The Department of Biology offers the Bachelor of Science in Biology with or without a concentration in Biotechnology, the Bachelor of Arts in Human Biological Sciences, and the Master of Science in Biology. Throughout its curriculum the Department emphasizes evolution and the relationship between organisms and the environment. Classes include extensive field and laboratory investigations allowing students to observe and measure biological systems. Students are encouraged to select elective courses best suited to their interests. See Biology Tracks below. A detailed description of student learning goals and objectives can be found at http://www.csub.edu/biology/.

Requirements for the Bachelor of Science Degree in Biology

Total Units Required to Graduate 180 units
Major Requirements 90 units
Biology Courses 65
Cognates 25
Minor Requirement 0 units
Other University Requirements 67-77 units
CSUB 101 2
American Institutions 5*
Area A 15
Area B 0*  
Area C 15
Area D 15
Theme 1 0*
Theme 2 5
Theme 3 5
GRE 5
GWAR (Exam) or Class 0-5
Additional Units 0-2 units
* satisfied in major, minor or other university requirement

Requirements for the Bachelor of Arts Degree in Human Biological Sciences

Total Units Required to Graduate 180 units
Major Requirements 92-93 units
Biology Courses 67-68
Cognates 25
Minor Requirement Not Required
Elective Units 15-20 units
Other University Requirements 67-72 units
CSUB 101 2
American Institutions 5*
Area A 15
Area B 0*  
Area C 15
Area D 15
Theme 1 0*
Theme 2 5
Theme 3 5
GRE 5
GWAR (Exam) or Class 0-5
Additional Units 0-2 units
* satisfied in major, minor or other university requirement

Note: One (1) quarter unit of credit normally represents one hour of in-class work and 2-3 hours of outside study per week.

Specific Requirements for the Bachelor of Science Degree with a Major in Biology

The Bachelor of Science in Biology curriculum includes a wide range of courses that allow for diverse student interests. Students seeking a Bachelor of Science degree with a major in Biology must complete the following:

1. Biology courses*
   a. BIOL 201, 202, and 203

   NOTE: A grade of C- or better in BIOL 201 is required to advance into upper division Biology courses.
b. BIOL 301, 304, 305, 306, 470 and 490

c. At least 25 units of additional upper division elective coursework in Biology. At least three courses must be five units with lab and at least one must be a laboratory course at the 400-level. One course selected from the following may be substituted for an elective: CHEM 331, 332, 333 or 340, PEAK 404 or other by advisor’s approval.

* A minimum GPA for these 65 units is 2.0

2. Cognates+
   a. CHEM 211, 212 and 213
   b. MATH 191 or equivalent
   c. At least 5 units in appropriate cognate areas subject to the approval of the advisor.

+ A minimum GPA for these 25 units is 2.0

Specific Requirements for the Bachelor of Science Degree with a Major in Biology and a Concentration in Biotechnology

The Bachelor of Science in Biology and a concentration in Biotechnology curriculum include a specific set of courses designed to provide students with a foundation in Biotechnology related fields. Students seeking a Bachelor of Science degree with a major in Biology and a concentration in Biotechnology must complete the following:

1. Biology courses*
   a. Core requirements: BIOL 201, 202, 203, 301, 304, 305, 470 and 490.
      NOTE: A grade of C- or better in BIOL 201 is required to advance into upper division Biology courses.
   b. Concentration specific: BIOL 312, 330, 360, CHEM 340 and one of the following: BIOL 412, 430, 414, 424, or any 400 level course with lab (other than 440) by consent of advisor.

* A minimum GPA for these 61 units is 2.0

2. Cognates+
   a. CHEM 211, 212, 213, 331, 332, 333
   b. PHYS 201, 202, 203
   c. MATH 201 or 211

+ A minimum GPA for these 50 units is 2.0

Specific Requirements for the Bachelor of Arts Degree with a Major in Human Biological Sciences

The Bachelor of Arts Degree in Human Biological Sciences curriculum includes a specific set of courses designed to provide students with a foundation in Biology in Human/Health related fields. This degree is not intended for pre-medical or pre-professional students. Students seeking a Bachelor of Arts degree with a major in Human Biological Sciences must complete the following:

1. Biology courses*
   Core Requirements:
   a. Lower division: BIOL 201, 250, 255, 256, 260, and 270.
      NOTE: A grade of C- or better in BIOL 201 is required to advance into upper division Biology courses.
   b. Upper division: BIOL 304, 305, 314, 355, 490B
      Electives:
      c. Two of the following: BIOL 316, 317, 318 or 319.
      d. 15 units of additional upper division, one elective must be 400-level.

* A minimum GPA for these 67 units is 2.0

2. Cognates+
   a. NURS 235
   b. CHEM 150 and 203
   c. One 5 unit cognate elective subject to advisor approval

+ A minimum GPA for these 25 units is 2.0

Biology Tracks

Students obtaining the BS in Biology are encouraged to take course sequences (tracks) with specific emphases such as Ecology/Field Biology, Physiology, Zoology, Pre-professional Biology, Clinical Laboratory Sciences, and Physical Therapy. These unofficial tracks are not listed on the diploma or transcript. For example, a track in Pre-professional Biology would include two years of chemistry, one year of physics, math through calculus, and selected electives in Biology. Specific courses recommended for these tracks can be obtained from an advisor or the Biology Department office.

Requirements for the Minor

A minor in Biology consists of 20 units, 10 of which must be upper division. Only courses applicable to the major will be accepted for the minor. Requests for approval are to be submitted to the Department Chair. A minimum grade point average of 2.0 is required for the units applied towards the Minor.

Science Teacher Preparation Program Leading to a Degree in Natural Sciences, Primary Concentration in Biology

CSUB has developed a degree program, the Bachelor of Arts in Natural Sciences, to prepare prospective science teachers for subject matter certification in California via the California Subject Matter Examinations for Teachers (CSET) in Science. See the catalog section under Natural Sciences for information about this degree program. Additional information may be obtained from the Biology Department office (661- 654-3089).
COURSE DESCRIPTIONS

Lower Division

BIOL 100 Perspectives in Biology (5)
Topics and issues in modern biology and their relevance to society. Four hours lecture and three hours laboratory. Not acceptable for the major or minor. Lab fee required.
GE B2/B3

BIOL 103 Principles of Ecology (5)
Basic ecological relationships of organisms to each other and to their physical environment. Topics include limiting factors, population dynamics, and evolutionary processes. Emphasis is placed on applications to the human condition. Four hours lectures and three hours laboratory. Not acceptable for the major or minor. Lab fee required. GE B2/B3

BIOL 201 Introductory Biology - Cells (5)
Cell structure and function with emphasis on molecular aspects. Three hours lecture and six hours laboratory. Prerequisites: ENGL 110. Lab fee required. NOTE: Students are encouraged to take BIOL 100 before BIOL 201 if they lack a firm background in biology because a grade of C- or better in BIOL 201 is required to advance into upper division Biology courses.

BIOL 202 Introductory Biology - Animals (5)
Function, form, and diversity of animals. Emphasis placed on the solutions to problems of survival and reproduction and the evolutionary relationships among various animal groups. Three hours lecture and six hours laboratory. Prerequisite: ENGL 110. Lab fee required.

BIOL 203 Introductory Biology - Plants (5)
Plant structure, function, and diversity with emphasis placed on ecological and evolutionary aspects of seed plants. Three hours lecture and six hours laboratory. Prerequisite: ENGL 110. Lab fee required.

BIOL 220 Current Health Problems (3)
A study of selected factors pertaining to current public health problems, with emphasis on the physiological and sociological effects of the use of tobacco, alcohol, and drugs; developing self-awareness for health by appropriate utilization of the health system, wellness as a life-long concept through health information services; fostering physical fitness and knowledge of nutrition, especially for children and young adults; and thorough stress management. Three hours lecture. Not acceptable for the major or minor. Prerequisite: Completion of General Education Area B. Fulfills requirement for teaching credential.

BIOL 250 Human Anatomy (5)
Major structures of the human body with an emphasis on the integration of histology and gross anatomy of the skeletal, muscular, nervous, circulatory, respiratory, digestive, excretory, reproductive and endocrine systems. Not acceptable for the BS in Biology degree or the Biology minor. Three hours lecture and six hours laboratory. Lab fee required.

BIOL 255 Human Physiology (5)
Functions of major body systems with emphasis on mechanics, control, and integration. Discussion of the nervous, muscle, circulatory, respiratory, urinary, reproductive, gastrointestinal and endocrine systems. Not acceptable for the BS in Biology degree or the Biology minor. Five hours lecture. Prerequisites: BIOL 250 or 201 and CHEM 150 or higher.

BIOL 256 Laboratory in Human Physiology (1)
Laboratory investigations into the functions of major systems of the human body. Experiments dealing with the physiology of muscles, the circulatory and respiratory systems, metabolism and body fluids are included. Not acceptable for the BS in Biology degree or the Biology minor. Three hours laboratory. Lab fee required. Corequisite: BIOL 255.

BIOL 260 Microbiology (5)
Physiochemical organization and function of microorganisms including bacteria, viruses, protozoa, helminths, and fungi. Concepts of pathogenic microbiology are emphasized in both lecture and laboratory. Not acceptable for the BS in Biology degree or the Biology minor. Three hours lecture and six hours laboratory. Prerequisite: CHEM 150, 211 or equivalent. Lab fee required.

BIOL 270 Principles of Nutrition (3)
Fundamentals of human nutrition based on the chemical and physiological processes of nutrient selection, digestion, absorption, and metabolism. Principles of nutrition information encountered in the public domain with emphasis on weight management. Selected coverage of nutritionally influenced disease processes across the life span. The special nutritional needs of children, pregnant women, and athletes are discussed. Three hours lecture. Not acceptable for the BS in Biology degree or the Biology minor. Prerequisite: Satisfaction of General Education Area B.
BIOL 289 Experiential Prior Learning (variable units)
Evaluation and assessment of learning that has occurred as a result of prior off-campus experience relevant to the Biology curriculum. Requires complementary academic study and/or documentation. Available by petition only, on a credit, no-credit basis. Not open to post-graduate students. Interested students should contact the Biology Department office.

Upper Division

BIOL 301 Research Design and Analysis (5) (formerly BIOL 310)
Construction of basic experimental designs based upon literature and data analyses. Students develop and participate in experimental designs of selected research projects including measurements, statistical analyses, and interpretation of data. Special emphasis placed upon the written presentation of the investigation. Two hours lecture and nine hours laboratory. Recommended for all upper division elective courses. Prerequisites: BIOL 201 (with a C- or better), 202 and 203. Recommended: MATH 140 or higher.

BIOL 304 General Genetics (4)
Physical and chemical basis of inheritance in cells, individuals, and populations, including molecular mechanisms of heredity. Four hours lecture. Prerequisites: CHEM 150 or 211 and BIOL 201 (with a C- or better) and 202 or 203 or CHEM 150 or 211 and BIOL 201 (with a C- or better), 255 and 260.

BIOL 305 General Physiology (4)
General aspects of cellular and organismic function in animals and plants with special emphasis on physical and chemical properties that regulate physiological processes. Topics include biological solutions, membrane characteristics, fluid dynamics, gas flow, material exchange, energy acquisition and utilization, and heat exchange. Four hours lecture. Prerequisite: CHEM 150 or 211 and BIOL 201 (with a C- or better) and 202 or 203 or CHEM 150 or 211 and BIOL 201 (with a C- or better), 255 and 260.

BIOL 306 General Ecology (4)
Relationships between organisms and their environment with emphasis placed on evolutionary mechanisms and terrestrial ecosystems. Topics will illustrate ecological principles and methods. Four hours lecture. Prerequisite: BIOL 201 (with a C- or better), 202 and 203 and CHEM 150 or 211.

BIOL 312 General Microbiology (5)
A comprehensive overview of the biology of microorganisms. Topics include microbial cell structure and function, physiology, metabolism, genetics, diversity, and ecology. Applied aspects of microbiology are also covered such as biotechnology, the role of microorganisms in environmental processes, food, and medical microbiology. Laboratory emphasizes methods in bacteriology, microbial diversity, and a research project. Three hours lecture and six hours laboratory. Lab fee required. Prerequisites: BIOL 301 and CHEM 150 or 211.

BIOL 319 Hematology (4)
Study of organs, cells, and molecules responsible for the recognition and disposal of foreign materials that enter the body. Practical considerations and applications. Four hours lecture. Prerequisite: BIOL 201 (with a C- or better); BIOL 319 recommended.

BIOL 321 Plant Diversity (5)
Phylogeny and classification of vascular plants with emphasis on field recognition and identification of important plant families and genera characterizing the major floristic regions of California. Lectures review taxonomic diversity, evolutionary relationships, and eco-geographic patterns of western floras. Laboratory includes weekend field trips for which a fee is required. Three hours lecture and six hours laboratory. Prerequisites: BIOL 201 (with a C- or better) and 203.
Biology

BIOL 322 Vertebrate Diversity (5)
Diversity, evolution, and biology of fish, amphibians, reptiles, and mammals, with special emphasis on the biology and identification of local species. Three hours lecture and six hours laboratory. Prerequisite: 301.

BIOL 323 Studies in Animal Rehabilitation (5)
Study and practicum of the repair, care, and release of injured animals; studies of the life histories, ecology, and biology of birds, particularly raptors. Three hours lecture and six hours laboratory. Prerequisite: 301 or consent of instructor.

BIOL 323L Practicum in Animal Rehabilitation (2)
Practicum in the repair, care and release of injured animals; present conservation programs to schools and groups. Six hours laboratory. Can be repeated. Not applicable to the major or minor. Credit/No Credit. Prerequisite: BIOL 323 or consent of instructor.

BIOL 324 Insect Biology and Diversity (5)
Comparative study of aquatic and terrestrial insects with emphasis placed on terrestrial insect diversity. Laboratory focuses on comparative morphology, phylogeny, classification, and student projects. Three hours lecture and six hours laboratory. Prerequisites: BIOL 201 (with a C- or better) and 202. Lab fee required.

BIOL 330 Molecular Genetics (5)
Evolution and molecular organization of the cell, macromolecules of organisms and gene expression. Emphasis placed on recombinant DNA techniques, genetic engineering and biotechnology. Five hours lecture. Prerequisite: BIOL 304.

BIOL 342 Cell Physiology (5)
Discussions of current topics in cellular physiology with emphasis placed on bioenergetics, enzyme kinetics and regulation of cellular activity. Three hours lecture and six hours laboratory. Prerequisite: BIOL 301.

BIOL 351 Comparative Vertebrate Anatomy (5)
Classical anatomy and the analysis of form in terms of the phylogenetic history of the major vertebrate groups: fishes, amphibians, turtles, lizards and snakes, birds and mammals. A survey of the vertebrate groups is followed by the study of the skeletal, muscular, digestive, respiratory, circulatory, urogenital, nervous and sensory systems. Three hours lecture and six hours laboratory. Prerequisite: BIOL 301. Lab fee required.

BIOL 355 Human Pathophysiology (5)
Human physiology with emphasis on the mechanisms of disease. Topics include physical responses to injury, disturbances of homeostasis in major body systems, and both physical and chemical stressors. Five hours lecture. Prerequisite: BIOL 255 or 357.

BIOL 357 Human Physiology (5)
Human physiology with an integrative approach to organ system function. Topics include the nervous, muscle, circulatory, respiratory, digestive, renal, reproductive, and endocrine systems. Laboratory emphasis will be placed on quantitative measurement of physiological responses in the major organ systems. Three hours lecture and six hours laboratory. Lab fee required. Prerequisites: BIOL 301 and either 250 or 305.

BIOL 360 Bioinformatics (5)
Introduction to basic concepts, methods and tools used in bioinformatics and their application to biological sequence and structure data analysis. Topics include (but not limited to) bioinformatics databases, sequence and structure alignment, motif and domain finding, gene, RNA and protein structure prediction, protein-protein interaction, microarray technology and data analysis, genome annotation and comparative genomics. Three hours lecture six hours laboratory. Prerequisites: BIOL 301 and 330.

BIOL 362 Plant Physiology (5)
Terrestrial plant physiology at the molecular, cellular, and organ scales relating to plant physiological and structural traits that facilitate the maintenance of homeostasis, determine productivity, and that represent key adaptations among vascular plants. Central topics covered include issues of scale, transport, water balance, energy metabolism, growth and development, regulation, and reproduction. Three hours lecture and six hours laboratory. Prerequisite: BIOL 301. Lab fee required.

BIOL 377 Special Topics in Biology (1-5)
Topics of current interest in biology. Although repeatable, a maximum of five units may be applied toward the major or minor, subject to advisor approval. Not necessarily restricted to Biology majors.

BIOL 404 Conservation Biology (5)
Study of problems related to biological conservation, including endangered species issues, environmental laws, and mitigation solutions required by regulations. Includes site visits to conservation areas, collection of biological data, preparation of assessment reports, and study environmental impact reports. Two hours lecture and nine hours laboratory. Prerequisites: BIOL 301 and 306.

BIOL 406 Advanced Ecology (5)
Advanced study of ecology. Emphasis includes evolutionary perspectives of physical and biological environments, population dynamics, and ecosystem stability. Laboratory emphasis will be placed on analytical methods used in the field. Laboratory includes weekend field trips. Two hours lecture and nine hours laboratory. Prerequisites: BIOL 301 and 306. Field trip fee required.
BIOL 412 Microbial Physiology (5)
This course focuses on the study of microbial structure and function. In particular, students will learn about fermentation procedures, bioremediation with the help of microbes, composting, and detection of antibiotic producing microbes, use of microbes to supply fresh drinking water, safe disposal of sewage, and how microbes are used in food, beer and wine production. Two hours lecture nine hours laboratory. Prerequisites: BIOL 301 and 312.

BIOL 414 Medical Microbiology (5)
Isolation and identification procedures and the clinical significance of medically important microorganisms (mainly bacteria). Key points of these organisms’ epidemiology and pathogenic mechanisms will be discussed. Skills concerning the isolation and identification of medically important bacteria are emphasized in laboratory. Three hours lecture and six hours laboratory. Lab fee required. Prerequisite: BIOL 260 or 312.

BIOL 424 Evolutionary Genetics (5)
Contributions of molecular genetics to the understanding of evolution. Emphasis is placed on the processes of mutation, selection, and random genetic events as they affect the genetic architecture of natural populations and the process of speciation. Topics include quantitative inheritance, population genetics, phylogenetics, conservation genetics, and bioinformatics. Two hours lecture and nine hours laboratory. Prerequisites: BIOL 301 and 304.

BIOL 430 Advanced Molecular Genetics (5)
Advanced concepts of molecular genetics, including DNA damage and repair, homologous recombination, transposition, alternative splicing and posttranscriptional regulation of gene expression. Additional topics that contribute to an understanding of gene expression will include recent advances in genomics, proteomics and bioinformatics. Two hours lecture and nine hours laboratory. Prerequisites: BIOL 301 and 330.

BIOL 433 Developmental Biology (5)
Development and growth of organisms from fertilization to the establishment of organ systems. Two hours lecture and nine hours laboratory. Prerequisites: BIOL 301 and 304. Lab fee required.

BIOL 440 Honors Practicum in the Teaching of Biology (3)
Theory and practice in teaching biology at the undergraduate level. Regular meetings with the faculty sponsor and supervised experience in course design, lecturing, tutoring, laboratory preparation and delivery, administering and scoring examinations, and leading classroom discussions. Two hours lecture and three hours laboratory. Offered on a credit, no-credit basis only. Prerequisites: Open to biology majors by faculty invitation only, Senior status and a GPA above 3.2.

BIOL 451 Functional Analysis of Vertebrate Structure (5)
Anatomy of vertebrates interpreted in terms of function including support, running, jumping, digging, climbing, swimming, flying and feeding. These functions are studied in their environmental context and as evolutionary adaptations. Independent student project will focus on one of these adaptations. Two hours lecture and nine hours laboratory. Prerequisite: BIOL 351. Lab fee required.

BIOL 455 Physiological Measurements (5)
Physiological measurement techniques focusing on data collection and analysis of selected vertebrate organ systems. Discussion topics include electrical properties of nerve, cardiac and skeletal muscle tissues, pulmonary and metabolic function, and sensory physiology. Emphasis will be placed on understanding the mechanisms of how each system works and the benefits and limitations of the measurement techniques currently available. Two hours lecture and nine hours laboratory. Prerequisites: BIOL 255 or 357, BIOL 301 and 305. Lab fee required.

BIOL 462 Physiological Plant Ecology (5)
The physiological basis of growth, reproduction, survival, abundance, and geographical distribution of plants. The ecological context of these processes will be examined by considering how plants are affected by interactions with the physical, chemical, and living components of their environment. Topics include the adaptive significance and evolutionary origins of plant functional traits. Two hours lecture and nine hours laboratory. Prerequisites: BIOL 301 and 305. Lab fee required.

BIOL 470 Evolution (5)
Study of the processes of organic evolution. Five hours lecture. Prerequisites: Open only to senior Biology majors who have completed BIOL 301, 304, 305, and 306.
BIOL 477 Special Topics in Biology (1-5)
Contemporary or interdisciplinary problems of current interest. Typical topical areas might include pollution, population or integrative biological phenomena. Although repeatable for different topics, a maximum of five units may be applied toward the major or minor, subject to advisor approval. Not necessarily restricted to Biology majors.

BIOL 480 Research (1-5)
Independent research: the student formulates a problem and research design in consultation with the faculty, conducts the investigation, compiles and analyzes the data, and presents the findings in written form. Offered on a credit, no-credit basis only. Although repeatable, a maximum of five units may be applied towards the major or minor. Available by consent of instructor.

BIOL 489 Experiential Prior Learning (variable units)
Evaluation and assessment of learning which has occurred as a result of prior off-campus experience relevant to the curriculum of the department. Requires complementary academic study and/or documentation. Available by petition only, on a credit, no-credit basis. Although repeatable, a maximum of five units may be applied toward the major or minor. Not open to post-baccalaureate students. Interested students should contact the department office.

BIOL 490 Senior Seminar (3)
Student original research presentations and discussion of current topics in biology. Three hours discussion. Prerequisites: Open only to senior Biology majors who have completed BIOL 301 and 40 units of Biology courses.

BIOL 490B Senior Seminar (3)
Student presentation of original research: Open only to senior Human Biological Sciences majors who have completed 30 units of upper division coursework specific to the major.

BIOL 496 Internship in Biology (1-5)
Internships may be arranged by the department with various agencies, businesses, or industries. The assignments and coordination of work projects with conferences and readings, as well as course credits, evaluation, and grading are the responsibility of the faculty liaison (or course instructor) working with the field supervisor. Offered on a credit, no-credit basis only. Department will determine credits and application of credit. Although repeatable, a maximum of five units may be applied toward the major or minor.

BIOL 497 Cooperative Education (variable units)
The Cooperative Education program offers a sponsored learning experience in a work setting, integrated with a field analysis seminar. The field experience is contracted by the Cooperative Education office on an individual basis, subject to approval by the department. The field experience, including the seminar and reading assignments, is supervised by the cooperative education coordinator and the faculty liaison (or course instructor), working with the field supervisor. Students are expected to enroll in the course for at least two quarters. The determination of course credits, evaluation, and grading are the responsibility of the departmental faculty. Offered on a credit, no-credit basis only. Department will determine application of credit.

GRADUATE COURSES
Graduate courses are listed in the “Graduate Programs” section of this catalog.