Program

BS in Biological Sciences
BS in Microbiology
Option in:
  General Microbiology
  Clinical Laboratory Science
Minor in Biological Sciences
Pre-Professional Programs:
  Dentistry
  Forestry
  Medicine
  Physical Therapy
  Veterinary Medicine
Single Subject Teaching
  Credential in Science with a
  Concentration in Biological Science
MS in Biological Sciences
MS in Botany

The Department of Biological Sciences seeks to introduce our students to a scientific understanding of the many forms of life and their ecological interactions and to equip our students with the scientific knowledge and perspective to participate in today’s world as well-informed and biologically literate citizens.

We intend further to expose our majors to current research and techniques in biological sciences and prepare them for employment opportunities, graduate education, or professional programs of study such as medicine and dentistry. Biology majors can create a course of study that will allow them to concentrate in ecology, zoology, botany, physiology, or cell/molecular biology. Microbiology majors can choose a General Microbiology Option or the Clinical Laboratory Science Option. In addition, they can select courses which will prepare them for a career in biotechnology. The close proximity to many natural research sites enhances field courses and provides research opportunities for both field and laboratory work.

Faculty and Facilities

The faculty represent diverse academic backgrounds. All are vitally interested in their students. Faculty members, in addition to teaching and advising, are actively involved in research and scientific publication. The department encourages undergraduates to be involved in faculty research programs.

In addition to excellent field sites, the department has many well-equipped teaching and research areas, such as labs for aquatic ecology, molecular biology and biotechnology, electron microscopy, microbiology, and cell physiology. A natural history museum, herbarium, and greenhouses are also available.

Graduate Programs

The objectives of the graduate program are to develop research and analytical skills so that students are equipped to conduct independent research and teach as professional biologists upon graduation. Faculty interests offer graduate students a wide range of areas in which to do research. The MS in Biology and in Botany combines coursework and satisfactory completion of original research, presented in a thesis.

Eagle Lake

The College of Natural Sciences, in conjunction with the University of California, Davis, operates the Biological Field Station on Eagle Lake, about forty kilometers northwest of Susanville, California. Summer course work and year-round research opportunities are available to undergraduates and graduate students.

Experiences

Students are involved in faculty research projects in the laboratory, field, and library. Internships are available with a number of agencies including the National Institutes of Health, California Department of Fish and Game, United States Forest Service, and many biotechnology firms. Additional listings and information are available from the department office.

Career Outlook

The organizational, data-gathering, and written communication skills acquired by biology majors prepare students for a wide variety of careers. Students may prepare themselves for employment in laboratories, business, or teaching. Laboratory technician or research associate positions are available in university and governmental research centers, pharmaceutical and biological product manufacturers, biotechnology, genetic engineering, and agricultural and food processing companies.

Students who emphasize field studies may prepare themselves for positions in private companies as well as state and federal agencies. Some of these positions include wildlife biologist, aquatic and restoration ecologist, and horticulturist. Participation in volunteer or paid internships or cooperative education programs while an undergraduate enhances employability in these areas.
Biological Sciences

The Bachelor of Science in Biological Sciences

Total Course Requirements for the Bachelor’s Degree: 120 units

See “Requirements for the Bachelor’s Degree” in The University Catalog for complete details on general degree requirements. A minimum of 48 units, including those required for the major, must be upper division.

A suggested Major Academic Plan (MAP) has been prepared to help students meet all graduation requirements within four years. Please request a plan from your major adviser or view it and other current advising information on the CSU, Chico Web.

General Education Requirements: 48 units

See “General Education Requirements” in The University Catalog and The Class Schedule for the most current information on General Education Requirements and course offerings. The course requirements marked below with an asterisk (*) may also be applied toward General Education. Biological Sciences majors may meet the Breadth Area B2 requirement by completing BIOL 151.

Cultural Diversity Course Requirements: 6 units

See “Cultural Diversity” in The University Catalog. Most courses taken to satisfy these requirements may also apply to General Education.

American Institutions Requirement: 6 units

See the “American Institutions Requirement” under “Bachelor’s Degree Requirements.” This requirement is normally fulfilled by completing HIST 130 and POLS 155. Courses used to satisfy this requirement do not apply to General Education.

Literacy Requirement:

See “Mathematics and Writing Requirements” in The University Catalog. Writing proficiency in the major is a graduation requirement and may be demonstrated through satisfactory completion of a course in your major which has been designated as the Writing Proficiency (WP) course for the semester in which you take the course. Students who earn below a C- are required to repeat the course and earn a C- or better to receive WP credit. See The Class Schedule for the designated WP courses for each semester. You must pass ENGL 130 (or its equivalent) with a grade of C- or higher with a C- or better before you may register for a WP course.

Course Requirements for the Major: 63 units

The following courses, or their approved transfer equivalents, are required of all candidates for this degree. Additional required courses, depending upon the selected option or advising pattern, are outlined following the degree core program requirements.

Lower-Division Requirements: 31-32 units

2 courses required:

BIOL 151 Biological Principles 4.0 FS
Prerequisites: Recommend CHEM 111 or concurrent enrollment.

BIOL 152 Biological Principles 4.0 FS
Prerequisites: BIOL 151; recommend CHEM 112 or concurrent enrollment.

1 course selected from:

BIOL 209 General Botany 3.0 FS
Prerequisites: BIOL 152 or faculty permission.

BIOL 210 General Zoology 3.0 FS
Prerequisites: BIOL 152 or faculty permission.

BIOL 211 General Microbiology 4.0 FS
Prerequisites: A college course in biology and in general chemistry.

NOTE: If BIOL 211 is chosen, the number of upper-division elective units required will be reduced by one unit.

5 courses required:

CHEM 111 General Chemistry 4.0 FS *
Prerequisites: Second-year high school algebra; one year high school chemistry. (One year of high school physics and one year of high school mathematics past Algebra II are recommended.)

CHEM 112 General Chemistry 4.0 FS
Prerequisites: CHEM 111.

CHEM 270 Organic Chemistry 4.0 FS
Prerequisites: CHEM 112.

PHYS 202A General Physics 4.0 FS *
Prerequisites: High school physics or faculty permission. High school trigonometry and second-year high school algebra or equivalent (MATH 051 and MATH 118 at CSU, Chico).

PHYS 202B General Physics 4.0 FS
Prerequisites: PHYS 202A.

Upper-Division Requirements: 31-32 units

Biological sciences majors are expected to have completed BIOL 151, BIOL 152, and CHEM 112 before beginning their upper-division requirements.

Upper-Division Core: 15-16 units

4 courses required:

BIOL 351 Intro to Biological Literature 1.0 FS WP
Prerequisites: ENGL 130 (or its equivalent) with a grade of C- or higher; junior standing; BIOL 152.

BIOL 360 Genetics 4.0 FS
Prerequisites: BIOL 152.

BIOL 400 Fundamentals of Ecology 4.0 FS
Prerequisites: BIOL 152 or faculty permission. Some taxonomic background is recommended.

CHEM 370 Organic Chemistry 3.0 FS
Prerequisites: CHEM 270.

Physics requirement:

1 course selected from:

BIOL 412 Bacterial Physiology 4.0 SP
Prerequisites: BIOL 211; BIOL 360; CHEM 270. CHEM 451 is recommended.

BIOL 414 Plant Physiology 4.0 FS
Prerequisites: BIOL 108 or BIOL 152; BIOL 209; CHEM 108 or CHEM 270; or faculty permission.

BIOL 416 Vertebrate Physiology 4.0 FS
Prerequisites: BIOL 152; CHEM 108 or CHEM 270. Strongly recommended: BIOL 210.

BIOL 417 Cell Physiology 3.0 SP
Prerequisites: BIOL 152; CHEM 108 or CHEM 270.

Upper-Division Electives: 15-17 units

15-17 units selected from:

Any 400-level biology (BIOL) courses.

Select courses in addition to the Upper-Division Core requirement to complete the minimum required number of 63 units total for the major. A maximum of 3 units of BIOL 399 may be taken in one semester, and a maximum of 3 units of BIOL 399, BIOL 489, or BIOL 499H may be counted toward the major.

NOTE: With your adviser’s approval, you may substitute one of BIOL 209, BIOL 210, or BIOL 211 for a 400-level course if it has not been used to meet the lower-division requirements. In addition, the following courses are acceptable substitutes for 400-level biology courses.

BIOB 380 Computer Applications Biology 3.0 SP
Prerequisites: BIOL 152 and a computer science course providing skills in programming. Recommended: MATH 120 or a statistics course.

BIOL 399 Special Problems 1.0-3.0 FS
Prerequisites: BIOL 370L Organic Chem Laboratory 1.0 FS
Prerequisites: CHEM 370L may be taken as a prerequisite or concurrently with CHEM 370L.

CHEM 451 Biochemistry 3.0 FS
Prerequisites: CHEM 370.

In selecting courses to meet the 15-17 unit elective requirement, you should consult with your adviser to create a package of elective courses that will best meet your career goals. You could select groups of courses that will allow you to concentrate in a given area such as cell/molecular biology, ecology, botany, zoology, or select courses that will meet requirements for a teaching credential, graduate or professional school, or a specific occupation.

Electives Requirement:

To complete the total units required for the bachelor’s degree, select additional elective courses from the total university offerings. You should consult with an adviser regarding the selection of courses which will provide breadth to your university experience and possibly apply to a supportive second major or minor.

Grading Requirement:

All courses taken to fulfill major course requirements must be taken for a letter grade except those courses specified by the department as Credit/No Credit grading only.

Advising Requirement:

Advising is mandatory for all majors in this degree program. Consult your undergraduate adviser for specific information.
Honors in the Major

Honors in the Major is a program of independent work in your major. It involves 6 units of honors course work completed over two semesters. Your Honors work will be recognized at your graduation, on your permanent transcripts, and on your diploma. It is often accompanied by letters of commendation from your mentor in the department or the department chair. Most importantly, however, the Honors in the Major program allows you to work closely with a faculty mentor in your area of interest on an original performance or research project. This year-long collaboration allows you to work in your field at a professional level and culminates in a public presentation of your work. Students sometimes take their projects beyond the university for submission in professional journals, presentation at conferences, or competition in shows; such experience is valuable for graduate school and later professional life.

Some common features of Honors in the Major program are:

1. You must take 6 units of Honors in the Major course work. At least 3 of these 6 units are independent study (499/499P) as specified by your department. You must have a minimum overall grade point average of B.
2. You must have completed 9 units of upper-division course work or 21 overall units in your major before you can be admitted to Honors in the Major.
3. Your cumulative GPA should be at least 3.5 or within the top 5 percent of majors in your department.
4. Your GPA in major should be at least 3.5 or within the top 5 percent of majors in your department.
5. Most students apply for or are invited to participate in Honors in the Major during the second semester of their junior year. Then they complete the 6 units of course work over the two semesters of their senior year.
6. Your honors work culminates with a public presentation of your Honors project.

While Honors in the Major is part of the Honors Program, each department administers its own program. Please contact your major department or major adviser for further information.

THE BACHELOR OF SCIENCE IN MICROBIOLOGY

Total Course Requirements for the Bachelor’s Degree: 120 units

See “Requirements for the Bachelor’s Degree” in The University Catalog for complete details on general degree requirements. A suggested Major Academic Plan (MAP) has been prepared to help students meet all graduation requirements within four years. Please request a plan from your major adviser or view it and other current advising information on the CSU, Chico Web.

Please see the General Education, Cultural Diversity, and U.S. Government requirements outlined under the BS in Biological Sciences.

For Microbiology majors, the following courses are to be double-counted toward General Education and a microbiology major: Breadth Area B2 requirement may be fulfilled by BIOL 151, BIOL 152, BIOL 209, or BIOL 210. Majors may count either HIST 130 or POLS 155 for a Breadth Area C requirement (3 units maximum).

Literacy Requirement:

See “Mathematics and Writing Requirements” in The University Catalog. Writing proficiency in the major is a graduation requirement and may be demonstrated through satisfactory completion of a course in your major which has been designated as the Writing Proficiency (WP) course for the semester in which you take the course. Students who earn below a C- are required to repeat the course and earn a C- or better to receive WP credit. See The Class Schedule for the designated WP courses for each semester. You must pass ENGL 130 (or its equivalent) with a C- or better before you may register for a WP course.

Course Requirements for the Major: 70 units

The following courses, or their approved transfer equivalents, are required of all candidates for this degree. Additional required courses, depending upon the selected option or advising pattern, are outlined following the degree core program requirements.

Lower-Division Requirements: 32 units

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<thead>
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<th>Course</th>
<th>Title</th>
<th>Units</th>
<th>Type</th>
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<tr>
<td>BIOL 151</td>
<td>Biological Principles</td>
<td>4.0</td>
<td>FS</td>
</tr>
<tr>
<td>BIOL 152</td>
<td>Biological Principles</td>
<td>4.0</td>
<td>FS</td>
</tr>
<tr>
<td>BIOL 211</td>
<td>General Microbiology</td>
<td>4.0</td>
<td>FS</td>
</tr>
<tr>
<td>CHEM 111</td>
<td>General Chemistry</td>
<td>4.0</td>
<td>FS</td>
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<tr>
<td>CHEM 270</td>
<td>Organic Chemistry</td>
<td>4.0</td>
<td>FS</td>
</tr>
<tr>
<td>PHYS 202A</td>
<td>General Physics</td>
<td>4.0</td>
<td>SP</td>
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<tr>
<td>PHYS 202B</td>
<td>General Physics</td>
<td>4.0</td>
<td>SP</td>
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Major Option Course Requirements: 38 units

The following courses, or their approved transfer equivalents, are required dependent upon the option chosen. Students must select one of the following options for completion of the major course requirements.

THE OPTION IN GENERAL MICROBIOLOGY: 38 units

11 courses required:

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<tr>
<td>BIOL 151</td>
<td>Intro to Biological Literature</td>
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<td>FS WP</td>
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<td>BIOL 152</td>
<td>General Microbiology</td>
<td>4.0</td>
<td>SP</td>
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<td>BIOL 360</td>
<td>Genetics</td>
<td>4.0</td>
<td>SP</td>
</tr>
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<td>BIOL 402</td>
<td>Microbial Ecology</td>
<td>4.0</td>
<td>SP</td>
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<td>BIOL 412</td>
<td>Bacterial Physiology</td>
<td>4.0</td>
<td>SP</td>
</tr>
<tr>
<td>BIOL 466</td>
<td>Immunology</td>
<td>4.0</td>
<td>SP</td>
</tr>
<tr>
<td>BIOL 412</td>
<td>Vertebrate Physiology</td>
<td>4.0</td>
<td>SP</td>
</tr>
<tr>
<td>BIOL 470</td>
<td>Medical Bacteriology</td>
<td>5.0</td>
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<tr>
<td>CHEM 320</td>
<td>Quantitative Analysis</td>
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<td>SP</td>
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<td>CHEM 370</td>
<td>Organic Chemistry</td>
<td>3.0</td>
<td>SP</td>
</tr>
<tr>
<td>CHEM 370L</td>
<td>Organic Chemistry Laboratory</td>
<td>1.0</td>
<td>SP</td>
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<tr>
<td>CHEM 451</td>
<td>Biochemistry</td>
<td>3.0</td>
<td>SP</td>
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<td>CHEM 455L</td>
<td>Biochemistry Laboratory</td>
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<td>SP</td>
</tr>
<tr>
<td>CHEM 320</td>
<td>Quantitative Analysis</td>
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<td>3.0</td>
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3 units selected from:

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<td>BIOL 399</td>
<td>Special Problems</td>
<td>1.0-3.0</td>
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<td>BIOL 211</td>
<td>General Microbiology</td>
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<tr>
<td>BIOL 244</td>
<td>Vertebrate Physiology</td>
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<td>BIOL 244P</td>
<td>Vertebrate Physiology</td>
<td>4.0</td>
</tr>
<tr>
<td>BIOL 242</td>
<td>Parasitology</td>
<td>4.0</td>
</tr>
<tr>
<td>BIOL 466</td>
<td>Immunology</td>
<td>4.0</td>
</tr>
<tr>
<td>CHEM 370</td>
<td>Organic Chemistry</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Biological Sciences

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Biology

CHEM 370L Organic Chem Laboratory 1.0 FS
Prerequisites: CHEM 370 may be taken as a prerequisite or concurrently with CHEM 370L
CHEM 451 Biochemistry 3.0 FS
Prerequisites: CHEM 370.
CHEM 455L Biochemistry Laboratory 2.0 FS
Prerequisites: CHEM 120, CHEM 451, CHEM 370L or CHEM 370M.

4 units selected from:
BIOL 399 Special Problems 1.0-3.0 FS
Or any 400-level biology (BIOL) course. Unlike the BS in Biological Sciences, BIOL 209 and BIOL 210 cannot be substituted for a 400-level course. Please see the Grading, Literacy, and Advising Requirements outlined under the BS in Biological Sciences above.

THE MINOR IN BIOLOGICAL SCIENCES

Course Requirements for the Minor: 21 units
The following courses, or their approved transfer equivalents, are required of all candidates for this minor.

2 courses required:
BIOL 151 Biological Principles 4.0 FS
Prerequisites: Recommend CHEM 111 or concurrent enrollment.
BIOL 152 Biological Principles 4.0 FS
Prerequisites: BIOL 151; recommend CHEM 112 or concurrent enrollment.

1 course selected from:
BIOL 209 General Botany 3.0 FS
Prerequisites: BIOL 152 or faculty permission.
BIOL 210 General Zoology 3.0 FS
Prerequisites: BIOL 152 or faculty permission.
BIOL 211 General Microbiology 4.0 FS
Prerequisites: A college course in biology and in general chemistry.

9-10 units selected from:
Any upper-division biology courses, with no more than 1 unit of BIOL 299 to bring the total for the minor to 21 units.

Written Notice
Departmental approval is required before you begin course work for this minor. Approval can be obtained by providing written notice of your intention to declare this minor to the department office.

PRE-PROFESSIONAL PROGRAMS

The following pre-professional programs are offered by the Department of Biological Sciences.

Pre-Dentistry
While dental schools do not require a degree in biology, over 90 percent of students accepted into dental schools have four years of undergraduate education or more, and over 65 percent have majors in some area of the biological sciences. It is usual for pre-dental students to complete a bachelor’s degree in biological sciences while broadly educating themselves in non-scientific subjects. Other scientific majors are also possible (see chemistry). The most important part of the pre-dentistry program is a solid general education. Dental schools select highly motivated students who have shown evidence of academic accomplishments in a rigorous academic program. During each semester your program of courses outside the sciences should reflect this commitment to becoming well-educated.

The courses listed here meet the minimum requirements of most dental schools. It is not realistic, however, to expect to be accepted into a dental school with just the minimum course requirements.

Lower-Division
BIOL 151 Biological Principles 4.0 FS
Prerequisites: Recommend CHEM 111 or concurrent enrollment.
BIOL 152 Biological Principles 4.0 FS
Prerequisites: BIOL 151; recommend CHEM 112 or concurrent enrollment.
BIOL 210 General Zoology 3.0 FS
Prerequisites: BIOL 152 or faculty permission.
CHEM 111 General Chemistry 4.0 FS
Prerequisites: BIOL 152 or faculty permission.
CHEM 270 Organic Chemistry 4.0 FS
Prerequisites: CHEM 111.

Upper-Division
BIOL 350 Intro to Biological Literature 1.0 FS WP
Prerequisites: ENGL 130 or its equivalent with a grade of C- or higher; junior standing; BIOL 152.
BIOL 360 Genetics 4.0 FS
Prerequisites: BIOL 152.
BIOL 400 Fundamentals of Ecology 4.0 FS
Prerequisites: BIOL 152 or faculty permission. Some taxonomic background is recommended.
**Prerequisites:** Completion of ELM requirement.

**CHEM 370** Organic Chemistry 3.0 FS
Prerequisites: CHEM 270.

**CHEM 370L** Organic Chem Laboratory 1.0 FS
Prerequisites: CHEM 370 may be taken as a prerequisite or concurrently with CHEM 370L.

**Additional courses recommended to complete the pre-medical requirement include:**

**BIOL 416** Vertebrate Physiology 4.0 FS
Prerequisites: BIOL 152; CHEM 108 or CHEM 270. Strongly recommended: BIOL 210.

**BIOL 426** Embryology 4.0 SP
Prerequisites: BIOL 152; BIOL 210 or faculty permission.

**BIOL 430** Comparative Anat: Vertebrates 4.0 FA
Prerequisites: BIOL 152, BIOL 210.

Plus additional 400-level courses selected according to interests. While acceptance rates into medical schools vary from year to year, CSU, Chico has a high rate of acceptance.

**Pre-Forestry and Pre-Physical Therapy**

The requirements of schools offering programs in Forestry and Physical Therapy vary widely. Pre-Forestry and Pre-Physical Therapy students should consult the Department of Biological Sciences for the names of the faculty advisors in their program of interest.

**Pre-Veterinary Medicine**

Admission to a veterinary college is highly competitive. Academic performance and non-academic factors, such as appropriate work experience, are a major part of the selection criteria. Pre-veterinary medicine students should consult with the pre-veterinary adviser each semester.

The following courses prepare the student to meet the minimum course requirements for admission to the School of Veterinary Medicine, University of California, Davis.

**Lower-Division**

**BIOL 151** Biological Principles 4.0 FS
Prerequisites: Recommend CHEM 111 or concurrent enrollment.

**BIOL 152** Biological Principles 4.0 FS
Prerequisites: BIOL 151; recommend CHEM 112 or concurrent enrollment.

**OR** (the following course may be substituted for the above)

**BIOL 210** General Zoology 3.0 FS
Prerequisites: BIOL 152 or faculty permission.

**CHEM 111** General Chemistry 4.0 FS *
Prerequisites: Second-year high school algebra; one year of high school chemistry.
(One year of high school physics and one year of high school mathematics past Algebra II are recommended.)

**CHEM 112** General Chemistry 4.0 FS
Prerequisites: CHEM 111.

**CHEM 270** Organic Chemistry 4.0 FS
Prerequisites: CHEM 112.

**CMST 131** Speech Comm Fundamentals 3.0 FS *
**CMST 132** Small Group Communication 3.0 FS *
**ENGL 130** Academic Writing 3.0 FS *
**MATH 105** Statistics 3.0 FS *
**OR** (the following course may be substituted for the above)

**MATH 105** Statistics 3.0 FS *
Prerequisites: Completion of ELM requirement.

**MATH 315** may be substituted for MATH 105.

**PHYS 202A** General Physics 4.0 FS *
Prerequisites: High school physics or faculty permission. High school trigonometry and second-year high school algebra or equivalent (MATH 051 and MATH 118 at CSU, Chico).

**Upper-Division**

**BIOL 360** Genetics 4.0 FS
Prerequisites: BIOL 152.

**BIOL 416** Vertebrate Physiology 4.0 FS
Prerequisites: BIOL 152, CHEM 108 or CHEM 270. Strongly recommended: BIOL 210.

**BIOL 426** Embryology 4.0 SP
Prerequisites: BIOL 152; BIOL 210 or faculty permission.

**CHEM 370** Organic Chemistry 3.0 FS
Prerequisites: CHEM 270.

**CHEM 451** Biochemistry 3.0 FS
Prerequisites: CHEM 370.

**MATH 315** Biometrics 3.0 FA
Prerequisites: Completion of ELM requirement.

**MATH 105** may be substituted for MATH 315. Elective courses in social sciences or humanities for a minimum of 8 units.
SPECIAL NOTE TO BS CANDIDATES:

Since the BS program in the biological sciences requires 15 units in chemistry, you may wish to consider a supplemental authorization which would allow teaching chemistry as well. We suggest that you confer with the Biological Sciences Department’s credential adviser to explore your options.

SUPPLEMENTARY AUTHORIZATION IN BIOLOGY

A supplementary authorization to teach biology can be added to any valid single subject teaching credential by taking 20 units of biology or 10 units of upper-division biology courses. Courses must include molecular and cell biology, biology of organisms, and evolution. At least one course must include a laboratory. Check with the Biological Sciences Department’s credential adviser for suggested courses.

THE MASTER OF SCIENCE IN BIOLOGICAL SCIENCES

Course Requirements for the Master’s Degree: 30 units

Continuous enrollment is required. A maximum of 9 semester units of transfer credit may be applied toward the degree.

Graduate Time Limit: All requirements for the degree are to be completed within five years of the end of the semester of enrollment in the oldest course applied toward the degree. See “Graduate Education” in The University Catalog for complete details on general degree requirements.

Prerequisites for Admission to Conditionally Classified Status:

1. Satisfactory grade point average as specified in “Admission to Master’s Degree Programs” in The University Catalog.
2. Approval by the department and the Office of Graduate Programs.
3. An acceptable baccalaureate in biological sciences from an accredited institution, or an equivalent approved by the Office of Graduate Studies.
4. Completion of the Graduate Record Examination with a minimum combined score of 1500 on the Aptitude Test.

Prerequisites for Admission to Classified Status:

In addition to any requirements listed above:

1. If based on undergraduate grade point average:
   (a) 2.75 cumulative grade point average or
   (b) 3.00 in the last 60 units or
   (c) 2.5 cumulative grade point average if a combined score of 2500 on the Graduate Record Examination Aptitude Test and Advanced Test in Biology is exceeded.

2. If admission is based on postbaccalaureate performance, a student may be eligible for admission to the graduate program if he/she has an undergraduate grade point average of at least 2.5 and completes 15 units of upper-division or graduate course work in biological sciences or a closely related science with a grade point average of 3.0 or better.

Advancement to Candidacy:

In addition to any requirements listed above:

1. Satisfactory completion of a written comprehensive qualifying examination in biological sciences following completion of BIOL 600, Research in the Biological Sciences.
2. Classified graduate standing and completion at the university of at least 9 units of the proposed program.
3. Formation of the graduate advisory committee in consultation with the Graduate Coordinator.
4. Development of an approved program in consultation with the graduate advisory committee.

Requirements for the MS in Biological Sciences:

Completion of all requirements as established by the departmental graduate committee, the Graduate Advisory Committee, and the Office of Graduate Studies, to include:

1. Completion of an approved program consisting of 30 units of 400/500/600-level courses as follows:
   (a) At least 18 units in the discipline of biological sciences, including at least one course of 3 or more units outside the sub-discipline (i.e., botany, zoology, microbiology);
   (b) BIOL 600, Research in the Biological Sciences, to be completed during the first fall semester.
   (c) At least one unit of graduate seminar (BIOL 605 or BIOL 605), completed during the first year.
   (d) At least 18 of the units required for the degree in 600-level courses.
   (e) Not more than 9 semester units of transfer and/or extension credit (correspondence courses and U.C. extension course work are not acceptable).
   (f) Not more than 15 units taken before admission to classified status.
   (g) Not more than 2 units of Independent Study (697) and 6 units of Master’s Thesis (699).
2. Completion and final approval of an independent research project resulting in an acceptable thesis as specified by the student’s Graduate Advisory Committee.
3. Presentation of a seminar based on the student’s master’s thesis research. This seminar will usually be given during the semester in which the student plans to complete the degree requirements.
4. Approval by the departmental graduate committee and the Graduate Coordinators Committee on behalf of the faculty of the university.

Graduate Literacy Requirement:

Writing proficiency is a graduation requirement.

Biological sciences majors will demonstrate their writing competence through satisfactory completion of a designated portion of the qualifying examination required as a prerequisite for admission to candidacy.

Graduate Grading Requirements:

All courses in the major (with the exceptions of Independent Study - 697, Master’s Project - 699P, and Master’s Thesis - 699T) must be taken for a letter grade, except those courses specified by the department as ABC/No Credit (400/500-level courses), AB/No Credit (600-level courses), or Credit/No Credit grading only. A maximum of 10 units combined of ABC/No Credit, AB/No Credit, and Credit/No Credit grades may be used on the approved program (including 697, 699P, 699T and courses outside the major). While grading standards are determined by individual programs and instructors, it is also the policy of the university that unsatisfactory grades may be given when work fails to reflect achievement of the high standards, including high writing standards, expected of students pursuing graduate study.

Students must maintain a minimum 3.0 grade point average in each of the following three categories: all course work taken at any accredited institution subsequent to admission to the master’s program; all course work taken at CSU, Chico subsequent to admission to the program; and all courses on the approved master’s degree program.

Graduate Advising Requirement:

Advising is mandatory each semester for biological sciences majors. Consult the Graduate Coordinator for specifics.
THE MASTER OF SCIENCE IN BOTANY

Course Requirements for the Master's Degree: 30 units
Continuous enrollment is required. A maximum of 9 semester units of transfer credit may be applied toward the degree.

Graduate Time Limit: All requirements for the degree are to be completed within five years of the end of the semester of enrollment in the oldest course applied toward the degree. See “Graduate Education” in The University Catalog for complete details on general degree requirements.

Prerequisites for Admission to Conditionally Classified Status:
1. Satisfactory grade point average as specified in “Admission to Master’s Degree Programs” in The University Catalog.
2. Approval by the department and the Office of Graduate Programs. Prerequisites are the same as for the Master’s degree in Biological Sciences.

Prerequisites for Admission to Classified Status:
In addition to any requirements listed above:
Prerequisites are the same as for the Master’s degree in Biological Sciences.

Advancement to Candidacy:
Prerequisites are the same as for the Master’s degree in Biological Sciences.

Requirements for the MS in Botany:
Requirements are the same as for the Master’s degree in Biological Sciences.

Graduate Literacy Requirement:
Writing proficiency is a graduation requirement. Botany majors will demonstrate their writing competence through satisfactory completion of a designated portion of the qualifying examination required as a prerequisite for advancement to candidacy.

Graduate Grading Requirements:
All courses in the major (with the exceptions of Independent Study - 697, Master's Project - 699P, and Master's Thesis - 699T) must be taken for a letter grade, except those courses specified by the department as ABC/No Credit (400/500-level courses), AB/No Credit (600-level courses), or Credit/No Credit grading only. A maximum of 10 units combined of ABC/No Credit, AB/No Credit, and Credit/No Credit grades may be used on the approved program (including 697, 699P, 699T and courses outside the major). While grading standards are determined by individual programs and instructors, it is also the policy of the university that unsatisfactory grades may be given when work fails to reflect achievement of the high standards, including high writing standards, expected of students pursuing graduate study.

Students must maintain a minimum 3.0 grade point average in each of the following three categories: all course work taken at any accredited institution subsequent to admission to the master’s program; all course work taken at CSU, Chico subsequent to admission to the program; and all courses on the approved master’s degree program.

Graduate Advising Requirement:
Advising is mandatory each semester for all botany majors. Consult the Graduate Coordinator for specifics.

The Faculty
Michael A. Abruzzo, 1973, Professor Emeritus, PhD, Mich St U.
Douglas G. Alexander, 1965, Professor Emeritus, PhD, U NC.
Raymond J. Barnett, 1976, Professor Emeritus, PhD, Duke U.
Jeffrey R. Bell, 1992, Professor, PhD, USC.
Kristopher A. Blee, 2001, Assist Professor, PhD, Utah St U.
Dwayne H. Curtis, 1963, Professor Emeritus, PhD, U Utah.
Jonathan R. Day, 2000, Assoc Professor, PhD, U Delaware.
Richard S. Jr. Demaree, 1972, Professor Emeritus, PhD, CO State U.
Wesley H. Dempsey, 1954, Professor Emeritus, PhD, UC Davis.
William F. Derr, 1964, Professor Emeritus, PhD, U WI.
Patricia L Edelmann, 1976, Chair, Professor, PhD, UC Davis.
Robert L. Ediger, 1967, Professor Emeritus, PhD, Kansas St.
Tag N. Engstrom, 2004, Assist Professor, PhD, UC Davis.
Michael J. Erpino, 1968, Professor Emeritus, PhD, U Wyoming.
Larry F. Hanne, 1983, Professor, PhD, U Texas.
James L. Houpt, 2001, Dean, Administrator, PhD, UC Berkeley.
Robbins S. King, 1956, Professor Emeritus, PhD, Stanford U.
David H. Kistner, 1959, Professor Emeritus, PhD, U Chicago.
Donald T. Kowalski, Professor Emeritus, PhD, U Michigan.
Roger J. Lederer, 1972, Professor Emeritus, PhD, U Illinois.
John R. Mahoney, 1997, Assoc Professor, PhD, U MN.
Michael P. Marchetti, 2000, Assist Professor, PhD, UC Davis.
Beverly A. Marcum, 1982, Professor, PhD, U Virginia.
Paul E. Maslin, 1970, Professor Emeritus, PhD, U Florida.
Ailsie B. McIntegart, 1969, Professor, PhD, U Texas.
Robert B. McNairn, 1967, Professor Emeritus, PhD, UC Davis.
Donald G. Miller III, 2002, Assist Professor, PhD, UC Berkeley.
James C. Pushnik, 1989, Professor, PhD, Utah St U.
Kristina A. Schierenbeck, 1998, Assoc Professor, PhD, WA State U.
Robert A. Schlisling, 1973, Professor Emeritus, PhD, UC Berkeley.
William L. Stephens, 1963, Professor Emeritus, PhD, UC Davis.
Kingdley R. Stern, 1959, Professor Emeritus, PhD, U MN.
Robert E. Thomas, 1966, Professor Emeritus, PhD, KS State U.
Alan R. Wilhelm, 1969, Professor Emeritus, PhD, U WI.
Gordon V. Wolfe, 2000, Assoc Professor, PhD, U of WA.
David M. Wood, 1990, Professor, PhD, U of WA.

Biological Sciences Course Offerings
Please see the section on “Course Description Symbols and Terms” in The University Catalog for an explanation of course description terminology and symbols, the course numbering system, and course credit units. All courses are lecture and discussion and employ letter grading unless otherwise stated. Some prerequisites may be waived with faculty permission. Many syllabi are available on the Chico Web.

Some 400/500/600-level courses are on an alternate-year schedule. Check with Department of Biological Sciences Office for schedule.

BIOL 101 Concepts of Biology
3.0 Fa/Spr
Study of the nature and interaction of living things on the planet. Includes cell organization; diversity and structure of plants and animals; DNA and genetics; ecology; and evolution. Primarily for students without a strong high school biology or chemistry background. 2.0 hours lecture, 2.0 hours activity. This is an approved General Education course. Formerly BIOL 001.

BIOL 103 Human Anatomy
4.0 Fa/Spr
Study of the structure of the human body, to include muscles, bones, heart, brain, ear, eye, and other systems, as well as a short look at development of the fetus. Lab work entails dissection of the cat and study of the human skeleton. 3.0 hours lecture, 2.0 hours activity. This is an approved General Education course. Special fee required; see The Class Schedule. Formerly BIOL 003. CAN BIOL110.

BIOL 104 Human Physiology
4.0 Fa/Spr
Basic functioning of the organ systems of the human body, including the brain and nervous system; vision and hearing; heart and circulation; blood and immunity; respiration, digestion and metabolism; muscles; excretory, endocrine, and reproductive systems. 3.0 hours lecture, 2.0 hours activity. This is an approved General Education course. Formerly BIOL 004. CAN BIOL12.

BIOL 105 Food, Fiber, and Drugs
3.0 Fa/Spr
Designed specifically for non-majors. Emphasis on broad biological principles, as illustrated by plants, and the economic importance and role of plants in human ecology. 2.0 hours lecture, 3.0 hours laboratory. Formerly BIOL 005.

BIOL 108 Principles of Biology
3.0 Fa/Spr
Prerequisites: High school biology and chemistry. Principles of Biology provides an understanding of the human ecosystem and the effects of human populations on ecosystems. Kerst Activity; the theories of evolution and heredity; modern genetic technology; the biology of cancer and AIDS; and human reproduction. Laboratory consists of scientific investigations designed by students. Designed primarily for students in the sciences and related fields. 2.0 hours lecture, 3.0 hours laboratory. This is an approved General Education course. Formerly BIOL 008.

BIOL 151 Biological Principles
4.0 Fa/Spr
Prerequisites: Recommend CHEM 111 or concurrent enrollment. Introduction to biological molecules, bioenergetics, cellular structure and function, elements of molecular biology and genetics, and mechanisms of macroevolution and systemsatics. 3.0 hours lecture, 3.0 hours laboratory. Special fee required; see The Class Schedule. Formerly BIOL 006A.
BIOL 302 Evolution 3.0 Spring
Sonar problems. This is an approved General Education course. Formerly BIOL 322 Science and Human Values 3.0 Spring
Making regarding children. This is an approved General Education course. 
Advancing of biological information in social, political, and ethical decision

Winism, neo-Darwinism, sociobiology, conflicts and misconceptions regarding evolution, creationism, and evolution of the human body and mind are considered. Formerly BIOL 102.

BIOL 303 Human Genetics 3.0 Fa/Spr
The inheritance, expression, and evolution of the genetic material in humans. Topics include genetic engineering, gene therapy, prenatal diagnosis, cancer, the human genome project, genetic influences on human behavior, such as homosexuality and mental illness, and the social and ethical consequences of the new technologies. This is an approved General Education course. Formerly BIOL 103.

BIOL 305 Museum Techniques 2.0 Inquire
Techniques of preparing biological specimens for study and display, with emphasis on vertebrate specimens. Museum and taxidermy mounts, wet and dry skeletons, and other preservation and display techniques will be covered. Practical work will be stressed. 1.0 hour lecture, 3.0 hours laboratory. Formerly BIOL 107.

BIOL 307 Microbes and Disease 3.0 Spring
Prerequisites: BIOL 101 or BIOL 108. Not open for credit to students majoring in microbiology or who have taken, or are taking, BIOL 211. Overview of infectious diseases, immunological diseases, vaccines, and modern approaches to disease control. Formerly BIOL 107.

BIOL 315 Human Biology 3.0 Spring
Prerequisites: One biological sciences course, preferably introductory biology. A study of human beings from a biological perspective, including their evolution, physiology, behavior, and ecology. Formerly BIOL 115.

BIOL 318 Biology of Childhood 3.0 Fa/Spr
Prerequisites: One biological sciences course. Basic biological principles, including the scientific method, reproduction, development, physiology, and anatomy. The biological basis of childhood diseases, immunity, nutrition, issues of health and well-being, and the relevance of biological information in social, political, and ethical decision making regarding children. This is an approved General Education course. Formerly BIOL 118.

BIOL 322 Science and Human Values 3.0 Spring
Prerequisites: BIOL 101 or BIOL 108. Critically examines scientific and humanistic world views and sensibilities, directly applying these approaches to contemporary social and personal problems. This is an approved General Education course. Formerly BIOL 116. This course is also offered as PHIL 322.

BIOL 322H Science and Human Values — Honors 3.0 Fall
Prerequisites: Acceptance into the Honors Program, faculty permission. Critically examines scientific and humanistic world views and sensibilities, directly applying these approaches to contemporary social and personal problems. This is an approved General Education course. Formerly BIOL 116H. This course is also offered as PHIL 322H.

BIOL 334 Conservation Ecology 3.0 Fa/Spr
Prerequisites: BIOL 101 or equivalent. An examination of ecological principles and the impact of increasing population and technology upon the environment. This is an approved General Education course. Formerly BIOL 134.

BIOL 341 Agricultural Entomology and Insect Control 3.0 Spring
Prerequisites: BIOL 101 or BIOL 108. Resistant taxonomy, morphology, and life histories of agriculturally important insects. Control measures, including biological, cultural, and chemical, 2.0 hours discussion, 3.0 hours laboratory. Formerly BIOL 141.

BIOL 342 Field Biology 3.0 Fa/Spr
Prerequisites: BIOL 101 or BIOL 108. Plant and animal morphology, classification, and ecological relationships examined through field and laboratory study. 2.0 hours discussion, 3.0 hours laboratory. Special fee required; see The Class Schedule. Formerly BIOL 142.

BIOL 343 Biology of Cancer 3.0 Fa/Spr
Prerequisites: BIOL 101 or BIOL 108. An introduction to cancer; what it is, what causes it, and how it is diagnosed and treated. This is an approved General Education course. Formerly BIOL 195.

BIOL 351 Introduction to Biological Literature 1.0 Fa/Spr
Prerequisites: ENGL 130 (or its equivalent) with a grade of C- or higher; junior standing; BIOL 152. Majors are expected to take this course prior to or concurrent with enrollment in any 200-level biology course. Principles of library research, scientific writing, and scientific data recording. This is a writing proficiency course. VP, course; a grade of C- or better certifies writing proficiency for majors. Formerly BIOL 201.

BIOL 360 Genetics 4.0 Fa/Spr
Prerequisites: BIOL 152. A detailed study of the principles of classical, molecular, and population/evolutionary genetics. Activities will include computer simulations of segregation, linkage, and population genetics, internet-based database searches for genetic diseases and cloned genes, and searches of the current genetic literature. 3.0 hours lecture, 1.0 hour discussion. Formerly BIOL 207.

BIOL 380 Computer Applications in Biology 3.0 Spring
Prerequisites: BIOL 152 and a computer science course providing skills in programming. Recommended: MATH 120 or a statistics course. Models of biological processes and systems will be introduced to use the potentials for computing in biological research. 2.0 hours seminar, 3.0 hours laboratory. Formerly BIOL 152.

BIOL 389 Clinical Laboratory Observation 1.0 Fa/Spr
Prerequisites: Microbiology/Clinical Laboratory Science majors with no previous clinical laboratory experience and who have completed BIOL 470 or CHIM 252; faculty permission. Students observe in a clinical hospital laboratory and in a private clinical laboratory. You may take this course more than once for a maximum of 15.0 units. Credit/no credit grading only. Formerly BIOL 189.

BIOL 398 Special Topics 1.0-3.0 Fa/Spr
This course is for special topics offered for 1.0-3.0 units. Typically the topic is offered on a one-time-only basis and may vary from term to term and be different for different sections. See The Class Schedule for the specific topic being offered. Formerly BIOL 198.

BIOL 399 Special Problems 1.0-3.0 Fa/Spr
This course is an independent study of special problems offered for 1.0-3.0 units. You must register directly with a supervising faculty member. Research in biology under direct supervision of faculty member. For majors only. This course counts toward the upper-division biology units required for the BS. You may take this course more than once for a maximum of 6.0 units. Credit/no credit grading only. Formerly BIOL 199.

BIOL 400 Fundamentals of Ecology 4.0 Fa/Spr
Prerequisites: BIOL 152 or faculty permission. Some taxonomic background is recommended. Interrelationships among living organisms, field observations of such phenomena. Application of quantitative and qualitative methods to the interpretation of ecological phenomena. 2.0 hours discussion, 6.0 hours laboratory. Special fee required; see The Class Schedule. Formerly BIOL 258.
BIOL 402 Microbial Ecology 4.0 Spring
Prerequisites: BIOL 152. Recommended: BIOL 211. The roles and interactions of viruses, bacteria, algae, protozoa, and fungi in the natural and human environment, stressing fundamental principles of ecology and evolution. 3.0 hours lecture, 3.0 hours laboratory. Special fee required; see The Class Schedule. Formerly BIOL 273.

BIOL 404 Comparative Anatomy of the Vertebrates 4.0 Fall
Prerequisites: BIOL 152, CHEM 112. Physical, chemical, and biological factors influencing the ecology of inland waters. 3.0 hours lecture, 3.0 hours laboratory. Special fee required; see The Class Schedule. Formerly BIOL 259.

BIOL 408 Principles of Evolution 3.0 Fall
Prerequisites: BIOL 152. A detailed study of the evolutionary process, including history, natural selection, population genetics, molecular evolution, speciation, coevolution, and macroevolution. Formerly BIOL 251.

BIOL 410 Cell and Molecular Biology 4.0 Fall
Prerequisites: BIOL 152. Introductory analysis of the structure and related functions of cells with an emphasis on the molecular mechanisms involved in membrane function, signal transduction, intracellular compartments and transport, cell division, and apoptosis. 3.0 hours discussion, 3.0 hours laboratory. Formerly BIOL 202.

BIOL 412 Bacterial Physiology 4.0 Spring
Prerequisites: BIOL 211, BIOL 360, CHEM 270. CHEM 451 is recommended. Study of bacterial structure and function, modes of metabolism, regulatory responses to environmental change and stress, and microbial aspects of nutrition and growth. 3.0 hours discussion, 3.0 hours laboratory. Formerly BIOL 272.

BIOL 414 Plant Physiology 4.0 Fa/Spr
Prerequisites: BIOL 108 or BIOL 152, BIOL 209, CHEM 108 or CHEM 270, or faculty permission. Functions in higher plants; water and soil relations, photosynthesis, respiration, enzyme action, and growth. 3.0 hours discussion, 3.0 hours laboratory. Formerly BIOL 213.

BIOL 416 Vertebrate Physiology 4.0 Fa/Spr
Prerequisites: BIOL 152, CHEM 108 or CHEM 270. Strongly recommended: BIOL 210. General features of vertebrate physiology. Function of muscular, nervous, respiratory, circulatory, excretory, and endocrine systems. 2.0 hours discussion, 6.0 hours laboratory. Formerly BIOL 214.

BIOL 417 Cell Physiology 3.0 Spring
Prerequisites: BIOL 152, CHEM 108 or CHEM 270. Detailed study of cellular function, with emphasis on regulation of cellular processes, modern experimental techniques, and a chemical approach to the cell in general. 2.0 hours discussion, 3.0 hours laboratory. Formerly BIOL 206.

BIOL 418 Neurophysiology 4.0 Spring
Prerequisites: BIOL 152, BIOL 210, CHEM 108 or CHEM 270. This course provides students with background and fundamental information necessary to pursue neuroscience at the graduate or professional level. Cellular and molecular mechanisms within mammalian central nervous system are emphasized. 3.0 hours lecture, 3.0 hours laboratory. Special fee required; see The Class Schedule. Formerly BIOL 269.

BIOL 420 Invertebrate Zoology 4.0 EvenSp
Prerequisites: BIOL 152, BIOL 210. A survey of the basic biology of the principal invertebrate phyla. Emphasis placed both on morphology and contribution of each group to biological principles, 2.0 hours discussion, 6.0 hours laboratory. Formerly BIOL 250.

BIOL 422 General Entomology 4.0 Spring
Prerequisites: BIOL 152 or faculty permission. Recommended: BIOL 210. The morphology, ecology, and physiology of insects. Economic entomology and medical entomology, and taxonomy. 2.0 hours discussion, 6.0 hours laboratory. Special fee required; see The Class Schedule. Formerly BIOL 221.

BIOL 424 Parasitology 4.0 OddSp
Prerequisites: BIOL 152 or equivalent. Strongly recommended: BIOL 210. Biology of human and animal parasites, with emphasis on life cycles and control strategies. 3.0 hours discussion, 3.0 hours laboratory. Formerly BIOL 212.

BIOL 426 Embryology 4.0 Spring
Prerequisites: BIOL 152, BIOL 210 or faculty permission. Principles and theories of animal development, emphasizing the vertebrate. 3.0 hours discussion, 3.0 hours laboratory. Formerly BIOL 220.

BIOL 428 Animal Behavior 3.0 OddFa
Prerequisites: BIOL 152, BIOL 210. Consideration of the basic problems in animal behavior, including orientation, social behavior, and the nature and organization of animal societies. 2.0 hours discussion, 3.0 hours laboratory. Formerly BIOL 256.

BIOL 430 Comparative Anatomy of the Vertebrates 4.0 Fall
Prerequisites: BIOL 152, BIOL 210. Explanation of the anatomical similarities and differences of selected vertebrates. The evolution and adaptive significance of various systems are considered. 2.0 hours discussion, 6.0 hours laboratory. Formerly BIOL 205.

BIOL 432 Ichthyology 4.0 EvenSp
Prerequisites: BIOL 152, BIOL 210. Morphology, ecology, behavior, and systematics of California fishes, with an introduction to fisheries biology. 2.0 hours discussion, 6.0 hours laboratory. Special fee required; see The Class Schedule. Formerly BIOL 261.

BIOL 433 Herpetology 4.0 OddSp
Prerequisites: BIOL 210. The morphology, evolution, physiology, behavior, ecology, and taxonomy of amphibians and reptiles. California amphibians and reptiles are emphasized, including field studies of local species. 3.0 hours lecture, 3.0 hours laboratory. Special fee required; see The Class Schedule. Formerly BIOL 264.

BIOL 434 Ornithology 4.0 EvenSp
Prerequisites: BIOL 152, BIOL 210. The morphology, evolution, ecology, physiology, taxonomy, and behavior of birds, including field studies of local species. 2.0 hours discussion, 6.0 hours laboratory. Special fee required; see The Class Schedule. Formerly BIOL 265.

BIOL 435 Mammalogy 3.0 Fall
Prerequisites: BIOL 152. Study of evolution, anatomy, physiology, ecology, and behavior of mammals. California mammals will be emphasized in lab. 2.0 hours discussion, 3.0 hours laboratory. Formerly BIOL 266.

BIOL 440 Plant Anatomy and Development 4.0 Spring
Prerequisites: BIOL 152. Plant anatomical study with inclusion of modern genetic methods of analysis for a molecular understanding of plant development. Developmental concepts include biochemical signal, genetic control of cell division, cell differentiation and cell death in relationship to formation of the plant body and life cycle completion. 3.0 hours lecture, 3.0 hours laboratory. Formerly BIOL 223.

BIOL 442 Plant Morphology 4.0 Fall
Prerequisites: BIOL 152. Comparative morphology of plant and fungal types, emphasizing evolution of structures and methods of reproduction. 3.0 hours discussion, 3.0 hours laboratory. Formerly BIOL 225.

BIOL 446 Plant Pathology 4.0 Fall
Prerequisites: BIOL 152. Study of plant pathology encompassing parasitism and disease in plants, pathogen attack strategies, diseases plant physiology, plant defense mechanisms, environmental effects on disease and descriptions of diseases and treatments. 3.0 hours lecture, 3.0 hours laboratory. Formerly BIOL 228.

BIOL 448 Plant Systematics 4.0 Spring
Prerequisites: BIOL 152 and BIOL 209, or faculty permission. Principles of plant classification with field study of local flora, emphasizing the higher plants and their phylogenetic relationships. 2.0 hours discussion, 6.0 hours laboratory. Special fee required; see The Class Schedule. Formerly BIOL 240.

BIOL 450 Plant Geography 2.0 Fall
Prerequisites: BIOL 152, BIOL 269. Recommended: BIOL 448. Discussion of the major plant communities with interpretation of environmental, migrational, and evolutionary processes affecting their distribution. Formerly BIOL 235.

BIOL 450L Plant Geography Laboratory 1.0 EvnFa
Prerequisites: Concurrent enrollment in or prior completion of BIOL 450. Field trips to local plant communities and laboratory work emphasizing range patterns of California plants. 3.0 hours laboratory. Formerly BIOL 255L.

BIOL 452 Phycology 4.0 Spring
Prerequisites: BIOL 152. Study of the roles and interactions of viruses, bacteria, algae, protozoa, and fungi in the natural and human environment. 3.0 hours lecture, 3.0 hours laboratory. Formerly BIOL 250.

BIOL 454 Mycology 4.0 Inquire
Prerequisites: BIOL 152, BIOL 209. A survey of the fungi, with emphasis upon structure and development, classification, and economic importance. 2.0 hours discussion, 6.0 hours laboratory. Formerly BIOL 227.
BIOL 456 Field Botany 2.0 Summer
Prerequisites: BIOL 152, BIOL 209.
An examination of the ecological factors of plant distribution; taxonomy of the plants of biotic communities of northeastern California. Offered only at Eagle Lake Biological Field Station. 1.0 hour discussion, 3.0 hours laboratory. Formerly BIOL 262.

BIOL 460 Histology 4.0 OddSp
Prerequisites: BIOL 152, BIOL 210.
Microscopic analysis of tissues, organs, and organ systems of vertebrates emphasizing mammalian histophysiology. 3.0 hours discussion, 3.0 hours laboratory. Formerly BIOL 203.

BIOL 462 Hematology 3.0 OddSp
Prerequisites: BIOL 152. Recommended: BIOL 424 and CHEM 270.
The study of blood in normal and abnormal conditions. 2.0 hours discussion, 3.0 hours laboratory. Formerly BIOL 208.

BIOL 464 Medical Genetics 3.0 Spring
Prerequisites: BIOL 152.
Lectures on genetic diseases in humans, emphasizing the biochemical and molecular advances in diagnosis, treatment, gene therapy, and prevention. A significant portion of the course will deal with the molecular biology of cancer and the Human Genome Project. Formerly BIOL 217.

BIOL 466 Immunology 4.0 Spring
Prerequisites: BIOL 152.
The development and expression of the immune response; the basic principles of antigen-antibody reactions and their relevance to medicine; genetics, taxonomy, and evolution. 3.0 hours discussion, 3.0 hours laboratory. Formerly BIOL 270.

BIOL 470 Medical Microbiology 5.0 Fall
Prerequisites: BIOL 217; BIOL 466; CHEM 270. Immunization against tetanus and diphtheria required.
Biological characteristics of medically important bacteria. Mechanisms of pathogenesis and host-resistance. Laboratory procedures for isolation and identification. 3.0 hours discussion, 6.0 hours laboratory. Special fee required; see The Class Schedule. Formerly BIOL 216.

BIOL 472 Microbial Genetics 4.0 Fall
Prerequisites: BIOL 360. BIOL 211 is recommended.
The molecular basis of mutation and recombination, mechanisms of gene transfer, transcription in bacteria and bacteriophages, genetics and biochemistry of regulation of bacterial operons, and bacteriophage development, and recombinant DNA application to genetic engineering. 3.0 hours discussion, 3.0 hours laboratory. Formerly BIOL 273.

BIOL 474 Food and Industrial Microbiology 3.0 Spring
Prerequisites: BIOL 211, CHEM 270.
Study of micro-organisms of industrial importance, emphasizing nutrition, metabolism, cultivation, and processing. Formerly BIOL 219.

BIOL 476 General Virology 4.0 EvnFa
Prerequisites: BIOL 152. Recommended: BIOL 211.
The physical, chemical, and biological properties of bacteria and animal viruses, and their interactions with the host at cellular and organismic levels. 3.0 hours discussion, 3.0 hours laboratory. Special fee required; see The Class Schedule. Formerly BIOL 216.

BIOL 477 Zoological Field Ecology 3.0 Summer
Prerequisites: BIOL 152 and BIOL 153 or equivalent.
This comprehensive field course introduces students to zoological field ecology, vertebrate osteology, fragmentary bone identification, as well as vertebrate ecology and natural history through a spectrum of lectures, laboratory exercises and field activities. This course is offered at the Eagle Lake Biological Field Station. 1.0 hour lecture, 6.0 hours laboratory. Formerly BIOL 279. This course is also offered as ANTH 477.

BIOL 480 Developmental Biology 3.0 EvnFa
Prerequisites: BIOL 152.
Includes concepts of macro-molecular assembly, biochemical signals, genetic controls, and morphological processes involved during development of organisms. The experimentally oriented laboratory exercises cover cell differentiation in fungi, plants, and animals, cell movement and communication mechanisms, teratogenic effects on limb development, regeneration, and metamorphosis. 2.0 hours discussion, 3.0 hours laboratory. Formerly BIOL 230.

BIOL 484 Field Ecology 3.0 Inquire
Prerequisites: BIOL 152.
Principles of ecology illustrated in the context of biotic communities of northern California. Field studies using quantitative and qualitative approaches. Laboratory segment offered at Eagle Lake Biological Field Station. 1.0 hour discussion, 6.0 hours laboratory. Formerly BIOL 254.

BIOL 485 Electron Microscopy 2.0 Spring
Prerequisites: PHYS 202A, PHYS 202B.
Introduction to electron optics and electron microscope construction. Electron microscope operation by demonstration only. Formerly BIOL 295.

BIOL 489 Internship 1.0-3.0 Fa/Spr
Prerequisites: Necessary background for the specific internship. This internship course is offered for 1.0-3.0 units. You must register with a supervising faculty member. The internship program is designed to provide students with direct field or laboratory research experience in occupational settings. You may take this course more than once for a maximum of 15.0 units. Credit/no credit grading only. Formerly BIOL 289.

BIOL 492 Seminars in Biological Science 1.0 Fa/Spr
Prerequisites: Junior or senior standing or faculty permission.
Analysis of seminars on various topics in the biological sciences. You may take this course more than once for a maximum of 6.0 units. Credit/no credit grading only. Formerly BIOL 292.

BIOL 494 Senior Seminar in Biology 1.0 Fa/Spr
Prerequisites: Senior standing. Presentation and discussion of scientific reports based on current literature. Credit/no credit grading only. Formerly BIOL 291.

BIOL 496 Field Studies in Natural History 1.0-3.0 Inquire
Prerequisites: BIOL 152.
This course is a field study offered for 1.0-3.0 units. You must register directly with a supervising faculty member. Concentrated field study of habitats or organisms in the field. Forty-five hours of field work for each unit of credit. You may take this course more than once for a maximum of 3.0 units. Formerly BIOL 296.

BIOL 498 Special Topics 1.0-4.0 Fa/Spr
Prerequisites: BIOL 152.
This course is special topics offered for 1.0-4.0 units. Typically the topic is offered on a one-time-only basis and may vary from term-to-term and be different for different sections. See The Class Schedule for the specific topic being offered. Formerly BIOL 298.

BIOL 499H Honors Research in Biological Sciences 6.0 Inquire
Prerequisites: Faculty permission.
An intensive 6-unit, one-year course in biological research. See department office for details. (Open only to students with at least a 3.0 GPA in the major.) The course will consist of participation in a team research effort. 18.0 hours laboratory. Formerly BIOL 299H.

BIOL 510 Advanced Cellular/Molecular Biology 3.0 EvnFa
Prerequisites: BIOL 210, CHEM 451.
Theory and strategies used in procaryotic and eucaryotic molecular biology. DNA manipulations, cloning systems, immunological assays, and protein purification and analytical techniques. 2.0 hours seminar, 3.0 hours laboratory. Formerly BIOL 331.

BIOL 512 Advanced Physiology/Cell Biology 3.0 OddFa
Prerequisites: BIOL 410, BIOL 417; BIOL 426.
Examination of the underlying molecular and bio-chemical mechanisms which allow physiological adaptations, establishment of pattern formation and differentiation of eucaryotic organisms. 2.0 hours seminar, 3.0 hours laboratory. Formerly BIOL 332.

BIOL 514 Population Ecology 4.0 EvnFa
Prerequisites: BIOL 400.
Study and lecture/discussion of population ecology, with an emphasis on field methods used on local populations. 2.0 hours seminar, 6.0 hours laboratory. Special fee required; see The Class Schedule. Formerly BIOL 357.

BIOL 518 Community and Ecosystem Ecology 3.0 OddSp
Prerequisites: BIOL 400 and a course in energy flow and ecological interactions. Laboratory and field studies of the structure and function of communities and ecosystems. Examination of patterns of competition, predation, energy and nutrient flow and succession. 2.0 hours seminar, 3.0 hours laboratory. Formerly BIOL 358.

BIOL 540 Experimental Parasitology 3.0 Inquire
Prerequisites: BIOL 210, graduate standing.
Microscopic analysis of parasites in the natural environment. Laboratory and field studies of parasitic infections. Directed original investigations and experimentation on the parasites of humans, domestic animals, and natural infections of animals in the wild. 1.0 hour seminar, 6.0 hours laboratory. Formerly BIOL 212.

BIOL 543 Social Insects 3.0 OddFa
Prerequisites: BIOL 222.
An advanced course for studying the problems of phylogeny, behavior, social organization, ecology, and zoogeography of social insects. 2.0 hours seminar, 3.0 hours laboratory. Formerly BIOL 263.

BIOL 569 Topics in Limnology 4.0 OddSp
Prerequisites: BIOL 295.
Study of the functional dynamics of aquatic ecosystems. 2.0 hours seminar, 6.0 hours laboratory. Formerly BIOL 359.
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<tr>
<td>BIOL 570</td>
<td>Developmental Plant Biology</td>
<td>4.0</td>
<td>EvnFa</td>
<td>Prerequisites: BIOL 414 or BIOL 440 or BIOL 442. A consideration of the</td>
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<td>processes involved in plant growth and the development of form, with</td>
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<td>emphasis on higher plants and recent experimental approaches.</td>
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<td>2.0 hours seminar, 6.0 hours laboratory. Formerly BIOL 330.</td>
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<tr>
<td>BIOL 571</td>
<td>Plant Systematics</td>
<td>4.0</td>
<td>OddSp</td>
<td>Prerequisites: BIOL 448. Advanced principles of plant classification,</td>
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<td>with emphasis on the grasses, sedges, and composites.</td>
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<td>3.0 hours seminar, 3.0 hours laboratory. Formerly BIOL 340.</td>
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<tr>
<td>BIOL 572</td>
<td>Plant Ecology</td>
<td>4.0</td>
<td>EvenSp</td>
<td>Prerequisites: BIOL 446, BIOL 400, graduate standing. Autecology,</td>
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<td>emphasizing California vascular plants, with focus on current topics</td>
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<td>in behavioral and reproductive ecology. Field project work and</td>
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<td>detailed literature survey. 2.0 hours seminar, 6.0 hours laboratory.</td>
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<td>Formerly BIOL 352.</td>
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<tr>
<td>BIOL 575</td>
<td>Ecological Plant Physiology</td>
<td>4.0</td>
<td>Spring</td>
<td>Prerequisites: BIOL 414. This course focuses on the way different plant</td>
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<td>species and functional types react in various locations and in all</td>
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<td>climatic zones. Emphasis is placed on mechanisms underlying plant</td>
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<td>physiological ecology at the levels of biochemistry, biophysics,</td>
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<td>molecular biology, and whole-plant physiology. 3.0 hours lecture,</td>
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<td>3.0 hours laboratory. Formerly BIOL 315.</td>
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<tr>
<td>BIOL 585</td>
<td>Electron Microscope Operation Laboratory</td>
<td>2.0</td>
<td>Spring</td>
<td>Prerequisites: May be taken concurrently with BIOL 486 and</td>
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<td>Introduction to the use of scanning and transmission electron microscopes,</td>
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<td>including daily operation, alignment, and routine maintenance. 6.0 hours</td>
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<td>laboratory. Special fee required; see The Class Schedule. Formerly BIOL</td>
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<tr>
<td>BIOL 586</td>
<td>Biological Preparations for Electron Microscopy</td>
<td>4.0</td>
<td>Inquire</td>
<td>Prerequisites: BIOL 410 or faculty permission. Preparation of biological</td>
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<td>specimens for scanning and transmission electron microscopes, using</td>
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<td>chemical and physical procedures. Emphasis is on preservation,</td>
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<td>localization, and identification of biological molecules. 2.0 hours</td>
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<td></td>
<td>seminar, 6.0 hours laboratory. Special fee required; see The Class</td>
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<td>Schedule. Formerly BIOL 396.</td>
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<tr>
<td>BIOL 600</td>
<td>Research in Biological Sciences</td>
<td>3.0</td>
<td>Fall</td>
<td>Prerequisites: BIOL 410 or faculty permission. Orientation to literature</td>
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<td>review and thesis research. Strategies and techniques used in molecular,</td>
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<td>cellular, organismic, and ecological research. Required of all biology/</td>
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<td>botany graduate students during their first fall semester and will</td>
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<td>include sign-up for the Graduate Qualifying Examination to be given</td>
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<td>the next semester. Formerly BIOL 300.</td>
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<tr>
<td>BIOL 605</td>
<td>Biological Seminar</td>
<td>1.0</td>
<td>Spring</td>
<td>Prerequisites: BIOL 414. Presentation and discussion of reports on current</td>
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<td>biological literature and special studies by graduate students. Formerly</td>
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<td>BIOL 305A.</td>
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<tr>
<td>BIOL 610</td>
<td>Topics in Cell/Molecular Biology</td>
<td>1.0-3.0</td>
<td>Fa/Spr</td>
<td>Prerequisites: BIOL 510. This course is a special topic offered for</td>
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<td>1.0-3.0 units. You must register directly with a supervising faculty</td>
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<td>member. Detailed discussion of selected topics in molecular and cellular</td>
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<td>biology. Extensive survey of current literature and analysis of research</td>
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<td>strategies. Topics will be selected and advertised by instructor. Past</td>
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<td>topics have included molecular actions between plants and microbes,</td>
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<td>pathogenesis of disease; oncogenes and signal transduction. You may take</td>
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<td>this course more than once for a maximum of 3.0 units. Formerly BIOL 333.</td>
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<td>BIOL 612</td>
<td>Topics in Physiological/Developmental Biology</td>
<td>1.0-3.0</td>
<td>Fa/Spr</td>
<td>Prerequisites: BIOL 512. This course is a special topic offered for</td>
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<td>1.0-3.0 units. You must register directly with a supervising faculty</td>
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<td>member. Detailed investigation of selected special topics in physiology,</td>
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<td>developmental biology. Topic will be selected and advertised by the</td>
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<td>instructor. You may take this course more than once for a maximum of</td>
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<td>4.0 units. Formerly BIOL 341.</td>
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<td>BIOL 614</td>
<td>Topics in Ecology and Systematics</td>
<td>1.0-3.0</td>
<td>OddSp</td>
<td>Prerequisites: BIOL 400. This course is a special topic offered for</td>
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<td>1.0-3.0 units. You must register directly with a supervising faculty</td>
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<td>member. Detailed investigation of selected special topics in ecology,</td>
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<td>systematics, or evolutionary biology. Extensive survey of current</td>
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<td>literature. Topics will be selected and advertised by the instructor.</td>
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<td>You may take this course more than once for a maximum of 4.0 units.</td>
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<td>Formerly BIOL 341.</td>
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<tr>
<td>BIOL 617</td>
<td>Independent Study</td>
<td>1.0-4.0</td>
<td>Fa/Spr</td>
<td>Prerequisites: BIOL 410 or faculty permission. Survey and careful study</td>
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<td>of literature, experimentation, observation, and collection of data in</td>
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<td>field and laboratory. You may take this course more than once for a</td>
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<td>maximum of 4.0 units. Formerly BIOL 398.</td>
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<tr>
<td>BIOL 699T</td>
<td>Master's Thesis</td>
<td>1.0-6.0</td>
<td>Fa/Spr</td>
<td>Prerequisites: BIOL 410 or faculty permission. This course is a master's</td>
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<td>study offered for 1.0-6.0 units. You must register directly with a</td>
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<td>supervising faculty member. You may take this course more than once for</td>
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<td>a maximum of 6.0 units. Formerly BIOL 399T.</td>
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