trained during the spring term before the year they plan to work in the advising center.

Although all biology majors have the opportunity to attend OIMB, the university's marine biology laboratory, students who major in marine biology spend three terms at the institute. Interested students should plan to attend during their junior or senior years.

Students are encouraged to express ideas and offer suggestions about curriculum and student relations to the chair of the department's curriculum committee, the director of undergraduate advising, the chair of the department's undergraduate affairs committee, or the head of the department.

Students are asked to evaluate their biology courses and instructors near the end of each term. This information is available to instructors after the end of the term and placed on file for possible use in promotion and tenure deliberations. Student answers to summary questions are available in electronic format in Knight Library and in the Office of Academic Advising.

The Biology Teacher Recognition Award highlights efforts to improve biology education through student feedback. Initiated by student nominations, the award recognizes faculty members and teaching assistants who excel in one or more aspects of teaching effectiveness.

Minor in Biology

Lower-Division Biology Courses		12-15
Select three of the following:		
BI211	General Biology I: Cells	
BI212	General Biology II: Organisms	
BI213	General Biology III: Populations	
BI214	General Biology IV: Mechanisms	
Or all three of the following:		
BI281H	Honors Biology I: Cells, Biochemistry and Physiology	
BI282H	Honors Biology II: Genetics and Molecular Biology	
BI283H	Honors Biology III: Evolution, Diversity and Ecology	
Upper-Division Biology Courses [1]		16
Total Credits		**28-31**

[1] No more than 4 credits from BI 401–409.

Students interested in a minor in biology should develop a plan for the minor in consultation with an advisor in the Biology Advising Center. Students completing the minor in biology must provide the biology advisor with a transcript or transfer evaluation that shows any transfer courses that may be applied to the minor.

At least 16 credits of biology applied to the minor must be taken at the University of Oregon.

Course work must be completed with grades of P or C– or better.

Kindergarten through Secondary Teaching Careers

Students who complete the bachelor's degree with a biology major are eligible to apply for the College of Education's fifth-year licensure program in middle-secondary teaching or the fifth-year licensure program to become an elementary teacher. More information is available from the department's K–12 education advisor, Peter Wetherwax; see also the **College of Education** section of this catalog.

Graduate Studies

The department offers graduate work leading to the degrees of master of arts (MA), master of science (MS), and doctor of philosophy(PhD). The department's primary emphasis for graduate study is the PhD program.

Applications are reviewed by members of the following programs:

1. Molecular and cellular biology
2. Neuroscience and development
3. Ecology and evolution
4. Marine biology

Interdisciplinary opportunities are available among the programs in biology as well as between biology and other departments, e.g., chemistry, computer science, human physiology, physics, and psychology.

Financial support for graduate students is available through training grants, research grants, and teaching assistantships.

Detailed information about the graduate program, faculty research interests, and facilities is available at the biology department website.

Master's Degree

Master's degrees earned on the UO campus generally emphasize ecology and evolution and can involve research on terrestrial, aquatic, or marine organisms.

Candidates for the master's degree complete one of the following requirements:

- 60 credits of course work and the preparation of a critical essay
- 45 credits of course work and the completion of a research project that is presented as a thesis

Two years are typically required for completion of the master's degree. More information is available from the biology department graduate program coordinator.

A two-year master's degree with a specialty in marine biology is offered at the Oregon Institute of Marine Biology. Master's degree students enrolled in the program at the institute must be admitted to the thesis master's option. This program provides training for a variety of careers in aquatic or marine biology and can serve as preparation for advancement to a PhD program at another institution.

Students may be able to accelerate completion of a master's degree program by completing graduate courses while still in the undergraduate program. For information, see Reservation of Graduate Credit (http://catalog.uoregon.edu/archive/2015-2016/graduate/#reservation) in the **Graduate School** section of this catalog.

Doctoral Degree

During the first year, students take courses in their area of interest and participate in a laboratory rotation program. The rotations provide direct exposure to research activities in three laboratories and are therefore invaluable in choosing a laboratory in which to carry out dissertation research. After the first year in the program, students devote nearly all their efforts to research. These activities culminate in the public defense of a dissertation.

Admission

Information on applying to the graduate program may be obtained from the department's website or from the department office. Requirements for admission to the graduate program include the following:

1. A completed online application
2. Three letters of recommendation
3. Transcripts of all college work

4. Scores on the quantitative, verbal, and analytical sections of the Graduate Record Examinations
5. TOEFL score of 600 (paper-based test) or 105 (Internet-based test) or better for international students

Applications and support materials are submitted electronically.

Application Deadline

Applications must be received by the department by December 1, when the graduate admissions committee begins reviewing applications.

Institute of Ecology and Evolution

The institute promotes and facilitates research and graduate education in ecology and evolutionary biology. Active research programs emphasize molecular evolution, evolution of development, life-history evolution, photoperiodism and seasonal development, population and quantitative genetics, ecology of mutualism, plant-fungus and plant-insect interactions, theoretical ecology, microbial ecology, host-microbe interaction, global change, biological oceanography, biogeochemistry, and community and ecosystem dynamics. Researchers use a variety of methods, organisms, and habitats to address critical questions in their disciplines. For more information, see the **Research Centers and Institutes** section of this catalog.

Institute of Molecular Biology

The Institute of Molecular Biology is an interdisciplinary research community dedicated to investigating biological questions at the molecular level, bringing together scientists from the biology, chemistry, and physics departments and providing them with state-of-the-art, shared facilities. Graduate students are admitted into academic departments and subsequently receive their degrees through those departments. They may, however, choose any faculty member as a dissertation advisor. For more information, see the **Research Centers and Institutes** section of this catalog or visit www.molbio.uoregon.edu/grad.html .

Institute of Neuroscience

Neuroscientists in the biology, human physiology, and psychology departments have formed an interdisciplinary institute in the neurosciences. Faculty members are engaged in research in cellular neuroscience, developmental biology, systems neuroscience, neural plasticity, and cognitive neuroscience. A coordinated graduate-degree program of instruction and research is available to students through any of the participating departments. For more information see the **Research Centers and Institutes** section of this catalog.

Developmental Biology Program

A rigorous graduate training program investigates the mechanisms that lead from a fertilized egg to an adult organism. Various laboratories in the Institutes of Neuroscience and of Molecular Biology are investigating how cell polarity is established in budding yeast (Saccharomyces cerevisiae), in embryos of the nematode (*Caenorhabditis elegans*), and in stem cells of the fruit fly (*Drosophila melanogaster*); how asymmetric cell division is regulated in *C. elegans* and *D. melanogaster*; how cell signals program cell-fate choice during plant and animal development; how *C. elegans* embryos establish major body axes; how neuronal diversity is generated in the zebra fish (*Danio rerio*) and in *D. melanogaster*; how hypoxia influences development in *D. melanogaster*; how resident bacteria influence intestinal development in *D. rerio*; and, in general, how genes are regulated during development. For more information see the **Research Centers and Institutes** section of this catalog.

Oregon Institute of Marine Biology

The Oregon Institute of Marine Biology offers a full program of study and research for graduate students. Graduate courses are offered mainly during summer session and fall and spring terms, and research is conducted year round. The marine biology graduate program focuses on research in biological oceanography, phytoplankton and microbial food webs, invertebrate physiology, larval ecology and evolution, the biology of intertidal organisms, deep-sea biology, and marine ecology. Direct inquiries to the biology department's graduate program coordinator. See also the **Research Centers and Institutes** (http://catalog.uoregon.edu/archive/2015-2016/research) section of this catalog.

Environmental Studies

The Environmental Studies Program offers interdisciplinary graduate study leading to a master of arts (MA) or master of science (MS) in environmental studies and an interdisciplinary doctor of philosophy (PhD) degree in environmental sciences, studies, and policy. Students choose courses offered in appropriate disciplines to design a program that meets individual goals. More information is available in the **Environmental Studies** section of this catalog.

Courses

BI121. Introduction to Human Physiology. 4 Credits.
Study of body functions with emphasis on organs and systems. Cell function, genetics, nutrition, exercise; function of the gut, heart, vessels, glands, lungs, nerves, and muscles with practical applications. Lecture, laboratories.

BI122. Introduction to Human Genetics. 4 Credits.
Basic concepts of genetics as they relate to humans. Blood groups, transplantation and immune reaction, prenatal effects, the biology of twinning, selection in humans, and sociological implications. Lectures, discussions.

BI123. Biology of Cancer. 4 Credits.
Comparison of cancer cells with normal cells; causes of cancer, including viral and environmental factors; biological basis of therapy. Lectures, laboratories.

BI130. Introduction to Ecology. 4 Credits.
The concept of an ecosystem; organismal energetics; biogeochemical cycles; succession; population growth; species interactions, species diversity; implications for human ecosystems. Lectures, discussions.

BI131. Introduction to Evolution. 4 Credits.
Darwinian evolution; human-caused evolution, natural selection, speciation, extinction, and human evolution. Lectures, discussions.

BI132. Introduction to Animal Behavior. 4 Credits.
Animal behavior, its evolutionary origins, and its neural mechanisms. Readings and films illustrate the adaptive nature of orientation, navigation, communication, and social behavior. Lectures, discussions.

BI140M. Science, Policy, and Biology. 4 Credits.
Explores the biology behind important topical issues such as stem cells, cloning, and genetically modified organisms. How policy decisions affect research in these areas. Lectures, discussions. Multilisted with CH 140M.

BI150. The Ocean Planet. 4 Credits.
The diversity of marine life is introduced in the context of appreciating nature and using science in the solution of environmental problems. Lectures, discussions.

BI196. Field Studies: [Topic]. 1-2 Credits.
Repeatable.

BI198. Laboratory Projects: [Topic]. 1-2 Credits.
Repeatable.

BI199. Special Studies: [Topic]. 1-5 Credits.
Repeatable.

BI211. General Biology I: Cells. 4 Credits.
How cells carry out functions of living organisms; genetic basis of inheritance; how genes and proteins work. Lectures, laboratories-discussions.
Prereq: C- or better or P in CH 111 or 113 or 114 or 221 or 224H.

BI212. General Biology II: Organisms. 4 Credits.
How cells develop and interact within complex organisms. Comparative anatomy and physiology of plants and animals. Lectures, laboratories-discussions.
Prereq: C- or better or P in BI 211.

BI213. General Biology III: Populations. 4 Credits.
How organisms interact with their environments and with each other; ecology, evolution, and behavior. Lectures, laboratories-discussions.
Prereq: C- or better or P in BI 211.

BI214. General Biology IV: Mechanisms. 4 Credits.
Protein structure and function; metabolism; DNA structure, replication, mutation, and repair; gene mapping and complementation; and gene regulation. Lectures, laboratories.
Prereq: C- or better or P in BI 212 and CH 223 or 226H.

BI281H. Honors Biology I: Cells, Biochemistry and Physiology. 5 Credits.
Focuses on the cellular structures and chemical reactions that allow cells to grow, to transform energy, and to communicate. Lectures, laboratories. Sequence with BI 282H, BI 283H.
Prereq: Math 111 with B- or better or minimum AP/IB mathematics score of 4/5 and CH 223 or CH 226H with B- or better.

BI282H. Honors Biology II: Genetics and Molecular Biology. 5 Credits.
How living organisms store, replicate, and transmit their genetic information, and how this information directs the activities of the cell and organism. Lectures, laboratories. Sequence with BI 281H, 283H.
Prereq: BI 281H with C- or better or P.

BI283H. Honors Biology III: Evolution, Diversity and Ecology. 5 Credits.
The genetic basis and ecological context of evolutionary change leading to an examination of the generation and major patterns of biodiversity. Lectures, laboratories, field trips. Sequence with BI 281H, 282H.
Prereq: BI 282H with grade of C– or better or P

BI306. Pollination Biology. 4 Credits.
Ecology and evolution of pollination biology: coevolution, mutualism, animal foraging behavior, plant breeding systems, biodiversity, and conservation issues associated with endangered species and introduced species. Lectures, laboratories, field trips.
Prereq: BI 213 or 283H.

BI307. Forest Biology. 4 Credits.
Structure and function of forested ecosystems emphasizing the Pacific Northwest. Interactions among trees, microorganisms, and animals; disturbance and recovery; forest management. Lectures, laboratories, field trips.
Prereq: BI 213 or 283H.

BI309. Tropical Diseases in Africa. 4 Credits.
Biological and medical aspects of major infectious and parasitic diseases in Africa, including HIV/AIDS and malaria; socioeconomic issues in public health; case studies. Lectures, discussions.
Prereq: BI 212 or BI 282H.

BI320. Molecular Genetics. 4 Credits.
Molecular mechanisms regulating control of gene expression. Topics include chromosome structure, transcription and processing of RNA, control of transcription, translational control, and genetic rearrangement. Lectures, discussions.
Prereq: BI 214 or BI 282H.

BI322. Cell Biology. 4 Credits.
Eukaryotic cell nuclear structure and exchange, protein trafficking, endocytosis, chaperones, cytoskeletal functions, intercellular junctions, extracellular materials, signaling, cell division mechanics and controls, aging and death. Lectures, discussions.
Prereq: BI 214 or BI 282H; CH 331 recommended.

BI328. Developmental Biology. 4 Credits.
Topics include genetic regulation, nucleocytoplasmic interactions, organogenesis, morphogenesis, pattern formation, cell differentiation, and neoplasia. Lectures, laboratories.
Prereq: BI 214 or BI 282H.

BI330. Microbiology. 3 Credits.
Biology of bacteria: photosynthetic, heterotrophic, and others. Cell structure and function, metabolism including anaerobic and O2-producing photosynthesis, nitrogen fixation, species interactions, and role in major geochemical cycles. Lectures.
Prereq: BI 214 or 282H.

BI331. Microbiology Laboratory. 3 Credits.
Microbial diversity through laboratory projects involving enrichments, culture isolations, and partial characterizations. Two scheduled laboratories and one scheduled lecture per week; additional unscheduled time required. Laboratories.
Prereq: BI 214 or 282H; pre- or coreq: BI 330.

BI353. Sensory Physiology. 4 Credits.
Introduction to physiology of the senses: cellular physiology of peripheral receptors through the computational mechanisms that are ultimately related to perception. Lectures, discussions.
Prereq: BI 214 or 282H.

BI355. Vertebrate Evolution and Development. 4 Credits.
Comparisons of vertebrate organs and tissues with emphasis on evolutionary trends, development, and diversification. How origins of novel structures may arise by changes in regulatory gene activities. Lectures, laboratories.
Prereq: BI 214 or 283H.

BI356. Animal Physiology. 5 Credits.
Neurophysiology, endocrinology, muscle contraction, and homeostatic mechanisms of circulation, respiration, metabolism, ionic regulation, and excretion in mammals; comparison with those in other animals. Lectures, laboratories.
Prereq: BI 214 or 281H.

BI357. Marine Biology. 4 Credits.
Ecology and physiology of marine plants and animals. Comparisons of various marine habitats. Human influences on marine systems. Lectures, laboratories, field trips.
Prereq: BI 213 or 283H. Not open to students who have credit for BI 458 or 474.

BI358. Investigations in Medical Physiology. 4 Credits.
Human physiology with research and clinical medicine applications. Nervous system, addiction medicine, endocrinology, immunology, cardiology, digestion, nutrition, reproduction, infertility, pediatrics, and ophthalmology. Lectures, discussions, primary literature research. Human anatomy and physiology background preferred.
Prereq: one from BI 214, BI 283H, HPHY 324.

BI359. Plant Biology. 4 Credits.
A detailed introduction of the unique features of the biology of land plants, including ecology, physiology, developmental genetics, and evolutionary biology. Lectures, discussions.
Prereq: BI 211; 212; 213 or 281H; 282H; 283H.

BI360. Neurobiology. 4 Credits.
Function of the nervous system from the single neuron to complex neural networks. Topics range from molecular and cellular neurobiological mechanisms to systems and behavioral analyses. Lectures, discussions.
Prereq: BI 214 or 282H.

BI370. Ecology. 4 Credits.
Relationship of organisms to their environment in space and time. Factors controlling the distribution and abundance of organisms, introductions to community systems, and paleoecology. Required fieldwork. Lectures, laboratories, field trips.
Prereq: BI 213 or 283H. Calculus or statistics recommended.

BI372. Field Biology. 4 Credits.
Students learn to identify the plants and animals of Oregon, their adaptations and ecology. Lectures, laboratories, field trips. Offered alternate years.

BI374. Conservation Biology. 4 Credits.
Global patterns of biological diversity; major threats to biodiversity; application of ecology, evolution, genetics, and other areas to protect and maintain biodiversity. Lectures, discussions.
Prereq: BI 213 or 283H.

BI375. Biological Diversity. 4 Credits.
Patterns of global biological diversity in space and time; major systematic groups of organisms and their ecological roles; historical and human effects on biological diversity. Lectures, discussions.
Prereq: BI 213 or 283H.

BI380. Evolution. 4 Credits.
Origin and maintenance of genetic variability. Historical and geographic patterns of variation. Application of population genetics to understanding evolutionary processes; modes of speciation. Lectures, discussions.
Prereq: college algebra and 213 or 283H.

BI390. Animal Behavior. 4 Credits.
How and why animals behave, and how animal behavior is studied. Mechanisms of behavior, behavioral ecology, and sociobiology. Lectures, discussions.
Prereq: BI 213 or 283H.

BI399. Special Studies: [Topic]. 1-5 Credits.
Repeatable.
Prereq: BI 212 and 213 and 214 or BI 283H.

BI401. Research: [Topic]. 1-16 Credits.
Repeatable.

BI402. Supervised College Teaching. 1-6 Credits.
Repeatable for maximum of 9 credits.

BI403. Thesis. 1-12 Credits.
Repeatable.

BI405. Reading and Conference: [Topic]. 1-16 Credits.
Repeatable.

BI406. Field Studies: [Topic]. 1-16 Credits.
Repeatable.

BI407. Seminar: [Topic]. 1-2 Credits.
Repeatable.

BI408. Laboratory Projects: [Topic]. 1-16 Credits.
Special laboratory training in research methods. A fee may be charged for supplies and materials that become the property of the student.

BI409. Practicum: [Topic]. 1-12 Credits.
Repeatable.

BI410. Experimental Course: [Topic]. 1-16 Credits.
Repeatable.
Prereq: BI 212 and 213 and 214 or BI 283H.

BI420. Cellular Basis of Learning and Memory. 4 Credits.
The history and current state of knowledge about the cellular and molecular mechanisms of learning and memory common to simple and complex animals. Lectures, discussions.
Prereq: BI 320 or BI 322; BI 360.

BI421. Advanced Molecular Genetics Research Laboratory. 5 Credits.
Intensive multipart research project using fungus *Neurospora*; includes mutagenesis, genetic selection-screening, complementation testing, mapping, DNA purification, restriction analysis, polymerase chain reaction, Southern blotting. Five credits for BI 421, 4 credits for BI 521.
Prereq: BI 320.
Prereq: BI 320

BI422. Protein Toxins in Cell Biology. 4 Credits.
Mechanisms used by protein toxins to kill other organisms and how they have been used as molecular scalpels to dissect pathways in cell and neurobiology. Lectures, discussions.
Prereq: BI 322, BI 356, or BI 360.

BI423. Human Molecular Genetics. 4 Credits.
Advanced topics in genetics that relate to human development and disease. The human genome, sex determination, X chromosome inactivation, chromosomal abnormalities, trinucleotide repeat expansions, cancer. Lectures, discussions.
Prereq: BI 320.

BI424. Advanced Molecular Genetics. 4 Credits.
Structure and function of chromosomes with emphasis on unsolved genetic problems such as genomic imprinting, position effects, and gene silencing. Lectures, discussions.
Prereq: BI 320.

BI425. Advanced Molecular Biology Research Laboratory. 5 Credits.
Provides an intensive, structured research experience that incorporates molecular biology, genetics, and genomic methodologies. Lectures, laboratories.
Prereq: one from BI 320, BI 322, BI 328.

BI426. Genetics of Cancer. 4 Credits.
Genetic regulation of cancer. Topics include oncogenes and tumor suppressor genes, signal transduction pathways, genetic animal models, and rationale treatment design. Lectures, discussions.
Prereq: BI 320 or BI 322.

BI427. Molecular Genetics of Human Disease. 4 Credits.
Advanced discussions of heritable diseases from single-gene mutations such as cystic fibrosis to complex multigenetic diseases such as autism and schizophrenia. Lectures, discussions.
Prereq: BI 320.

BI428. Developmental Genetics. 4 Credits.
Genetic regulation of development, including investigations of molecular mechanisms and studies of developmental mutants. Topics include molecular biology of eukaryotic chromosomes, genetic mosaics, and models of gene regulation. Lectures, discussions.
Prereq: BI 320, 328.

BI432. Mycology. 5 Credits.
Physiology, ecology, structure, and classification of fungi; emphasis on structural and physiological adaptations to saprophytic, parasitic, and symbiotic modes of existence. Lectures, laboratories.
Prereq: BI 214 or 283H.

BI433. Bacterial-Host Interactions. 4 Credits.
Examines spectrum of interactions between bacteria and animals, from pathogenesis to symbiosis, focusing on the molecular and cellular bases of these interactions. Lectures, discussions.
Prereq: BI 320 or 322 or 330.

BI442. Systematic Botany. 5 Credits.
Principles of plant classification with emphasis on flowering plants, introduction to taxonomic theory and methods of biosystematics, collection and identification procedures, recognition of common families in native flora. Lectures, laboratories, field trips.
Prereq: BI 213 or 283H.

BI448. Field Botany. 4 Credits.
Intensive study of the regional flora; ecology and native uses; sight recognition of prominent species; field characteristics of principal plant families; identification using dichotomous keys. Lectures, field trips. Offered summer session only.
Prereq: BI 213 or 283H.

BI451. Invertebrate Zoology. 1-8 Credits.
Representative invertebrate groups with emphasis on marine forms; morphology, systematics, life history, and ecology. Lectures, laboratories, field trips. Offered at Oregon Institute of Marine Biology.
Prereq: BI 213 or 283H.

BI452. Insect Biology. 4 Credits.
Anatomy, physiology, systematics, and behavior of insects. Insect societies. Lectures, laboratories, field trips. Offered summer session only.
Prereq: BI 213 or 283H.

BI454. Estuarine Biology. 5 Credits.
The biological and physical factors regulating abundance, distribution, production, and biodiversity within estuaries. Includes field trips to marshes, tidal flats and exploration of estuarine habitats. Offered at Oregon Institute of Marine Biology.
Prereq: BI 213 or 283H.

BI455. Marine Birds and Mammals. 1-6 Credits.
Principles of morphology, physiology, evolution, life history, and systematics as demonstrated through study of birds and mammals of the Oregon coast. Comparison of the fauna from the open sea to coastal waters. Lectures, laboratory, field trips. Offered at Oregon Institute of Marine Biology.
Prereq: BI 213 or 283H.

BI457. Marine Biology: [Topic]. 1-8 Credits.
Content varies. Topics include comparative embryology, environmental issues, biology of fishes, and other subjects related to marine biology. Lectures, laboratories, field trips. Repeatable when topic changes. Offered at Oregon Institute of Marine Biology.
Prereq: BI 212 & 213 or 283H.

BI458. Biological Oceanography. 5 Credits.
Examines patterns of biological productivity and controlling physical and chemical mechanisms in the various environments of the world's oceans. Lectures, laboratories, field trips. Offered at Oregon Institute of Marine Biology.
Prereq: BI 213 or 283H.

BI459. Field Ornithology. 4 Credits.
Natural history and identification of birds. Fieldwork emphasizes adaptation, behavior, breeding, distribution, migration, and ecology. Lectures, field trips. Offered summer session only.
Prereq: BI 213 or 283H.

BI461. Systems Neuroscience. 4 Credits.
Principles of organization of nervous systems with emphasis on vertebrate brain and spinal cord. Functional implications of synaptic organization and pattern of projections, and comparative aspects. Lectures, discussions.
Prereq: BI 353 or 360 or equivalent.

BI463. Cellular Neuroscience. 4 Credits.
Physiology of excitation, conduction, and synaptic transmission. Lectures, discussions.
Prereq: BI 360.

BI464. Biological Clocks. 4 Credits.
Biological time keeping at ecological, evolutionary, behavioral, physiological, neurological, and molecular levels, with emphasis on daily and seasonal rhythmicity. Senior standing in Biology or Psychology required. Lectures, discussions.
Prereq: BI 320 or 322.

BI466. Developmental Neurobiology. 4 Credits.
Mechanisms underlying development of the nervous system. The genesis of nerve cells; differentiation of neurons; synaptogenesis and neuronal specificity; plasticity, regeneration, and degeneration of nervous tissue. Lectures, discussions.
Prereq: BI 320, 328.

BI468. Amphibians and Reptiles of Oregon. 4 Credits.
Field identification and understanding of ecology, biogeography, and evolution of the common herpetofauna of four major physiographic regions of Oregon. Conservation biology issues addressed. Lectures, field trips. Offered summer session only.
Prereq: one year of college biology or BI 213 or BI 283H.

BI469. Ecological Restoration. 4 Credits.
Examines the basics of ecological restoration through restoration projects in the field and evaluation of scientific literature. Offered at Bend campus only.
Prereq: introductory ecology course.

BI471. Population Ecology. 4 Credits.
Theoretical, experimental and applied aspects of growth, structure, and regulation of natural populations; population estimation; demographic analysis; life-history theory. Lectures, discussions.
Prereq: MATH 247 or 252; BI 370.

BI472. Community Ecology. 4 Credits.
Quantitative and conceptual approaches to the study of biological communities. Biodiversity measurement. Effect of climate and climate change on ecosystem structure and function. Lectures, discussions.
Prereq: BI 370.

BI473. Quantitative Ecology. 5 Credits.
Quantitative methods applied to field analyses of pattern, dominance, community structure, and interactions. Required fieldwork.
Pre- or coreq: BI 370.

BI474. Marine Ecology. 1-8 Credits.
Factors that influence the distribution, abundance, and diversity of marine organisms. Field emphasis on local intertidal and shallow-water communities. Offered at Oregon Institute of Marine Biology.
Prereq: BI 213 or 283H.

BI476. Terrestrial Ecosystem Ecology. 4 Credits.
Flux of nutrients, carbon, water, and energy in the environment; interactions and consequences for organisms. Scale ranges from microbial to global. Lectures, discussions.
Prereq: BI 370.

BI480. Evolution of Development. 4 Credits.
Exploration of the mechanisms by which organisms evolve new developmental pathways; techniques used to discover the evolutionary history of these innovations. Lectures, discussions.
Prereq: BI 328, 355, or 380.

BI484. Molecular Evolution. 4 Credits.
General description of patterns of molecular variation within and between species, underlying mechanisms, and methods of analysis.
Prereq: BI 320 or 380.

BI485. Techniques in Computational Neuroscience. 4 Credits.
Introduction to numerical techniques for modeling the nervous system from single neurons to neutral networks. Lectures, laboratories.
Prereq: BI 360 or 461; MATH 247 or 252 or higher.

BI486. Population Genetics. 4 Credits.
Analysis of the genetic mechanisms of evolutionary change. Study of artificial and natural selection, mutation, migration, population structure, and genetic drift. Lectures, discussions.
Prereq: BI 380; MATH 247 or 252.

BI487. Molecular Phylogenetics. 4 Credits.
A critical introduction to the concepts and techniques of modern molecular phylogenetic analysis—the inference of evolutionary relationships from gene sequence data. Lectures, discussions.
Prereq: BI 380

BI488. Evolutionary Processes. 4 Credits.
Critical discussion of the ecological and evolutionary genetic processes associated with adaptation in natural populations; draws from topics in population, quantitative, and molecular genetics, molecular evolution, and statistics.
Prereq: BI 380.

BI493. Genomic Approaches and Analysis. 4 Credits.
Introduction to experimental methods and analytical techniques for studying biological questions on a genome-wide scale. Lectures, discussions.
Prereq: BI 320.

BI503. Thesis. 1-16 Credits.
Repeatable.

BI507. Seminar: [Topic]. 1-2 Credits.
Repeatable.

BI508. Laboratory Projects: [Topic]. 1-16 Credits.
Special laboratory training in research methods. A fee may be charged for supplies and materials that become the property of the student.

BI510. Experimental Course: [Topic]. 1-16 Credits.
Repeatable.

BI520. Cellular Basis of Learning and Memory. 4 Credits.
The history and current state of knowledge about the cellular and molecular mechanisms of learning and memory common to simple and complex animals. Lectures, discussions.

BI521. Advanced Molecular Genetics Research Laboratory. 4 Credits.
Intensive multipart research project using fungus *Neurospora*; includes mutagenesis, genetic selection-screening, complementation testing, mapping, DNA purification, restriction analysis, polymerase chain reaction, Southern blotting. Five credits for BI 421, 4 credits for BI 521.
Prereq: BI 320.

BI522. Protein Toxins in Cell Biology. 4 Credits.
Mechanisms used by protein toxins to kill other organisms and how they have been used as molecular scalpels to dissect pathways in cell and neurobiology. Lectures, discussions.

BI523. Human Molecular Genetics. 4 Credits.
Advanced topics in genetics that relate to human development and disease. The human genome, sex determination, X chromosome inactivation, chromosomal abnormalities, trinucleotide repeat expansions, cancer. Lectures, discussions.

BI524. Advanced Molecular Genetics. 4 Credits.
Structure and function of chromosomes with emphasis on unsolved genetic problems such as genomic imprinting, position effects, and gene silencing. Lectures, discussions.

BI525. Advanced Molecular Biology Research Laboratory. 4 Credits.
Provides an intensive, structured research experience that incorporates molecular biology, genetics, and genomic methodologies. Lectures, laboratories.

BI526. Genetics of Cancer. 4 Credits.
Genetic regulation of cancer. Topics include oncogenes and tumor suppressor genes, signal transduction pathways, genetic animal models, and rationale treatment design. Lectures, discussions.

BI527. Molecular Genetics of Human Disease. 4 Credits.
Advanced discussions of heritable diseases from single-gene mutations such as cystic fibrosis to complex multigenetic diseases such as autism and schizophrenia. Lectures, discussions.

BI528. Developmental Genetics. 4 Credits.
Genetic regulation of development, including investigations of molecular mechanisms and studies of developmental mutants. Topics include molecular biology of eukaryotic chromosomes, genetic mosaics, and models of gene regulation. Lectures, discussions.

BI532. Mycology. 5 Credits.
Physiology, ecology, structure, and classification of fungi; emphasis on structural and physiological adaptations to saprophytic, parasitic, and symbiotic modes of existence. Lectures, laboratories.

BI533. Bacterial-Host Interactions. 4 Credits.
Examines spectrum of interactions between bacteria and animals, from pathogenesis to symbiosis, focusing on the molecular and cellular bases of these interactions. Lectures, discussions.

BI542. Systematic Botany. 5 Credits.
Principles of plant classification with emphasis on flowering plants, introduction to taxonomic theory and methods of biosystematics, collection and identification procedures, recognition of common families in native flora. Lectures, laboratories, field trips.

BI548. Field Botany. 4 Credits.
Intensive study of the regional flora; ecology and native uses; sight recognition of prominent species; field characteristics of principal plant families; identification using dichotomous keys. Lectures, field trips. Offered summer session only.

BI551. Invertebrate Zoology. 1-8 Credits.
Representative invertebrate groups with emphasis on marine forms; morphology, systematics, life history, and ecology. Lectures, laboratories, field trips. Offered at Oregon Institute of Marine Biology.

BI552. Insect Biology. 4 Credits.
Anatomy, physiology, systematics, and behavior of insects. Insect societies. Lectures, laboratories, field trips. Offered summer session only.

BI554. Estuarine Biology. 5 Credits.
The biological and physical factors regulating abundance, distribution, production, and biodiversity within estuaries. Includes field trips to marshes, tidal flats and exploration of estuarine habitats. Offered at Oregon Institute of Marine Biology.

BI555. Marine Birds and Mammals. 1-6 Credits.
Principles of morphology, physiology, evolution, life history, and systematics as demonstrated through study of birds and mammals of the Oregon coast. Comparison of the fauna from the open sea to coastal waters. Lectures, laboratory, field trips. Offered at Oregon Institute of Marine Biology.

BI557. Marine Biology: [Topic]. 1-8 Credits.
Content varies. Topics include comparative embryology, environmental issues, biology of fishes, and other subjects related to marine biology. Lectures, laboratories, field trips. Repeatable when topic changes. Offered at Oregon Institute of Marine Biology.

BI558. Biological Oceanography. 5 Credits.
Examines patterns of biological productivity and controlling physical and chemical mechanisms in the various environments of the world's oceans. Lectures, laboratories, field trips. Offered at Oregon Institute of Marine Biology.

BI559. Field Ornithology. 4 Credits.
Natural history and identification of birds. Fieldwork emphasizes adaptation, behavior, breeding, distribution, migration, and ecology. Lectures, field trips. Offered summer session only.

BI561. Systems Neuroscience. 4 Credits.
Principles of organization of nervous systems with emphasis on vertebrate brain and spinal cord. Functional implications of synaptic organization and pattern of projections, and comparative aspects. Lectures, discussions.

BI563. Cellular Neuroscience. 4 Credits.
Physiology of excitation, conduction, and synaptic transmission. Lectures, discussions.

BI564. Biological Clocks. 4 Credits.
Biological time keeping at ecological, evolutionary, behavioral, physiological, neurological, and molecular levels, with emphasis on daily and seasonal rhythmicity. Lectures, discussions.

BI566. Developmental Neurobiology. 4 Credits.
Mechanisms underlying development of the nervous system. The genesis of nerve cells; differentiation of neurons; synaptogenesis and neuronal specificity; plasticity, regeneration, and degeneration of nervous tissue. Lectures, discussions.

BI568. Amphibians and Reptiles of Oregon. 4 Credits.
Field identification and understanding of ecology, biogeography, and evolution of the common herpetofauna of four major physiographic regions of Oregon. Conservation biology issues addressed. Lectures, field trips. Offered summer session only.

BI569. Ecological Restoration. 4 Credits.
Examines the basics of ecological restoration through restoration projects in the field and evaluation of scientific literature. Offered at Bend campus only.
Prereq: introductory ecology course.

BI571. Population Ecology. 4 Credits.
Theoretical, experimental and applied aspects of growth, structure, and regulation of natural populations; population estimation; demographic analysis; life-history theory. Lectures, discussions.

BI572. Community Ecology. 4 Credits.
Quantitative and conceptual approaches to the study of biological communities. Biodiversity measurement. Effect of climate and climate change on ecosystem structure and function. Lectures, discussions.

BI573. Quantitative Ecology. 5 Credits.
Quantitative methods applied to field analyses of pattern, dominance, community structure, and interactions. Required fieldwork.

BI574. Marine Ecology. 1-8 Credits.
Factors that influence the distribution, abundance, and diversity of marine organisms. Field emphasis on local intertidal and shallow-water communities. Offered at Oregon Institute of Marine Biology.

BI576. Terrestrial Ecosystem Ecology. 4 Credits.
Flux of nutrients, carbon, water, and energy in the environment; interactions and consequences for organisms. Scale ranges from microbial to global. Lectures, discussions.

BI580. Evolution of Development. 4 Credits.
Exploration of the mechanisms by which organisms evolve new developmental pathways; techniques used to discover the evolutionary history of these innovations. Lectures, discussions.

BI584. Molecular Evolution. 4 Credits.
General description of patterns of molecular variation within and between species, underlying mechanisms, and methods of analysis.

BI585. Techniques in Computational Neuroscience. 4 Credits.
Introduction to numerical techniques for modeling the nervous system from single neurons to neutral networks. Lectures, laboratories.

BI586. Population Genetics. 4 Credits.
Analysis of the genetic mechanisms of evolutionary change. Study of artificial and natural selection, mutation, migration, population structure, and genetic drift. Lectures, discussions.

BI587. Molecular Phylogenetics. 4 Credits.
A critical introduction to the concepts and techniques of modern molecular phylogenetic analysis—the inference of evolutionary relationships from gene sequence data. Lectures, discussions.

BI588. Evolutionary Processes. 4 Credits.
Critical discussion of the ecological and evolutionary genetic processes associated with adaptation in natural populations; draws from topics in population, quantitative, and molecular genetics, molecular evolution, and statistics.

BI593. Genomic Approaches and Analysis. 4 Credits.
Introduction to experimental methods and analytical techniques for studying biological questions on a genome-wide scale. Lectures, discussions.

BI601. Research: [Topic]. 1-16 Credits.
Repeatable.

BI602. Supervised College Teaching. 1-5 Credits.
Repeatable.

BI603. Dissertation. 1-16 Credits.
Repeatable.

BI605. Reading and Conference: [Topic]. 1-16 Credits.
Repeatable.

BI606. Field Studies: [Topic]. 1-16 Credits.
Repeatable.

BI607. Seminar: [Topic]. 1-3 Credits.
Topics may include neurobiology, developmental biology, ecology colloquium, genetics, molecular biology, and neuroscience. Repeatable.

BI608. Special Topics: [Topic]. 1-5 Credits.
Lecture course devoted to advanced topics that reflect instructor's research interests. Repeatable.

BI609. Practicum: [Topic]. 1-3 Credits.
Repeatable.

BI610. Experimental Course: [Topic]. 1-5 Credits.
Repeatable.

BI621. Computational Methods in Genomic Analysis. 4 Credits.
An introduction to Unix shell, Python, and R programming skills for analysis of biological data sets, specifically focusing on high-throughput sequencing data. Series with BI 622, BI 623, BI 624.

BI622. Genomics Techniques. 4 Credits.
Students will be introduced to various genomics laboratory techniques, as well as trained in oral and written scientific communication. Series with BI 621, BI 623, BI 624.

BI623. Advanced Topics in Genomics Analysis. 4 Credits.
Exposure to a variety of topics in genomics analysis including phylogenetics, transcriptome assembly, transcript quantification, and microbial community analysis. Series with BI 621, BI 622, BI 624.

BI624. Genomics Research Lab. 4 Credits.
Group research on high-throughput sequencing data. Series with BI 621, BI 622, BI 623.