

Biological Sciences

The Biological Sciences curriculum provides the foundation for our majors: Biological Sciences, Bio-Medical Sciences and Natural History. Our two-year Associate in Arts Degrees are designed to provide the knowledge and skills for success before and after transfer to a four-year institution. Students who complete specialized one-year programs of study in Bio-Medical Sciences, Marine Science and Natural History can earn Biological Sciences Departmental Awards.

Our Biological Sciences Associate in Arts Degree provides preparation for transfer in such areas as Biochemistry, Molecular Biology, Pharmacology, Cell Biology, Ecology, Marine Biology, Botany, Zoology, Medical Technology and Pre-Medicine.

The Bio-Medical Sciences Emphasis: Associate in Arts Degree in Liberal Arts provides a strong foundation for students interested in pursuing a career in the health sciences.

The Natural History Associate in Arts Degree provides preparation for transfer in such areas as Natural History, Freshwater and Marine Fisheries and Wildlife Management. The Natural History A.A. can be completed fully online.

We offer specialized and general courses for all students, and support courses for medical technology and health services; recreation and nature interpretation; environmental studies; marine diving technology; and sports medicine. Many courses of a more general nature allow students to fulfill General Education and graduation requirements in Natural Sciences, while developing a biological perspective.

Our courses utilize advanced technology to deliver information to students, while retaining the tradition of personalized instruction and small class sizes. Computers at every lab bench, a 30-station computer classroom and a seamless network with wireless access facilitates student learning through the use of computer tools and information from any Biological Sciences classroom, laboratory and tutor room.

Online instruction carries this concept off campus to our students in Santa Barbara and worldwide, through more than 12 fully online classes, as well as many hybrid courses where the lecture is online and the lab is on campus. The excitement of beginning a path to a meaningful profession in biology is enhanced by a completely integrated system for acquiring information from instructors who love biology and teaching.

Advances in biological knowledge are providing solutions to the most challenging problems in medicine, environmental resources, agriculture and

human ecology. Employment opportunities continue to increase as knowledge grows in genetic engineering, embryonic development, learning and memory, aging, environmental studies, natural resource management and the regulation of populations.

Department Student Learning Outcomes

1. Articulate the principles of evolutionary theory, the history of its development, and the role that evolution plays in the continuity and diversity of life.
2. Communicate the unifying principles governing the organization of organisms, from molecules to populations.
3. Explain and apply fundamental ecological principles, from populations to communities through ecosystems, and the geographical distribution of life on Earth.
4. Summarize and illustrate an understanding of the development of the organism, from fertilization to the adult form.
5. Compare and contrast organismal diversity and life histories, including nomenclature, taxonomy and systematics.
6. Characterize fundamental metabolic pathways, describe bioenergetics, and relate the interdependence of these pathways.
7. Demonstrate understanding of the structure and function of tissues, organs and organ systems, describing interrelationships and mechanisms of their integration to support the whole, functioning organism and the underlying causes of dysfunction.
8. Describe and connect the role of DNA in regulating cell activity to its importance as the basis of inheritance, evolution and biotechnology.
9. Demonstrate proficiency in the basic methods, instrumentation and quantitative analytical skills used to conduct biological research, including fundamental methods of microscopy, animal and plant dissection, and molecular and cellular biology.
10. Produce original research reports and review papers in a standard scientific format based on laboratory, field experiments and literature searches that include critical quantitative and qualitative evaluation of data to effectively communicate results, interpretations and concepts.

Department Offices

Eric Wise, *Chair* (EBS-322, ext. 2517)
Susan Williams, *Division Aide* (EBS-213, ext. 2393)
Blakely Barron and Eric Wise,
Faculty Advisers, Biological Sciences
Larry Jon Friesen, *Faculty Adviser, Natural History*
Heather J. Rose, *Faculty Adviser, Bio-Medical Sciences*
Adam Green, *Faculty Adviser, Environmental Studies*
Chelsea O'Connell, *Teachers' Aide* (EBS-212, ext. 2311)
Cecilia Contreras, *Senior Lab Tech.* (EBS-218, ext. 2838)
Brett Leigh Dicks, *Senior Lab Tech.* (EBS-333, ext. 2319)
Samuel Hammond, *Senior Lab Tech.*
(EBS-218, ext. 2327)
Joe Rivas, *Instructional Computer Lab Coordinator*
(EBS-216, ext. 3499)
TBD, *Dean*

Faculty and Offices

Peter Aguilar (EBS-308, ext. 2515)
Blakely R. Barron (EBS-322, ext. 2444)
James P. Doohan (EBS-314, ext. 2330)
Robert H. Fischer (EBS-308, ext. 8780)
Larry Jon Friesen (EBS-324, ext. 2318)
Adam Green (EBS-323, ext. 2394)
Matthew C. Kay (EBS-307, ext. 5172)
Jennifer L. Maupin (EBS-321 ext. 2396)
Michelle Paddack (EBS-319 ext. 2328)
Heather J. Rose (EBS-320, ext. 2329)
Barry Tanowitz (EBS-306, ext. 2778)
Eric Wise (EBS-305, ext. 2517)

Degrees Awarded

Biological Sciences: Associate in Arts
Liberal Arts: Emphasis in Bio-Medical Sciences:
Associate in Arts
Natural History: Associate in Arts

Departmental Awards

Bio-Medical Sciences: Departmental Award
Marine Science: Departmental Award
Natural History: Departmental Award

Honors Certificate of Achievement: Sciences

See "Honors Program" in the *Catalog* Index.

Planning a Program of Study for Transfer

Special problems confront the student planning to transfer to a four-year college or university. Both General Education and major requirements differ from one institution to another and within a single institution by major emphasis. These differences, plus personal, educational and professional goals, employment and prior preparation, will influence the courses you take. *You should work closely with one of the Biological Sciences Faculty Advisers, Eric Wise (EBS-305, ext. 2517) and Blakely Barron (EBS-322, ext. 2444), to plan your program of study at SBCC.*

General Education. It is very important for biology majors to complete the preparation in the major even if it means delaying some General Education/IGETC requirements. The science curriculum is sequential, controlled by prerequisites; you do not want to be in the position of taking freshman science classes as a junior.

Preparation in the Major. Since biology courses are built upon a base of mathematics and the physical sciences, it is important for biology students to begin these courses early so that they may be completed before transfer. The areas of highest concern are Mathematics, Chemistry, Physics and preparation in Biology. Students who must make up deficiencies should do so as early as possible.

Mathematics. Statistics is more widely applicable in biology than is calculus, yet most institutions require calculus because of its utility in rate-oriented biology. You should attempt to complete Elementary Statistics (MATH 117) and a calculus sequence (MATH 130-131 or 150-160) prior to transfer. If you are not eligible for these courses based on your placement exam scores, immediately enter the mathematics sequence at the recommended course level.

Chemistry. It is difficult to understand modern biology without at least an introduction to organic chemistry. Students without prior chemistry background and/or mathematics deficiencies may need to take CHEM 101 and appropriate mathematics courses before beginning the General and Organic Chemistry sequence (CHEM 155, 156, 211-221, 212-222). *Note:* however, that some universities require upper division organic chemistry. If so, complete organic chemistry after transfer.

Physics. There are three physics sequences for biology majors. General Physics (PHYS 105-106) requires algebra and trigonometry. PHYS 110-111 and PHYS 121-122-123 require calculus. Again, colleges and universities differ as to their physics requirements. Many require calculus-based physics.

Biology. SBCC has one of the strongest programs for preparation in three biology majors: Biological Sciences, Bio-Medical Sciences and Natural History. In addition to the biology major core sequence, BIOL 101-Plant, 102-Animal, 103-Cell, 104-Molecular and 105-Molecular Laboratory, biology students may choose from a wide range of courses to add depth and diversity to match their goals and interests. Four-year colleges and universities have different core sequences; to assure compatibility of your course selection and transfer institutions, contact the Counseling Center (Student Services, Room 120).

Declaring a Biology Major

If you have decided to major in biology, or you are not sure but are strongly considering it, *declare a biology major*. Declaring your major protects you from changes of departmental requirements. You will be able to follow either the rules in effect at the time you declared your major, or the rules as later changed. Further, by declaring a biology major you meet one of the requirements for scholarships offered by the Biological Sciences Department.

You may declare a biology major at the time you register at SBCC. Any time thereafter, you may declare a biology major or change your major by filing a "Change of Major" form at the Office of Admissions & Records or online through Pipeline.

Associate in Arts Degree

In order to achieve an Associate in Arts Degree, a student must complete a minimum of sixty (60) units of work, which must fulfill General Education, SBCC and department requirements. For complete information on General Education and SBCC requirements, see "General Education" and "Graduation and Transfer Requirements" in the *Catalog* Index.

Associate in Arts Degree: Biological Sciences

The Biological Sciences major is designed to provide a strong foundation for students interested in life's structures and functions from perspectives of molecules and cells, organisms and populations, and ecology and evolution.

Department Requirements (29.5 units)

BIOL 101 — Plant Biology.....	5
BIOL 102 — Animal Biology	5
BIOL 103 — Cell Biology.....	5.5
BIOL 104 — Molecular Biology*	4
CHEM 155 — General Chemistry I	5
CHEM 156 — General Chemistry II	5

*BIOL 105, *Molecular Biology Laboratory*, strongly recommended.

*BIOL 104 satisfies SBCC GE area A if taken with BIOL 105.

Recommended for Transfer

These additional courses should be considered when planning a program of study for transfer as a biology major.

BIOL 105 — Molecular Biology Laboratory
CHEM 211-221 — Organic Chemistry I and Lab
CHEM 212-222 — Organic Chemistry II and Lab
MATH 117 — Elementary Statistics or
MATH 117H — Elementary Statistics, Honors
MATH 130-131 — Calculus for Biological Sciences,
Social Sciences & Business I and II or
MATH 150-160 — Calculus with Analytic Geometry I and II
PHYS 105-106 — General Physics or
PHYS 110-111 — Introductory Physics or
PHYS 121-122-123 — Calculus-Based Physics

Biological Sciences Sample Program

The following sample program will satisfy department and college requirements for graduation with an AA Degree and includes additional recommended courses to meet department requirements of most four-year colleges and universities.

First Year

<i>Fall Semester</i>	<i>Spring Semester</i>
Biology 101	Biology 102
Chemistry 155	Chemistry 156
Mathematics 130 or 150*	Mathematics 131 or 160*
English 110 or 110H	English 111 or 111H
Physical Education	

Second Year

<i>Fall Semester</i>	<i>Spring Semester</i>
Biology 103	Biology 104
Chemistry 211-221*	Biology 105*
Physics 110*	Chemistry 212-222*
Geography 102	Physics 111*

Emphasis in Bio-Medical Sciences should include introductory courses in general and organic chemistry, physics and statistics.

AH 120; **ANTH** 101, 103#, 104#; **ART** 122, 123, 135; **BIOL** 100+, 101+, 102+, 103+, 104+, 105+, 106+, 110*, 110H+, 111*, 112*, 116, 120+, 140*, 141*, 291; **BMS** 118, 119C, 128, 128L, 136, 146; **BOT** 100+, 121+, 123, 129; **CHEM** 156, 211, 212, 221, 222; **CIM** 100, 125, 225, 250; **COMM** 101♦, 121%, 121H%, 122%, 131%, 131H%, 141%, 151#; **EMT** 110; **HE** 101~, 102~, 103, 104, 108; **HIT** 101, 135, 201, 204, 220, 265; **MATH** 107^, 111^, 117^, 117H^, 120^, 130^, 131^, 137^, 138^, 150^, 160^; **PE** 200; **PHIL** 204, **PHSC** 103+; **PHYS** 101*, 101L*, 102+, 105+, 106+, 110+, 111+; **PSY** 100♦, 100H♦, 105, 110, 115♦, 120♦, 125♦, 130♦, 140♦, 145♦, 150^, 170♦, 175♦; **SOC** 101♦, 101H♦, 103#, 104♦, 106♦, 109♦, 113#; **ZOOL** 110, 122*, 123*, 140.

♦ Satisfies SBCC GE Area B

+ Satisfies SBCC GE Area A

* Satisfies SBCC GE Area A only if lecture and lab are combined

~ Satisfies SBCC GE Area E3 when combined with 1 unit of PE activity

% Satisfies SBCC GE Areas D2 and E4

Satisfies SBCC GE Areas B and E5

^ Satisfies SBCC GE Areas D2 and E1

Departmental Awards

Students who have successfully completed a defined program of study in the areas of bio-medical sciences, marine science and natural history earn Biological Sciences Departmental Awards. Each program of study can be completed in one year. There are neither college requirements nor General Education requirements that need be taken.

Complete descriptions of Departmental Awards requirements are available from the Biological Sciences Department office.

Bio-Medical Sciences

Department Requirements: 30 units

The Bio-Medical Sciences Department Award recognizes achievement by students interested in careers in the allied health fields, physical/health education, recreation and sports technology. Core courses consist of BMS 107 (Human Anatomy), BMS 108 (Human Physiology) and BMS 127 (Medical Microbiology). In addition to the core

curriculum, students must select 18 units of electives from an approved listing of courses in biology, anthropology, art, chemistry, physical/health education, recreation and human biology.

A student must complete each of the courses in the Approved Program of Study with a grade of "C" or better.

Natural History

Department Requirements (29-30 units)

BIOL 110 — Natural Science <i>or</i>	
BIOL 110H — Natural Science, Honors <i>or</i>	
BIOL 120 — Natural History <i>or</i>	
BIOL 140 — Principles of Biology	3 - 4
BIOL 112 — Evolution and Adaptation <i>or</i>	
BIOL 150 — Biodiversity	3
BIOL 122 — Ecology	3
BIOL 123 — Ecology Laboratory	1
BIOL 144 — Biogeography <i>or</i>	
ERTH 141/GEOG 101 — Physical Geography	3
BOT 121 — Plant Diversity ¹	4
ZOOL 122 — Animal Diversity ^{2,3}	3
Natural History Electives*	9

¹ Biology 101 — Plant Biology (5) may substitute for Botany 121

² Biology 102 — Animal Biology (5) may substitute for Zoology 122 + 123

³ Zoology 123 — Animal Diversity Lab recommended

*In addition, 9 units of elective credit, selected in consultation with the Natural History Faculty Adviser, are required to complete the major field requirements.

A student must complete each of the courses required with a grade of "C" or better.

Marine Science

The Marine Science Departmental Award comprises 21 units and signifies that students have a broad background in the physical and biological processes of the world's oceans and the tools and techniques with which they are studied. The curriculum includes courses from Biology, Marine Technology and Earth and Planetary Sciences, and is especially suited to students interested in the fields of mariculture, boating and recreation, skin and Scuba diving, fishing, scientific research and marine science.

Students interested in a Marine Biology major should take the Biological Sciences majors sequence. You are encouraged to supplement this sequence with courses in Marine Science.

Marine Science Required Courses (18.8 units)

Students planning on completing the Marine Science curriculum in two semesters can begin in either Fall or Spring.

Fall Semester

BIOL 124* — Biological Oceanography	4
ERTH 152 — Weather and Climate or	
GEOG 152 — Weather and Climate	3
MDT 108 — Rigging	1
MDT 109 — Seamanship and Small Boat Handling.....	1.5
HE 103* — Responding to Medical Emergencies.....	2

Spring Semester

BIOL 125* — Marine Biology.....	4
MDT 101 — Information and Introduction to Marine Diving Technology	0.3
ERTH 151/151L — Introductory Physical Oceanography and Lab.....	4

Plus completion of Basic Scuba Diving Certificate

**Substitutions:* The combination of BIOL 101 (Plant Biology) and BIOL 102 (Animal Biology) can be substituted for BIOL 125. The completion of EMT 110 can be substituted for HE 103. The completion of BIOL 142 can be substituted for BIOL 124.

A student must complete each of the required courses (or use substitution options) with a grade of “C” or better.

Advising

Students pursuing Departmental Awards are encouraged to identify themselves to the appropriate adviser to formulate a program of study.

Bio-Medical Sciences: Heather J. Rose

Environmental Studies: Adam Green

Marine Science: Michelle Paddack

Natural History: Larry Jon Friesen

Honors and Awards

Outstanding Student Awards

Each year one student may be selected “Outstanding Student” in Biological Sciences, Bio-Medical Sciences, Botany, Cell, Molecular, Natural History, Marine Science,

Zoology and some other courses. Selections are made by the Biological Sciences Department faculty. Selections are based solely on academic excellence and applications by students are not required.

Robert J. Profant Memorial Scholarship

Established in 1991 in honor of the late Professor Profant’s long and dedicated career, and awarded once each year, the Robert J. Profant Scholarship recognizes an outstanding student majoring in biology. Students are recommended to the department by faculty or may apply through the Financial Aid Office.

To qualify for a scholarship award, a student must be a declared biology major (Biological Sciences or Natural History), enrolled in a course offered by the Biological Sciences Department during the academic year of application, and have a 3.5 GPA in courses from the sciences and mathematics.

William Olivarius Scholarships

In 1982, a generous endowment from the late William Olivarius enabled the Biological Sciences Department to offer scholarships to students majoring in biology. Several scholarships are awarded each year on the basis of academic excellence.

To qualify for a scholarship award, a student must be a declared biology major (Biological Sciences, Biotechnology or Natural History), be enrolled in a minimum of 12 units each semester of the award year, and have a minimum overall grade point average of 3.0. All students with exceptional overall GPAs are encouraged to apply. Applications and faculty nominations are due at the end of the first week of February.

Richard Armstrong Memorial Scholarship

Richard Armstrong is warmly remembered as a dedicated scientist and SBCC professor who taught in the Biological Sciences Department for three decades. He passed away in the Spring 2005 semester and is honored by his family, friends and colleagues with this scholarship.

Eligible students must demonstrate academic excellence and a passion for biology. They must have declared a major in one of the Biological Sciences and have completed at least 12 units of the biology majors sequence of courses, preferably (but not limited to) the following courses: Biology 101, 102, 103, and 104 and Chemistry 155, 156. They may be either continuing their studies at SBCC (with a clear intent of pursuing an advanced degree) or transferring to a 4-year institution as a biology major.

Microbiology Achievement Award

The Microbiology Achievement Award is an endowed gift administered jointly by the Biological Sciences Department and the Santa Barbara City College Foundation. The award is meant as a special recognition to the student who demonstrated superior academic achievement in the field of microbiology, as well as in true academic tradition, exhibited outstanding class leadership and provided strong support to classmates.

Dr. Judith Evans Meyer Memorial Scholarship for the Bio-Medical Sciences

Award is based equally on financial need and academic achievement. Applicants must have earned a passing grade in at least one (1) SBCC Bio-Medical Science course and either be currently enrolled or have successfully completed one (1) other Bio-Medical Science course within the past two (2) college terms (including summer sessions). Applicants may be entering, continuing, re-entering or transferring to a four-year institution. During the award period they must be enrolled in a minimum of six (6) units maintain a minimum 3.0 GPA.

David W. Doner, Jr., M.D. Scholarship

This award is made possible by the generous gift of David W. Doner, Jr., M.D. Dr. Doner practiced medicine for forty years and taught medical residents and students at Boston University, Tufts University and Santa Barbara Cottage Hospital as an active faculty mentor. He endowed a scholarship fund for the Biological Sciences Department and the School of Nursing at Santa Barbara City College, specifically for pre-medical science and allied health majors.

Special Programs and Courses**291 — Seminars in the Biological Sciences**

The 291 series in Biological Sciences is designed to provide students the opportunity to investigate areas outside the regular course offerings. The topics are selected on the basis of faculty and student interest. Students are urged to suggest topics to the department.

295/298/299 — Internship and Independent Studies

This series offers opportunities to students with particular skills or interests to receive credit for internship (295), independent reading (298) or research (299). You may enroll in Internship and Independent Studies at any time during the semester. You must secure a faculty sponsor and file an Independent Studies proposal with the Biological Sciences Office and the Office of Admissions & Records.

Student Employment Opportunities

Each semester the Biological Sciences Department hires students as laboratory and museum assistants, collectors, tutors and readers. Students may apply for one of these positions at the Biological Sciences Offices (EBS-212). The greatest number of positions is available at the beginning of the school year. Students are encouraged to file an application during the prior spring semester or during the summer to have the best chance for employment beginning in the fall.

Student laboratory and museum assistants gain experience in laboratory and museum techniques under the supervision of Biological Sciences faculty and laboratory technicians. Museum assistants and collectors collect, accession and preserve botanical and animal specimens for use in classes and work on a variety of departmental projects.

Students who have performed well in a course and who demonstrate interest and ability in teaching are selected by the faculty as readers or to tutor students currently enrolled in the course. The purpose of this program is twofold: current students in the course receive excellent peer tutoring; and tutors learn the techniques of teaching. Tutors also find that to teach is to learn.

Anthropology Course**ANTH 101 — Physical Anthropology****(3) — CSU, UC***Skills Advisories: Eligibility for ENG 110 or 110H**Hours: 54 lecture*

Biological aspects of human characteristics and behavior; the relationship of humans to other animals; the origins and evolutionary adaptations of human populations and the biological basis for the diversity of human groups.

Biology Courses**BIOL 100 — Concepts of Biology****(4) — CSU, UC****Skills Advisories: Eligibility for ENG 110 or 110H**Hours: 108 (54 lecture, 54 lab)*

Basic concepts of biology. Designed for non-biological sciences majors with no prior general biology course. Satisfies SBCC General Education requirement in Natural Sciences. (*UC Transfer Limit: no credit for BIOL 100 if taken after BIOL 101, 102 or 103)

BIOL 101 — Plant Biology

(5) — CSU, UC

Prerequisites: MATH 107 or 111

Skills Advisories: Eligibility for ENG 110 or 110H

Hours: 162 (54 lecture, 108 lab)

Principles of biology, with emphasis on major plant groups. Anatomy, physiology, evolution and diversity of the Monera, Protocista, Fungi and Plantae. Required for the Biological Sciences major. Satisfies SBCC General Education requirement in Natural Sciences.

BIOL 102 — Animal Biology

(5) — CSU, UC

Prerequisites: MATH 107 or 111

Skills Advisories: Eligibility for ENG 110 or 110H

Course Advisories: BIOL 101

Hours: 162 (54 lecture, 108 lab)

Principles of animal taxonomy, evolution, population and community ecology; protist and animal diversity and adaptations; emphasis on vertebrate anatomy and physiology. Required for the Biological Sciences major. Satisfies SBCC General Education requirement in Natural Sciences.

BIOL 103 — Cell Biology

(5.5) — CSU, UC*

Prerequisites: MATH 107 or 111 and

CHEM 104 or 155 and ENG 110 or 110H

Hours: 153 (54 lecture, 18 discussion, 81 lab)

Cell structure and function: molecular architecture, reproduction and growth; mechanisms of genetics; intercellular communication; cell and organ system physiology; life's origin. Study scientific literature with instruction in critical thinking, composition and logical analyses of ideas and experiments. Required for the Biological Sciences and Biotechnology majors. Satisfies SBCC General Education requirement in Communication and Analytical Thinking. (*UC Transfer Limit: BIOL 103 maximum credit, 5 units)

BIOL 104 — Molecular Biology

(4) — CSU, UC*

Prerequisites: MATH 107 or 111

Skills Advisories: Eligibility for ENG 110 or 110H

Course Advisories: CHEM 155 and 156

Hours: 54 lecture, 18 discussion

Molecular cell biology and genetics of prokaryotes and eukaryotes; emphasis on transmission and molecular biology of genes. Required for the Biological Sciences majors. (*UC Transfer Limit: BIOL 104 and 105 combined: maximum credit, 5 units)

BIOL 105 — Molecular Biology Laboratory

(2) — CSU, UC*

Prerequisites: MATH 107 or 111

Corequisites: BIOL 104

Skills Advisories: Eligibility for ENG 110 or 110H

Hours: 72 (18 discussion, 54 lab)

Laboratory in molecular cell biology and genetics of prokaryotes and eukaryotes; with emphasis on transmission and molecular biology of genes. Strongly recommended for the Biological Sciences major; required for Biotechnology majors. (*UC Transfer Limit: BIOL 104 and 105 combined: maximum credit, 5 units)

BIOL 110 — Natural Science

(3) — CSU, UC*

Skills Advisories: Eligibility for ENG 110 or 110H

Hours: 54 lecture

Physical and chemical principles underlying biological architecture and function. In combination with BIOL 141, BIOL 110 satisfies General Education requirement in Natural Sciences. (*UC Transfer Limit: BIOL 110 and 110H combined: maximum credit, one course)

BIOL 110H — Natural Science, Honors

(4) — CSU, UC*

Skills Advisories: Eligibility for ENG 110 or 110H

Limitation on Enrollment: Honors Program Acceptance

See "Honors Program" section of this Catalog.

Hours: 72 lecture

Introduction to the physical and chemical principles important to an understanding of biological architecture and function. Laboratory and field investigations of forces, light and biomaterial; optimal form; bioenergetics; functional design. Satisfies SBCC General Education requirement in Natural Sciences. (*UC Transfer Limit: BIOL 110 and 110H combined: maximum credit, one course)

BIOL 112 — Evolution and Adaptation

(3) — CSU, UC

Skills Advisories: Eligibility for ENG 110 or 110H

Hours: 54 lecture

Principles of biological evolution, diversity of life on Earth, and a survey of living and extinct organisms. Investigates theories of life's origin, modes of speciation and adaptations of dominant life forms through the ages. In combination with BIOL 141, BIOL 112 satisfies General Education requirement in Natural Sciences.

BIOL 116 — Biological Illustration**(4) — CSU***Skills Advisories: Eligibility for ENG 110 or 110H**Course Advisories: ART 120**Hours: 108 (54 lecture, 54 lab)*

Traditional and contemporary techniques of scientific illustration of biological subjects for technical and medical print and electronic publications. May be taken four times for credit.

BIOL 118 — Nature Photography**(3) — CSU***Skills Advisories: Eligibility for ENG 110 or 110H**Hours: 90 (36 lecture, 54 lab)*

Field and laboratory photography of biological subjects. Camera, light and film, and the special methods of wildlife photography, photomacrography, photomicrography and converting images to digital formats. May be taken four times for credit.

BIOL 120 — Natural History**(4) — CSU, UC***Skills Advisories: Eligibility for ENG 110 or 110H and proficiency in MATH 104 or 107 or 111**Hours: 108 (54 lecture, 54 lab)*

Survey of the natural environment through studies of Earth's ecosystems: emphasis on the plant and animal inhabitants and the influences of cosmic, geological and meteorological phenomena. Satisfies SBCC General Education requirement in Natural Sciences.

BIOL 122 — Ecology**(3) — CSU, UC***Skills Advisories: Eligibility for ENG 110 or 110H**Hours: 54 lecture*

Organisms and populations as integrated elements of communities and ecosystems. Population structure, growth and evolution; relationships between species: competition, predation, coevolution; community structure and development; biodiversity; biogeography. Satisfies SBCC General Education requirement in Natural Sciences when combined with BIOL 123.

BIOL 123 — Ecology Laboratory**(1) — CSU, UC***Corequisites: BIOL 122**Skills Advisories: Eligibility for ENG 110 or 110H**Hours: 54 lab*

Laboratory and field investigations of ecological principles. Satisfies SBCC General Education requirement in Natural Sciences when combined with BIOL 122.

BIOL 124 — Biological Oceanography**(4) — CSU, UC***Skills Advisories: Eligibility for ENG 110 or 110H**Hours: 108 (54 lecture, 54 lab)*

Relationships between marine plants and animals and physical characteristics of Earth's oceans. Emphasis on forms of marine organisms found in the open sea, their characteristics and ecological relationships. Biological sampling techniques and physical measurements studied in laboratory and at sea. Satisfies SBCC General Education requirement in Natural Sciences.

BIOL 125 — Marine Biology**(4) — CSU, UC****Skills Advisories: Eligibility for ENG 110 or 110H**Hours: 108 (54 lecture, 54 lab)*

Marine plants and animals, with emphasis on local organisms and their ecological adaptations. Laboratory covers particular habitats in the littoral zone during low tides. Satisfies SBCC General Education requirement in Natural Sciences. (*UC Transfer Limit: BIOL 125 and 126 combined: maximum credit, one course)

BIOL 126 — Freshwater Biology**(4) — CSU, UC****Skills Advisories: Eligibility for ENG 110 or 110H**Hours: 108 (54 lecture, 54 lab)*

Diversity of plants and animals associated with marshes, ponds, lakes and streams; ecological relationships and adaptations to life in water. Field studies emphasized. Satisfies SBCC General Education requirement in Natural Sciences. (*UC Transfer Limit: BIOL 125 and 126 combined: maximum credit, one course)

BIOL 130 — Methods in Field Biology**(3) — CSU***Skills Advisories: Eligibility for ENG 110 or 110H**Hours: 90 (36 lecture, 54 lab)*

Through weekly field trips and 2-3 weekend field experiences, students will study flora and fauna of California using current biological and ecological field research methods, collect and analyze data, demonstrate leadership and group work skills, and write and present a research proposal. Students

must be able to hike in rough terrain and carry bulky equipment.

BIOL 133 — Ecology of Morro Bay Area

(1) — CSU

Skills Advisories: Eligibility for ENG 110 or 110H

Hours: 32 (8 lecture, 24 lab)

Field course of study introducing the ecology of the relatively undisturbed wetland habitats of the Morro Bay region of the central California coast (mudflats, salt marsh, rocky outer coast).

BIOL 140 — Principles of Biology

(3) — CSU, UC*

Skills Advisories: Eligibility for ENG 110 or 110H

Hours: 54 lecture

Basic principles of cells, genetics, evolution, biodiversity and ecology. Designed for Natural History majors. Satisfies Natural Science General Education requirement when combined with Bio 141. (*UC Transfer Limit: no credit for BIOL 140 if taken after 100, 101, 102 or 103)

BIOL 141 — Biology Laboratory

(2) — CSU, UC*

Prerequisites: BIOL 110 with a minimum grade of "C"

Corequisites: BIOL 112 with a minimum grade of "C" or BIOL 140 with a minimum grade of "C"

Skills Advisories: Eligibility for ENG 110 or 110H, proficiency in MATH 104 or 107 or 111

Hours: 72 (18 lecture, 54 lab)

Laboratory investigation of biological principles and techniques of investigation. Satisfies SBCC General Education requirement in Natural Sciences when combined with BIOL 110 or 112 or 140. (*UC Transfer Limit: no credit for BIOL 141 unless taken after or concurrently with BIOL 112 or 140)

BIOL 142 — Marine Science

(3) — CSU, UC

Skills Advisories: Eligibility for ENG 110 or 110H

Hours: 54 lecture

Introduction to oceanography and marine biology: ocean properties, marine ecology of the tropics, poles, temperate and deep-sea regions, and marine environmental concerns.

BIOL 144 — Biogeography

(3) — CSU

Skills Advisories: Eligibility for ENG 110 or 110H

Hours: 54 lecture

Survey of the history, distribution and diversity of life and the methods by which biodiversity is defined and measured.

BIOL 150 — Biodiversity

(3) — CSU, UC

Skills Advisories: Eligibility for ENG 110 or 110H

Course Advisories: High school biology

Hours: 54 lecture

Diversity, adaptations and evolutionary history of life on Earth; principles of ecology and evolution. Examination of theories of systematics and nomenclature.

BIOL 161 — DNA and Society

(3) — CSU, UC

Skills Advisories: Eligibility for ENG 110 or 110H

Hours: 54 lecture

Introduction to DNA structures and functions, heredity, genetics, biotechnology, cloning, genetically modified organisms and stem cells from a biological perspective; relevant ethical issues and implications for society and the individual are explored. Satisfies SBCC General Education requirement in Natural Sciences.

BIOL 172 — Symbiosis

(3) — CSU, UC

Skills Advisories: Eligibility for ENG 110 or 110H

Hours: 54 lecture

Origins and nature of biological partnerships. Symbiotic relations from microbial landscapes to global ecology. Emphasis on ecological, behavioral and chemical exchanges between organisms and ecosystems.

BIOL 291 — Seminars in Biology

(2) — CSU

Skills Advisories: Eligibility for ENG 110 or 110H

Hours: 36 lecture

Topic or group of interrelated topics presented in seminar format by students enrolled in the course. Course content varies. Information on course content may be obtained from the Biological Sciences Department Office or SBCC *Schedule of Classes*. May be taken four times for credit. (*UC Transfer Limit: BIOL 291 computed as Independent Studies; see a counselor)

Independent Studies in Biology

For prerequisites and eligibility information, see “Independent Study” in the *Catalog* Index. In order to enroll in a BIOL 295 or 299 course, a student must have completed 12 units at SBCC with a GPA of 2.5 and a minimum of 6 units with a GPA of 3.0 in the Biological Sciences Department.

BIOL 295 — Internship in Biology (1-4) — CSU

Limitation on Enrollment: Student must have completed 12 units at SBCC with a GPA of 2.5 and a minimum of 6 units with a GPA of 3.0 in the Biological Sciences Department.

*Skills Advisories: Eligibility for ENG 110 or 110H
Hours: 48-273 lab*

Structured, on-the-job experience in a field directly related to the student’s area of interest in the biological sciences.

BIOL 298 — Independent Reading in Biology (1-4) — CSU

Limitation on Enrollment: Student must have completed 12 units at SBCC with a GPA of 2.5 and a minimum of 6 units with a GPA of 3.0 in the Biological Sciences Department.

*Skills Advisories: Eligibility for ENG 110 or 110H
Hours: 48-192 lab*

Independent literature search and/or reading of material on a topic in biology. A final report, including an annotated bibliography, is required. May be taken four times for credit. (*UC Transfer Limit: BIOL 298 computed as Independent Studies; see counselor)

BIOL 299 — Independent Research in Biology (1-4) — CSU

Limitation on Enrollment: Student must have completed 12 units at SBCC with a GPA of 2.5 and a minimum of 6 units with a GPA of 3.0 in the Biological Sciences Department.

*Skills Advisories: Eligibility for ENG 110 or 110H
Hours: 48-192 lab*

Independent, systematic research investigation of a problem in biology. A final report on research conducted is required. May be taken four times for credit. (*UC Transfer Limit: BIOL 299 computed as Independent Studies; see counselor)

Bio-Medical Sciences Courses

BMS 100 — The Human Body

(4) — CSU, UC*

Skills Advisories: Eligibility for ENG 110 or 110H

Course Advisories: One semester high school biology

Hours: 108 (54 lecture, 54 lab)

Structure and function of the human body. Non-technical introduction to anatomy, physiology, exercise, fitness and nutrition. Laboratory experiments in human physiology; study of human anatomical materials. Satisfies SBCC General Education requirement in Natural Sciences. Satisfies Anatomy and Physiology requirements for SBCC LVN Program. Does not satisfy requirements for ADN majors. (*UC Transfer Limit: no credit for BMS 100 if taken after BMS 107 or 108 or 109; BMS 100, 107, 108, 109, and 146 combined: maximum credit, two courses)

BMS 107 — Human Anatomy

(4) — CSU, UC*

Skills Advisories: Eligibility for ENG 110 or 110H

Hours: 108 (54 lecture, 54 lab)

Structure of the human body. Laboratory includes study of a human anatomical specimen and comparative anatomy. Transferable to all four-year institutions, including nursing schools. Satisfies SBCC General Education requirement in Natural Sciences. (*UC Transfer Limit: BMS 100, 107, 108, 109 and 146 combined: maximum credit, two courses)

BMS 108 — Human Physiology

(4) — CSU, UC*

Skills Advisories: Eligibility for ENG 110 or 110H

Course Advisories: BMS 107

Hours: 108 (54 lecture, 54 lab)

Functions of the human body. Laboratory emphasizes recording physiological data from each student. Transferable to all four-year institutions, including nursing schools. Satisfies SBCC General Education requirement in Natural Sciences. (*UC Transfer Limit: BMS 100, 107, 108, 109, and 146 combined: maximum credit, two courses)

BMS 118 — Human Microanatomy

(3) — CSU

Skills Advisories: Eligibility for ENG 110 or 110H

Course Advisories: BMS 100 or 107

Hours: 54 lecture

Functional histology of the human body. Cell structure and function; architecture, control and integration of cells in tissues of all major organs.

BMS 119A — Human Dissection of the Head and Neck

(1) — CSU

Prerequisites: BMS 107, with a minimum grade of "B"
Hours: 54 lab

Directed dissection of the head and neck of the human cadaver. May be taken for one credit. This unit of credit requires 48 hours of laboratory work per semester.
Graded Pass/No Pass

BMS 119B — Human Dissection of the Appendages

(1) — CSU

Prerequisites: BMS 107 with a minimum grade of "B"
Hours: 54 lab

Directed dissection of the appendages of the human cadaver. May be taken for one credit. This unit of credit requires 48 hours laboratory work per semester.
Graded Pass/No Pass.

BMS 119C — Human Dissection of the Torso

(1) — CSU

Prerequisites: BMS 107 with a minimum grade of "B"
Hours: 54 lab

Directed dissection of the external and internal structures of the torso of the human cadaver. May be taken for one credit. This unit of credit requires 48 hours of laboratory work per semester.

BMS 127 — Medical Microbiology

(4) — CSU, UC

Prerequisites: CHEM 101 with a minimum grade of "C" or high school chemistry with a minimum grade of "C" or CHEM 104 with a minimum grade of "C" or CHEM 155 with a minimum grade of "C"
Skills Advisories: Eligibility for ENG 110 or 110H
Course Advisories: BMS 108 and BIOL100
Hours: 108 (54 lecture, 54 lab)

Surveys of the microorganisms that contribute to human health and human disease. Biology of bacteria, viruses, fungi, prions and a variety of Eukaryotic organisms are investigated; emphases includes the structural and metabolic diversity of microorganisms, and the molecular and cellular basis of host-microbe interactions.

BMS 128 — Human Nutrition

(3) — CSU, UC

Skills Advisories: Eligibility for ENG 110 or 110H
Hours: 54 lecture

Nutritional needs of the human body. Studies individual, local, national and world nutritional efforts.

BMS 128L — Human Nutrition Laboratory

(1) — CSU, UC

Corequisites: BMS 128
Skills Advisories: Eligibility for ENG 110 or 110H
Hours: 54 lab

Laboratory investigations of human nutrition; nutritional analysis of food; and guidelines for prevention of chronic diseases through diet.

BMS 136 — Biology of Human Sexuality

(3) — CSU, UC

Skills Advisories: Eligibility for ENG 110 or 110H
Hours: 54 lecture

Fundamental principles and current research focused on the anatomy and physiology of reproductive systems, hormonal control of reproductive cycles, diversity of sexual responses, basic genetics and heredity, early human development, pregnancy, parturition, causes and treatments of infertility, sexually-transmitted infections, contraception, age-related changes in sexual function and behavior, sexual dysfunction and comparative sexual behaviors.

BMS 146 — Human Form and Function

(3) — CSU, UC*

Skills Advisories: Eligibility for ENG 110 or 110H
Course Advisories: CHEM 101 or 156. Computer and internet competence.
Hours: 54 lecture

Descriptive introduction to the structure and function of the human body. (*UC Transfer Limit: BMS 100, 107, 108, 109, and 146 combined: maximum credit, two courses)

BMS 157— General Microbiology**(4) — CSU, UC**

Prerequisites: CHEM 101 with a minimum grade of “C” or high school chemistry with a minimum grade of “C” or CHEM 104 with a minimum grade of “C” or CHEM 155 with a minimum grade of “C”

*Skills Advisories: Eligibility for ENG 110 or 110H or 110GB
Course Advisories: BIOL 100 with a minimum grade of “C” BMS 108 with a minimum grade of “C”*

Hours: 108 (54 lecture, 54 lab)

Surveys the biology and ecology of various microbiological taxa: bacteria, archaea, viruses, fungi, protists and microscopic animals. Emphasis placed on their symbiotic roles in nature, as well as on their evolution, taxonomy, metabolism and genetics. Associated biotechnological techniques and industrial applications are explored.

Botany Courses**BOT 100 — Concepts of Botany****(4) — CSU, UC***

Skills Advisories: Eligibility for ENG 110 or 110H

Hours: 108 (54 lecture, 54 lab)

Plant structure and function; the role of plants in the biosphere and society. Laboratory includes field studies. Designed for non-Biological Sciences majors with no prior general botany course. Satisfies SBCC General Education requirement in Natural Sciences. (*UC Transfer Limit: No credit for BOT 100 if taken after BOT 121; BOT 100, 121, and 122 combined: maximum credit, two courses)

BOT 121— Plant Diversity**(4) — CSU, UC***

Skills Advisories: Eligibility for ENG 110 or 110H

Course Advisories: BIOL 100

Hours: 108 (54 lecture, 54 lab)

Plant diversity, adaptations and evolutionary history; principles of ecology and evolution. Satisfies SBCC General Education requirement in Natural Sciences. (*UC Transfer Limit: BOT 100, 121, and 122 combined: maximum credit, two courses)

BOT 122 — Flowering Plant Identification**(3) — CSU, UC***

Skills Advisories: Eligibility for ENG 110 or 110H

Hours: 90 (36 lecture, 54 lab)

Botanical classification, methods of identification and recognition of important California plant species and

families. (*UC Transfer Limit: BOT 100, 121 and 122 combined: maximum credit, two courses)

BOT 123 — Field Botany**(3) — CSU, UC**

Skills Advisories: Eligibility for ENG 110 or 110H

Hours: 80 (32 lecture, 48 lab)

Flora, vegetation and major ecological features of natural ecosystems; field lectures, laboratories and camping. Five one-day field trips; a fee is charged. May be taken four times for credit.

BOT 129 — Survey of Earth’s Vegetation**(3) — CSU, UC**

Skills Advisories: Eligibility for ENG 110 or 110H

Hours: 54 lecture

Diversity and structure of Earth’s vegetation types and associated environmental factors responsible for these natural associations. Consideration is given to the preservation, destruction and reconstruction of native vegetation.

BOT 132 — Marine Botany**(1) — CSU**

Skills Advisories: Eligibility for ENG 110 or 110H

Hours: 24 (12 lecture, 12 lab)

Six-week short course beginning mid-semester. Two hours lecture weekly. Twelve (12) hours field to be arranged. May be taken four times for credit.

Environmental Studies Courses**ENVS 110 — Humans and the****Biological Environment****(3) — CSU, UC**

Skills Advisories: Eligibility for ENG 110 or 110H

Hours: 54 lecture

Growth and variations in populations of organisms and their interactions with the physical environment. Characteristics of living natural resources and changes caused by expanding human populations and technological developments. Satisfies SBCC General Education requirement in Natural Sciences when combined with ENVS 111. (Required for the Environmental Studies major.)

ENVS 111 — Environmental Field Studies

(1) — CSU, UC

Corequisites: ENVS 110

Skills Advisories: Eligibility for ENG 110 or 110H

Hours: 54 lab

Field studies designed to demonstrate general ecological/environmental principles through exposure to and analysis of many different communities and sites of environmental concern. Satisfies SBCC General Education requirement in Natural Sciences when combined with ENVS 110.

Zoology Courses

ZOOL 110 — Animal Physiology

(3) — CSU, UC

Skills Advisories: Eligibility for ENG 110 or 110H and proficiency in MATH 104 or 107 or 111

Hours: 54 lecture

How animals work. Animal physiological systems, perception of and responses to external stimuli, integration of activities, maintenance of the internal environment, locomotion and reproduction.

ZOOL 122 — Animal Diversity

(3) — CSU, UC

Skills Advisories: Eligibility for ENG 110 or 110H

Hours: 54 lecture

Introduction to zoology. Animal diversity, anatomy and physiology, adaptations and evolution. Principles of ecology. Satisfies SBCC General Education requirement in Natural Sciences when combined with ZOOL 123.

ZOOL 123 — Animal Diversity Laboratory

(1) — CSU, UC

Corequisites: ZOOL 122

Skills Advisories: Eligibility for ENG 110 or 110H

Hours: 54 lab

Laboratory and field investigations of animals. Animal diversity, anatomy and physiology, principles of ecology and evolution. Satisfies SBCC General Education requirement in Natural Sciences when combined with ZOOL 122.

ZOOL 124 — Insect Biology

(3) — CSU, UC

Skills Advisories: Eligibility for ENG 110 or 110H

Hours: 54 lecture

Introduction to anatomy, physiology, ecology, behavior and diversity of insects and other terrestrial arthropods.

ZOOL 137 — Ornithology

(3) — CSU, UC

Skills Advisories: Eligibility for ENG 110 or 110H

Hours: 54 lecture

Systematics, distribution, physiology, behavior and ecology of birds. Emphasis on diversity, functional morphology and evolutionary history.

ZOOL 138 — Biology of Birds

(1.5) — CSU

Skills Advisories: Eligibility for ENG 110 or 110H

Eight-week short course

Hours: 40 (18 lecture, 27 lab)

Anatomy, physiology, evolution and behavior of birds. Field trips are timed to coincide with migratory periods, and emphasize identification and classification.

ZOOL 140 — Animal Behavior

(3) — CSU, UC

Skills Advisories: Eligibility for ENG 110 or 110H

Hours: 54 lecture

Introduction to animal behavior; methods and results of studies of invertebrate and vertebrate behavior; foraging strategies, social competition, sexual selection, mating systems, cooperation and social organization.