

SENATE RESOLUTION 18-01

**Motion: to approve the Bachelor of Science in Biology with an
Emphasis in Cell and Molecular Biology**

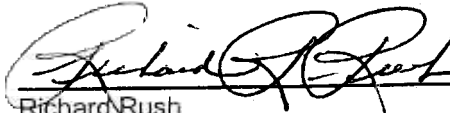
Passed at the November 6, 2001 meeting of the Academic Senate

APPROVALS:



Dennis Muraoka
Chair, Academic Senate

Date: 11/21/01



Richard Rush
President, CSU Channel Islands

Date: 11/27/01

PROPOSAL TO OFFER A NEW ACADEMIC PROGRAM/ MAJOR IN FALL 2002
(LONG FORM)

Proposed Name of Degree: Bachelor of Science in Biology
Options/ Emphases in the Degree: Cell and Molecular Biology
Faculty Proposing New Program: Ching-Hua Wang, Professor of Biology

Review and Approval:

1. Curriculum Committee Approval:

Curriculum Chair: W. H. Allen Date: 11/6/01

2. Academic Senate Approval:

Chair, Academic Senate: Dei Hua Date: 11/6/01

3. Administration Approval:

President (or designee): _____ Date: _____

PROCEDURE FOR SUBMITTING PROPOSALS FOR NEW DEGREE MAJOR PROGRAMS

A campus, in accordance with its approved academic master plan, submits detailed proposals for new degree major programs to the Office of Academic Program Planning for review and approval in the academic year preceding projected implementation. Approval of any degree major program is subject to campus assurances that financial support, qualified faculty, physical facilities and library holdings sufficient to establish and maintain the program will be available within current budgetary support levels. The proposal must follow the format below, and four copies should be sent to Academic Program Planning, Office of the Chancellor.

1. Definition of the Proposed Degree Major Program

- a. Name of the campus submitting the request, the full and exact designation (degree terminology) for the proposed degree major program, and academic year of intended implementation.

Campus- California State University Channel Islands

Degree- Bachelor of Science in Biology

Bachelor of Science in Biology with an Emphasis in Cell and Molecular Biology

Implementation- Fall, 2002

- b. Name of the department, departments, division or other unit of the campus that would offer the proposed degree major program. Identify the unit that will have primary responsibility.

Academic Affairs, CSUCI

- c. Name, title, and rank of the individual(s) primarily responsible for drafting the proposed degree major program.

Ching-Hua Wang, MD, PhD, Professor of Biology, CSUCI

- d. Objectives of the proposed degree major program.

To offer BS degree in Biology and BS degree in Biology with an Emphasis in Cell and Molecular Biology to students, and prepare them to become highly valued with powerful analytical skills and a sophisticated expertise in life sciences for such diverse vocations as scientific research, teaching, consulting, biotechnology, and the health professions.

To provide required and elective biology courses to students in the Environmental Science and Resource Management program;

To provide biology courses for the CSUCI General Education requirements;

To provide courses for a Biology Concentration in the Liberal Studies degree program;

To contribute to the Teacher Education programs at CSUCI to address California mandated requirements for education in sciences at the primary and secondary educational levels;

To provide the CSUCI academic program with areas of content that enable the university to meet philosophical, educational and cultural goals of its mission.

- e. Total number of units required for the major. List of all courses, by catalog number, title, and units of credit, to be specifically required for a major under the proposed degree program. Identify those new courses that are (1) needed to initiate the program and (2) needed during the first two years after implementation. Include proposed catalog descriptions of all new courses.

REQUIREMENTS FOR THE BACHELOR OF SCIENCE DEGREE IN BIOLOGY (120 units):

COMMON LOWER DIVISION

REQUIREMENTS (31 units):

(12 units of the following will be counted toward lower division
GE credits, 4 units in each of three different disciplines)

1. Biology
 - BIOL 200 Principles of Organismal and Population Biology .. 4
 - BIOL 201 Principles of Cell and Molecular Biology..... 4
 - BIOL 202 Biostatistics 3
2. Mathematics
 - MATH 150 Calculus I 4
3. Chemistry
 - CHEM 121 General Chemistry I 4
 - CHEM 122 General Chemistry II 4
4. Physics
 - PHYS 200 General Physics I..... 4
 - PHYS 201 General Physics II..... 4

For General Biology and Pre-Professional Students:

UPPER DIVISION REQUIREMENTS (32 units):

1. Organic Chemistry
 - CHEM 311 & 312 Organic Chemistry I 4
 - CHEM 314 & 315 Organic Chemistry II 4
 - (Organic Chemistry I & II taken at the 200 levels from community colleges are accepted as a year of organic chemistry for the Biology major.)
 2. Biology
 - BIOL 300 Cell Physiology 4
 - BIOL 302 Genetics and Evolution..... 3
 - BIOL 330* Ecology and the Environment..... 4
 - BIOL 346* Scientific and Professional Ethics..... 3
 - BIOL 400 Molecular Biology and Molecular Genetics 4
 3. Computing in Biology
 - Select one of the following courses:
 - BIOL 410 Computer Applications in Biomedical Fields 3
 - BIOL 430* Research Design and Data Analysis 3
 4. Service Learning
 - A minimum of 2 units taken from the following:
 - BIOL 494 Independent Research..... 2
 - BIOL 497 Directed Study..... 2
 5. Capstone
 - BIOL 499 Senior Capstone Colloquium 1
- (Courses with * are double-counted toward UD GE credits.)

ELECTIVES IN BIOLOGY (15 UNITS):

A minimum of 15 units chosen from 300 to 400 level upper division biology courses, with at least one lab-based course and only one course that could be taken at 300 level (no courses from BIOL 331 to 333 would be counted toward the major).
CHEM 318 or CHEM 400 could also be taken to satisfy the electives.

REQUIRED SUPPORTING AND OTHER GE COURSES (42 units):

- ENGL 330 Writing in the Disciplines..... 3
- Title V Courses 6
- Other GE Courses in Categories A-E 33

For Biology Students in Cell and Molecular Biology Emphasis:

UPPER DIVISION REQUIREMENTS (40-41 units):

1. Organic Chemistry and Biochemistry
CHEM 311 Organic Chemistry I 3
CHEM 312 Organic Chemistry I Laboratory 1
CHEM 318 Biological Chemistry 3
(Note: Students completing the following courses to satisfy this category will obtain a Minor in Chemistry in addition to a Major in Biology:
CHEM 311 Organic Chemistry I 3
CHEM 312 Organic Chemistry I Laboratory 1
CHEM 314 Organic Chemistry II 3
CHEM 315 Organic Chemistry II Laboratory 1
CHEM 400 Biochemistry 4
Organic Chemistry I & II taken at the 200 levels from community colleges are accepted as a year of organic chemistry for the Biology major.)
2. Biology
BIOL 300 Cell Physiology 4
BIOL 301 Microbiology 4
BIOL 302 Genetics and Evolution 3
BIOL 330* Ecology and the Environment 4
BIOL 346* Scientific and Professional Ethics 3
BIOL 400 Molecular Biology and Molecular Genetics 4
BIOL 401 Biotechnology and Recombinant DNA Technology 5
3. Computing in Biology
Select one of the following courses:
BIOL 430* Research Design and Data Analysis 3
BIOL 431* Bioinformatics 4
4. Service Learning
A minimum of 2 units taken from the following:
BIOL 492 Biotech Internship 2-3
BIOL 494 Independent Research 2
BIOL 497 Directed Study 2
5. Capstone
BIOL 499 Senior Capstone Colloquium 1
(Courses with * are double-counted toward UD GE credits.)

ELECTIVES IN BIOLOGY (10 UNITS):

A minimum of 10 units chosen from 400 level courses, excluding BIOL 410.

REQUIRED SUPPORTING AND OTHER GE COURSES (38-39 units):

- ENGL 330 Writing in the Disciplines 3
Title V Courses 6
Other GE Courses in Categories A-E 29-30

REQUIREMENTS FOR CERTIFICATE IN BIOTECHNOLOGY (24-25 units):

(For students with a B.S. degree in biology pursuing a certificate in biotechnology)

1. B.S. degree in biology (may be concurrent);
2. Completion of the following courses with "C" or better grades:
CHEM 318 or 400 Biological Chemistry or Biochemistry I... 3-4
BIOL 401 Biotechnology and Recombinant DNA Technology 5
BIOL 420 Cellular and Molecular Immunology 3
BIOL 431 Bioinformatics 4
3. Complete another 6 units of upper-division biology courses in consultation with the program director;
4. Complete a Biotech Internship course;
5. Complete the Capstone course;
6. Approval by the program director.

As indicated above, a total of 120 units are required for the major

Summary of Total Units for Graduation with BS Degree in Biology

Common Lower Division Requirements.....	31
2. Upper Division Requirements	
a. General Biology and Pre-Professionals.....	32
b. Cell and Molecular Biology Emphasis.....	40-41
3. Electives in Biology	
a. General Biology and Pre-Professionals.....	15
b. Cell and Molecular Biology Emphasis.....	10
4. Required Supporting and GE Courses	
a. General Biology and Pre-Professionals.....	42
b. Cell and Molecular Biology Emphasis.....	38-39
Including ENGL 330.....	3
Title V Courses.....	6
Other GE Courses.....	30-34
(Some courses are double-counted in major and categories of GE which makes the total GE plus Title V course units to 54)	
Total units	120

- (1) To initiate the program in 2002, we need to offer upper-division courses to transfer students. We also need to offer BIOL 202, Biostatistics to transfer students who have not taken this required course at the community colleges.
- (2) All upper-division courses are needed during the first two years for transfer students, including students in Biology and Environmental Science and Resource Management.
- (3) All lower-division courses are needed for in-coming freshmen beginning in 2003.

COURSE DESCRIPTIONS:

BIOL 100. GENERAL BIOLOGY (4)

An introduction to organismal biology, including the diversity, structure, and function of prokaryotes, protists, fungi, plants, and animals. Also includes the principles of evolution, ecology and population biology. No credit given toward the biology major. Weekly three-hour lectures and three-hour laboratories. A standard lab fee is required.

BIOL 200. PRINCIPLES OF ORGANISMAL AND POPULATION BIOLOGY (4)

An introduction to organismal biology, including the diversity, comparative structure, organ system function, development, phylogeny, taxonomy and systematics of prokaryotes, protists, fungi, plants, and animals. Discussion of the principles of evolution including speciation and natural selection, the environmental impact and ecosystem interaction of plants and animals, the behavior of animals, population genetics and population biology. Weekly three-hour lectures and three-hour laboratories. A standard lab fee is required.

BIOL 201. PRINCIPLES OF CELL AND MOLECULAR BIOLOGY (4)

Prerequisite: CHEM 121; BIOL 200 with "C" or better grade for biology majors. (No prerequisite for students in Liberal Studies, Teaching and Learning Option.)

This course will cover principles and applications of basic chemistry, biological macromolecules, prokaryotic and eucaryotic cell structure and function, homeostasis, metabolism including both respiration and photosynthesis, cell cycling, signal transduction, Mendelian genetics, molecular genetics including transcription and translation, and a brief introduction to virology and immunology. The philosophy of science, scientific method and experimental design are foundational to the course. Weekly three-hour lectures and three-hour laboratories. A standard lab fee is required.

BIOL 202. BIOSTATISTICS (3)

Use of probability and statistics in the description and analysis of biological data collected from laboratory and or field experiments. Weekly three-hour laboratory instruction and exercise. (Same as MATH 202)

BIOL 210. HUMAN ANATOMY AND PHYSIOLOGY I (4)

Prerequisite: BIOL 100.

Gross and microscopic anatomy and organ system of human body with integrated physiological functions of the nine body organ systems studied from organ system through cellular levels of organization including basic chemistry, cell metabolism, acid-base relationships, membrane function, basic genetics, alleles and inherited disorders. No credit given toward the biology major. Weekly three-hour lectures and three-hour laboratories. A standard lab fee is required.

BIOL 211. HUMAN ANATOMY AND PHYSIOLOGY II (4)

Prerequisite: BIOL 210.

Continuation of BIOL 210. No credit given toward the biology major. Weekly three-hour lectures and three-hour laboratories. A standard lab fee is required.

BIOL 212. NEUROBIOLOGY AND COGNITIVE SCIENCE (3)

Prerequisite: BIOL 100.

Principles of brain organization and function underlying behavior. Topics include neuroanatomy and physiology of language, vision, sexual behavior, memory and abnormal behavior. No credit given toward the biology major. Weekly three-hour lectures. (Same as PSY 212)

BIOL 300. CELL PHYSIOLOGY (4)

Prerequisites: CHEM 122; CHEM 311 and 312 or concurrent enrollment; BIOL 201 with "C" or better grades.

Detailed study of the organization and functioning of cells and cellular organelles at the cellular and molecular levels, emphasizing experimental approaches and structural and functional relationships and their regulation and control. Topics include macromolecules, membrane phenomena, metabolism, enzyme kinetics, and cellular events associated with excitable cells and tissues. Individual research paper on a current aspect of cellular and molecular biology required. Weekly three-hour lectures and three-hour laboratories. A standard lab fee is required.

BIOL 301. MICROBIOLOGY (4)

Prerequisites: CHEM 122; BIOL 201 with "C" or better grades.

Study of microorganisms of the environment, including disease-causing organisms, their structures and functions and their interactions to their host animals and the environment. Weekly three-hours lectures and two one-and-a-half hour-laboratories. A standard lab fee is required.

BIOL 302. GENETICS AND EVOLUTION (3)

Prerequisites: CHEM 122; BIOL 201 with "C" or better grades.

Principles of classical transmission genetics, population genetics and evolution, with an introduction to modern molecular genetics. Weekly three-hour lectures.

BIOL 310. ANIMAL BIOLOGY AND ECOLOGY (4)

Prerequisites: BIOL 100 or BIOL 201.

Animal adaptation and diversity and their relationship to the development of evolutionary theory and the environment. Identification of common invertebrate and vertebrate animals. No credit given toward the biology major. Weekly three-hour lectures and three-hour laboratories with periodic field trips in local ecosystem and its animals. A standard lab fee is required.

BIOL 311. PLANT BIOLOGY AND ECOLOGY (4)

Prerequisite: BIOL 100 or BIOL 201.

A general introduction of diverse structures and functions of plants and their relationship to the environment. Identification of common, local native plants and plant communities, uses of native plants by Native Americans, and human and environmental impacts on native plant communities. No credit given toward the biology major. Weekly three-hour lecture and three-hour laboratories with periodic field trips. A standard lab fee is required.

BIOL 312. MARINE BIOLOGY (4)

Prerequisite: BIOL 201.

Overview of complexity of marine life including marine plants and animals and the processes that underlie their distribution and abundance in open oceans, coastal regions, estuaries, and wetlands. Diverse interactions of organisms in the intertidal zone, over the continental shelves and in the open oceans. Weekly three-hour lectures and three-hour laboratories with periodic field trips. A standard lab fee is required.

BIOL 330. ECOLOGY AND THE ENVIRONMENT (4)

Ecological characteristics of natural ecosystems and basic effects of human society upon those systems. Plant and animal distribution patterns in relation to past and present physical and biotic factors. Issues of resource management, population, food production, global environmental problems will be emphasized to explore future directions. Weekly three-hour lectures and three-hour laboratories, including periodic field trips. A standard lab fee is required. (Same as ANTH 330)

BIOL 331. BIOTECHNOLOGY IN THE TWENTY- FIRST CENTURY (2)

Presentation of recent advances in biotechnology and discussion of societal implications. Topics include applications in basic research, medicine, agriculture, consumer products and warfare. No credit given toward the biology major. Weekly two-hour lectures.

BIOL 332. CANCER AND SOCIETY (2)

The biological, clinical and psychological nature of cancer and its impact on society from perspectives of medical researchers and physicians. No credit given toward the biology major. Weekly two-hour lectures augmented by readings and discussion.

BIOL 333. EMERGING PUBLIC HEALTH ISSUES (2)

Discussion of emerging infectious diseases and other health related issues with global concerns such as AIDS, tuberculosis, sexually transmitted diseases, cardiovascular diseases, animal and bird diseases which may be transmitted to people, food and blood safety issues, environmental public health hazards, immigration and public health issues, potential biological weapons and their impact on human and animal populations in the world and the ecosystem. Weekly two-hour lectures.

BIOL 346. SCIENTIFIC AND PROFESSIONAL ETHICS (3)

Discussion of ethical issues and societal challenges derived from scientific research and professional activities. Examines the sources, fundamental principles, and applications of ethical behavior; the relationship between personal ethics and social responsibility of organizations; and the stakeholder management concept. Applies ethical principles to different types of organizations: business, non-profits, government, health care, science/technology, and other professional groups. Topics also include integrity of scientific research and literature and responsibilities of scientists to society, intellectual property, ethical practices in professional fields, ethical dilemmas in using animal or human subjects in experimentation, gene cloning, animal cloning, gene manipulation, genetic engineering, genetic counseling, and ethical issues of applying biotechnology in agricultural fields. Emphasizes cases to explore ethical issues. Weekly three-hour lectures and discussions. (Same as MGT 346)

BIOL 400. MOLECULAR BIOLOGY AND MOLECULAR GENETICS (4)

Prerequisites: CHEM 314 & 315, 318 or 400; BIOL 300 and 302 with "C" or better grades.

Study of informational macromolecules and how they direct molecular processes in both eucaryotic and prokaryotic cells. Topics include structure, function and regulation of the genetic material at the molecular level, gene organization, structures and functions of DNA, RNA and proteins, gene transcription and expression, RNA processing, genomics and proteomics. Weekly three-hour lectures and three-hour laboratories. A standard lab fee is required.

BIOL 401. BIOTECHNOLOGY AND RECOMBINANT DNA TECHNOLOGY (5)

Prerequisites: CHEM 318 or 400; BIOL 300 and 302 with "C" or better grades.

Theory and practice of various biotechnologies and recombinant DNA technology applicable to research and development, drug discoveries, clinical therapies, preventative medicine, agriculture, criminal justice system, and a variety of other fields. Modern techniques in genomics and proteomics will be introduced in the laboratories. Weekly three-hour lectures and six-hour laboratories. A standard lab fee is required.

BIOL 402. TOXICOLOGY (3)

Prerequisites: CHEM 122; BIOL 201 with "C" or better grades.

An in depth study of toxic chemicals and their interactions within the ecosystems. Topics include the origin, fate, chemical and biological detection, and quantification of pollutants and toxins and their impact on organisms at the molecular, biochemical, cellular, physiological, organismal, and community levels of organization. Basic toxicology, genetic toxicology, environmental mutagenesis and the molecular basis of mutation induction will be covered. Weekly three-hour lectures.

BIOL 410. COMPUTER APPLICATIONS IN BIOMEDICAL FIELDS (3)

Prerequisites: BIOL 201 with "C" or better grades.

Applications of computers and data processing technology to the understanding and solving of specific problems in biomedical fields. Weekly three-hour laboratory instruction and exercise. (Same as COMP 410)

BIOL 420. CELLULAR AND MOLECULAR IMMUNOLOGY (4)

Prerequisites: CHEM 122; BIOL 301 with "C" or better grades.

Study of cellular and molecular aspects of the immune system and its responses against infectious agents and or environmental insults. Included are development of the organs and cells of the immune system, genetics of the molecules of the immune system and their functions and interactions during an immune response, immunological disorders such as immunodeficiencies, autoimmune diseases, transplantation, and contemporary immunological techniques used in clinical diagnosis and other modern research and development applications. Weekly three-hour lectures and three-hour laboratories. A standard lab fee is required.

BIOL 421. VIROLOGY (3)

Prerequisites: CHEM 122; BIOL 301 with "C" or better grades.

Study of aspects of molecular structure, genetics, and replication of viruses and other sub-viral agents such as prions and viroids, virus-host interactions, pathogenesis of viral infections, diagnostic virology, and antiviral vaccines and drugs; emphasis on human pathogens. Weekly three-hour lectures.

BIOL 422. MOLECULAR PLANT PHYSIOLOGY (4)

Prerequisites: CHEM 318 or 400; BIOL 311 recommended; BIOL 300 with "C" or better grades.

Study of principles and methods of plant physiology at molecular level combined with modern plant technology. Topics include plant tissue and cell culture, genetic engineering and transformation, plant defense and genomics, and applications of DNA technology. Weekly three-hour lectures and three-hour laboratories. A standard lab fee is required.

BIOL 423. CELLULAR AND MOLECULAR NEUROBIOLOGY (3)

Prerequisites: CHEM 122; BIOL 212 recommended; BIOL 300 with "C" or better grades.

Study of the nervous system at cellular and molecular levels, including cellular structure of neurons and other types of neuronal cells and their functions and interactions, neurotransmitters and their functions and regulation, chemical agents and their effects on the neuronal cells and their functions, and normal responses by the cells and the molecules of the nervous system and their response under adverse conditions. Weekly three-hour lectures.

BIOL 424. HUMAN PHYSIOLOGY (3)

Prerequisites: CHEM 122; BIOL 300 with "C" or better grades.

Study of human physiology at both the cellular and organ system levels, including neurophysiology, muscle physiology, cardiovascular physiology, respiration, kidney function, hormone function and reproduction. Weekly three-hour lectures.

BIOL 425. HUMAN GENETICS (3)

Prerequisites: CHEM 122; BIOL 300 and 302 with "C" or better grades.

Basic principles of human inheritance, including the transmission of genetic traits, chromosomal abnormalities and their effects, gene structure and function, pedigree analysis, gene mapping, cytogenetics, mutations and mutagenic agents, cancer genetics, molecular analysis of inherited diseases and genetically controlled phenomena in humans. Weekly three-hour lectures.

BIOL 426. EMBRYOLOGY (4)

Prerequisites: CHEM 122; BIOL 300 with "C" or better grades.

Studies in comparative gametogenesis, morphogenesis, and reproductive physiology. Weekly three-hour lectures and three hour laboratories. A standard lab fee is required.

BIOL 427. DEVELOPMENTAL BIOLOGY (3)

Prerequisites: CHEM 122; BIOL 300 with "C" or better grades.

Studies in human developmental sequences from fertilization to adolescence and examine how the developmental processes can be altered due to genetic, drug or other environmental factors. Other animal systems (fly, frog, chick, mouse) will also be studied to aid in understanding anatomical, physiological, genetic and molecular mechanisms operating during gametogenesis, fertilization, cleavage, gastrulation and organogenesis. Weekly three-hour lectures.

BIOL 428. BIOLOGY OF CANCER (2)

Prerequisites: CHEM 122; BIOL 300 with "C" or better grades.

Principles of oncology are examined. Included are mechanisms of oncogenesis at cellular and molecular levels, characteristics of cancer, advantages and disadvantages of various therapies of cancer treatment. Weekly two-hour lectures.

BIOL 430. RESEARCH DESIGN AND DATA ANALYSIS (3)

Prerequisites: BIOL 202 with "C" or better grades.

Discussion on experimental design, sampling methods, data collection, and methods of data analysis related to scientific fields. Weekly three-hour laboratory instruction and exercise. (Same as MATH 430)

BIOL 431. BIOINFORMATICS (4)

Prerequisites: CHEM 318 or 400; COMP 150 recommended; BIOL 400 with "C" or better grades.

Computational methods for analysis of biological systems at all levels of scale from macromolecules to ecosystems. Topics include development of algorithms, macromolecular sequence analysis to determine structure and function, study phylogenetic relationships, imaging in two to four dimensions, and mathematical modeling in biological sciences. Technology applicable to research and development, gene discoveries, discoveries of new molecules, which could lead to drug discoveries, clinical therapies, and applications in preventative medicine, agriculture, criminal justice system, and a variety of other fields. Weekly four-hour laboratory instruction and exercise. A standard lab fee is required. (same as COMP 431)

BIOL 432. PRINCIPLES OF EPIDEMIOLOGY AND ENVIRONMENTAL HEALTH (3)

Prerequisites: CHEM 122; BIOL 201 with "C" or better grades.

Distribution and dynamics of human health problems and principles and procedures used to determine circumstances under which disease occurs or health prevails and to aid in managing and planning health and environmental systems. The broadened scope of epidemiology is examined through case studies and community and environmental health approach. Weekly three-hour lectures.

BIOL 490. SPECIAL TOPICS (1-3)

Prerequisites: CHEM 122; BIOL 300 with "C" or better grades.

Group study of a selected topic, the title of which is to be specified in advance. May be repeated for credits as topics change.

BIOL 491. SPECIAL LABORATORY TOPICS (1-3)

Prerequisites: CHEM 122; BIOL 300 with "C" or better grades.

Group laboratory study of a selected topic, the title of which is to be specified in advance. May be repeated for credits as topics change. A standard lab fee is required.

BIOL 492. BIOTECH INTERNSHIP (2-3)

Prerequisites: CHEM 318 or 400; BIOL 400 and 401 with a minimum overall grade point average of 3.0 or program approval.

Supervised work and study in work situations involving biological research, technical skills, and service learning. Up to three units may be applied toward degree in biology program. All students are required to attend the Biology Program Senior Capstone Colloquium scheduled at the end of each semester to present their projects. Graded credit/no credit.

BIOL 494. INDEPENDENT RESEARCH (2)

Prerequisites: CHEM 122 or 311 and 312, 318 or 400; BIOL 300 with a minimum overall grade point average of 3.0 or consent of instructor and program approval.

Laboratory and/or library research in selected areas in biology conducted under the direction of a faculty member. A total of four units by taking the course twice may be applied toward graduation. All students are required to attend the Biology Program Senior Capstone Colloquium scheduled at the end of each semester to present their projects. Graded credit/no credit.

BIOL 497. DIRECTED STUDY (2)

Prerequisites: CHEM 122; BIOL 300 with "C" or better grades; Consent of instructor and program approval.

Reading and library research in an area of biology conducted under the direction of a faculty member in Biology. No more than two units may be applied toward graduation. All students are required to attend the Biology Program Senior Capstone Colloquium scheduled at the end of each semester to present their projects. Graded credit/no credit.

BIOL 499. SENIOR CAPSTONE COLLOQUIUM (1)

Prerequisites: BIOL 492, 494 or 497 with credits.

Oral presentation of completed or work-in-progress projects of BIOL 492, 494, or 497 courses. Only one unit may be applied toward graduation. Graded credit/no credit.

- f. List of elective courses, by catalog number, title, and units of credit, that can be used to satisfy requirements for the major. Identify those new courses that are (1) needed to initiate the program and (2) needed during the first two years after implementation. Include proposed catalog descriptions of all new courses.
- (1) Identify new courses to initiate the program:
The above are all new courses. No specific course is required as an elective to initiate the program for transfer students.
- (2) Courses needed for the first two years:
All upper-division courses are need in the first two years of implementation of the program so that students can graduate after two years.

(Note: With regard to Sections 1e and 1f, a proposed program should take advantage of courses already offered in other departments when subject matter would otherwise overlap or duplicate existing course content.)

- g. If any formal options, concentrations, or special emphases are planned under the proposed major, explain fully.

We plan to offer BS degree in Biology with an Emphasis in Cell and Molecular Biology. See the above requirements. The students enrolled in the Emphasis will be required to take more upper-division courses and therefore, less elective courses, to ensure their gaining sufficient knowledge and skills in the field of cell and molecular biology. Specifically, they would be required to take BIOL Microbiology, BIOL 401 Biotechnology and Recombinant DNA Technology, a Biochemistry course, and BIOL 431 Bioinformatics or BIOL 430 Research Design and Data Analysis. On top of these types of essential knowledge and skill courses, students can choose their electives from any of the upper-division courses, particularly from cellular and molecular immunology, virology, molecular plant physiology, cellular and molecular neurobiology, molecular genetics, human genetics, and cancer biology.

- h. Course prerequisites and other criteria for admission of students to the proposed degree major program, and for their continuation in it.

There is no additional course prerequisite or other criterion from the biology program beyond the standard admission criteria of the university.

Students seeking admission to the Biology degree program must be officially accepted into the CSUCI academic program.

Students must declare themselves as Biology majors.

Students must remain good academic standing throughout the duration of their enrollment in CSUCI.

Students must complete and fulfill the requirements of the degree program within a designated period specified by the university.

- i. Explanation of special characteristics of the proposed degree major program, e.g., in terminology, units of credit required, types of course work, etc.

The special characteristics of this program are:

- It takes 120 units to complete, which ensures that full-time students can complete the program in 4 years.

The program contains the most up-to-date essential fields in biology such as cell physiology, genetics and evolution, ecology and molecular biology as required upper-division courses, which will provide students with a rigorous and comprehensive education in biology. For students in the Cell and Molecular Biology (C+MB) Emphasis, they are required to take an additional 9 units of courses in microbiology and biotechnology and recombinant DNA technology, which will provide them with modern concepts and knowledge and newest technical skills.

The program contains lower-division and upper-division core courses, service learning, computing in biology and capstone courses, which will be useful vehicles to carry out community service, learning community activities, and formative and summative outcomes assessment.

Through service learning types of courses, students will be intimately engaged with the community they live in and will be able to apply the knowledge they learned from classrooms and laboratories to the real world. We, as faculty, are committed to constantly engaging ourselves with the local communities and what's going on in the fore-front of the biotech world, and the rest of the world at large, so that we will bring the real world and cutting-edge knowledge and skills to our students.

We design our courses using highly interdisciplinary approaches so that the subject matters we discuss during the classes are always closely tied to multiple aspects of people's lives.

Our GE and other courses are also designed to provide global perspectives to our students. Periodically, we will also invite guest lecturers from biotech companies, local professional practitioners, people with international experiences, and other relevant persons from the local communities into our classrooms to engage our students and faculty with the real world.

Bioinformatics is an emerging biotechnological field. We consider it vital to expose our students to this newest and fastest growing field. Hence, it is provided as one of the two courses for the students in the C+MB Emphasis to take within the category of computing in biology.

The upper-division elective courses allow students to satisfy their individual curiosity and the need to explore into more in-depth and specialized areas of biology. Since the C+MB Emphasis requires more upper-division courses, therefore, their units in electives are reduced.

The program contains required and elective biology courses to support the Environmental Science and Resource Management program.

- j. For undergraduate programs, provisions for articulation of the proposed major with community college programs.

For community college transfer students, they will most likely have completed their lower-division biology courses, which is to be articulated with the CAN Bio Seq A. Some of them, from Moorpark College and Oxnard College, might also have taken introductory statistics. These units are accepted by other CSU campuses and therefore, will be easily transferred to CSUCI.

For the chemistry requirements, we will allow the transfer of lower-division general chemistry as well as lower-division organic chemistry courses.

Physics and mathematics from community colleges should also articulate with our requirements. (see attached addendum of articulation)

- k. Provision for meeting accreditation requirements, where applicable, and anticipated date of accreditation request.

N/A

2. Need for the Proposed Degree Major Program

- a. List of other California State University campuses currently offering or projecting the proposed degree major program; list of neighboring institutions, public and private, currently offering the proposed degree major program.

All 4-year comprehensive CSU campuses, with the exceptions of Maritime Academy and Monterey Bay, and neighboring universities currently offer BS degree in Biology.

Northridge, San Diego, and San Francisco campuses offer Cell and Molecular Biology option. Sacramento and San Jose also offer BS degree in Biology with an Option in Cell Biology.

Cal Lutheran University offers a general undergraduate biology program with no special cell and molecular option or emphasis.

- b. Differences between the proposed program and programs listed in Section 2a above.

CSUCI is the only four-year public university in Ventura County that will offer a Bachelors of Science Degree in Biology and a BS degree with an Emphasis in Cell and Molecular Biology.

To reflect the rapidly advancing biological sciences, the Biology program at CSUCI is completely committed to the integration of newest technologies throughout our curriculum.

Despite the rigor of the program, our program requires 120 units to complete, which ensures that students can indeed finish the program and graduate in 4 years. Most of the aforementioned institutions required more than 120 units, e.g., the BS degree in Biology at California State University Northridge requires 131-139 units to complete, and at San Jose State University, it requires 132 units. In order for students enrolled in the biology programs to complete their degree requirements at these campuses, these extra units often translate into an additional semester or two for the students.

The program is well organized to include the lower-division core, upper-division core, computing in biology, service learning and capstone, and electives in biology.

It provides a solid one-year core biology courses plus Biostatistics as the lower-division requirements. The two core courses cover organismal, population, cell and molecular biology, which will introduce students in the major with a comprehensive background in biology. This set of courses will allow assessment activities to evaluate the students and the program as a whole during the initial phase of the four-year program.

It also contains the most up-to-date essential fields in biology such as Cell Physiology, Genetics and Evolution, Ecology, and Molecular Biology as required upper-division courses, which will provide students with a solid, rigorous and comprehensive education in biology. Cell Physiology provides the fundamentals of cell, which is the building block of *all* living organisms. This course requires all students to write a paper about a related topic in cell and

molecular biology, which will be used as a mid-program outcomes assessment tool. Genetics provides the basis of cellular structure, function and reproduction. Ecology broadens the scope of biological studies and Molecular Biology sharpens and modernizes the understanding of biology.

Overarching all, we include Scientific and Professional Ethics as a required course due to its vital importance in daily conduct of scientific and professional activities. This course will have students from various disciplines and will be used to carry out learning community activities.

The lower- and upper-core two-tier organization will allow us carry out learning community activities as well as outcomes assessment. Not all the aforementioned programs make these courses required courses.

The program is unique in that it contains service learning, computing in biology and capstone courses, which will be useful vehicles to carry out community service, learning community activities, and outcomes assessment. The capstone course will be highly useful for summative assessment.

The program is designed to constantly engage students as well as faculty to the real issues and concerns of the local communities and the rest of the world through learning community activities, inviting guest lecturers with special experiences and global perspectives, communicating and exchanging with scientists in the biotech world.

The program also contains required and elective biology courses to support the Environmental Science and Resource Management program.

f. Professional uses of the proposed degree major program.

Students in the major will develop powerful analytical skills and a sophisticated expertise in life sciences, which will make them highly valued in such diverse vocations as scientific research, teaching, consulting, biotechnology, and the health professions.

Students graduate from this program can directly gain entry into work force in many areas, including education, biomedical, biotechnological, and pharmaceutical industries, governmental agencies, environmental agencies, research institutes, consulting firms, clinics and laboratories, and public health organizations.

Students can also use this degree to apply for and gain acceptance into graduate programs at universities as well as professional schools such as law schools to study intellectual property laws in the areas of biotechnology, as well as medical, dental, pharmacy, optometry, veterinary, and other medically related professional schools.

g. The expected number of majors in the year of initiation and three years and five years thereafter. The expected number of graduates in the year of initiation and three years and five years thereafter.

The rough and conservative estimates for the first year, third year and fifth year enrollment are as follows:

Year 1: 30-40; Year 3: 75-85; Year 5: 100-120.

The expected number of graduates in:

Year 1: zero to minimal, depending on how many juniors will be admitted the first year;

Year 3: 20-30; Year 5: 60-70

3. Existing Support Resources for the Proposed Degree Major Program

- a. Faculty members, with rank, appointment status, highest degree earned, date and field of highest degree, and professional experience (including publications if the proposal is for a graduate degree), who would teach in the program.

Ching-Hua Wang

Professor

PhD, 1986, Cornell University

MD, 1978, Beijing University Medical Center (Former Beijing Medical University)

CSU professor since 1990

Taught biology courses at undergraduate and graduate levels at CSUSB from 1990-2001

Extensive experience in the areas of immunology, virology, infectious diseases, and microbiology.

Louise H. Lutze-Mann

Associate Professor

PhD, 1983, University of New South Wales, Australia

Associate Professor at University of New South Wales

Taught biology courses from 1994-1995 at University of California San Francisco and from 1997-2001 at University of New South Wales.

Extensive experience in biochemistry, physiology, cancer biology, and molecular biology

Two additional full-time hires in the area of Biology are planned and together with the existing faculty, they will begin course offerings in Fall 2002.

Other CSUCI full-time faculty listed below are also involved in teaching some of the relevant courses:

N. Jacquelyn Kilpatrick

Associate Professor of English

PhD in Literature, 1996, UC Santa Cruz

English Professor since 1981

Extensive experience in British literature, American literature, integrative studies, with specialty in Native American literature and cultures.

Kevin Volkan

Associate Professor of Psychology

PhD in Clinical Psychology, 1991, Center for Psychology Studies, Albany CA

EdD in Educational Psychology, 1987, Northern Illinois University

Psychology Professor since 1987

Extensive experience in psychology, bioethics, public health, and biostatistics.

Ivona Grzegorzczuk

Associate Professor of Mathematics

PhD in Mathematics, 1990, UC Berkeley

Mathematics Professor since 1992

Extensive experience in mathematics and its applications and mathematics education.

Philip Hampton

Associate Professor of Chemistry

PhD in Chemistry, 1989, Stanford University

Chemistry Professor since 1991

Extensive experience in research and education in organic chemistry.

William H. Adams

Associate Professor of Anthropology
PhD in Anthropology, 1976, Washington State University
Anthropology Professor since 1976
Extensive experience teaching anthropology and conducting anthropological research in eight countries since 1971.

William P. Cordeiro
Professor of Management
PhD in Executive Management, 1986, Peter F. Drucker Management School of the Claremont Graduate University
Management Professor since 1988
Extensive experience as employee and consultant in private and public organizations since 1969.

We are in the process of hiring a physics and several computer science professors to cover those courses for the program, including Bioinformatics.

We plan to hire two additional faculty members and several part-time lecturers next year to cover the numerous fields in biology in order to offer enough of the core courses and electives to our students. Some of these courses also serve the General Education, Liberal Studies, as well as Environmental Science and Resource Management and other disciplines. The precise number of part-time faculty is dependent upon what kind of full-time faculty we will hire and what specialties will or will not be covered.

The new science building is being planned which houses several biology labs and a temporary lab facility is being identified to carry out the lab activities in the first year. Due to the extensive lab preparations, biohazard treatment and disposals, and biosafety regulations involved in these lab courses, we plan to hire two technicians.

4. Additional Support Resources Required

- b. Any special characteristics of the additional faculty or staff support positions needed to implement the proposed program.**

We plan to hire fully qualified faculty and staff who are willing and capable to carry out the daily functions of instruction, research activities involving students, and service to the university and the community at large. A start-up fund will be provided to the faculty hires to establish their research laboratories.

We may also need to hire several Teaching Assistants from nearby universities, e.g., UCSB, to help in labs and or hire Work-Study students from CSUCI.

- c. The amount of additional lecture and/or laboratory space required to initiate and sustain the program over the next five years. Indicate any additional special facilities that will be required. If the space is under construction, what is the projected occupancy date? If the space is planned, indicate campus-wide priority of the facility, capital outlay program priority, and projected date of occupancy.**

The Science Building is under planning and will be completed by Fall, 2003. It has the top priority on the construction list and top capital outlay priority. Ten million dollars are already committed from the State of California for capital construction and the balance of fund will be coming from the Site-Authority. Several biology instructional labs are included in this building as planned. In order to attract high quality faculty members and ensure that they keep up with their areas of research and professional development, each faculty member will be allocated a research laboratory space. There is a need of a large lecture hall with a capacity of ~200 students for large lectures like BIOL 100 and some of the GE classes that Biology will offer to the whole university.

- d. **Additional library resources needed.** Indicate the commitment of the campus to purchase or borrow through interlibrary loan these additional resources.

CSUCI's acquisition of library resources planned for the upcoming years should be sufficient to meet the needs of the program.

- e. **Additional equipment or specialized materials** that will be (1) needed to implement the program and (2) needed during the first two years after initiation. Indicate the source of funds and priority to secure these resource needs.

The expected CSUCI budget, state support and the standard lab fees will be able to cover our normal operational expenses.

5. Abstract of the Proposal and Proposed Catalog Description

Attach an abstract of the foregoing proposal, not to exceed two pages, and a complete proposed catalog description, including admission and degree requirements.

See attached.

**APPENDIX C: SUPPLEMENTARY DOCUMENTATION
FOR PROPOSALS TO OFFER A NEW ACADEMIC
PROGRAM/ MAJOR IN FALL 2002**

Supplementary Information

The following information should be submitted to the Curriculum Committee.

- 1) Provide a proposed four-year schedule of all courses offered by the discipline (including General Education, remedial courses, and supporting courses for other majors) and when they will be offered using Table 2.

Please refer to Table 2.

- 2) Provide a discussion of the minimum faculty/ lecturer/ staff hiring that will be necessary to offer the program over the four years after the program is implemented.

A. The minimum faculty hiring over the next four years would be three. The reasons are:

Biology is a discipline that covers numerous distinctly different yet related fields, such as physiology, animal biology, plant biology, anatomy, neurobiology, organismal biology, population biology, ecology, cell biology, molecular biology, microbiology, virology, immunology, genetics, marine biology, biotechnology, DNA recombinant technology, plant biotechnology, bioinformatics, biostatistics, toxicology, embryology, cancer biology, epidemiology, and developmental biology, just to name a few. It is unreasonable to expect fewer than 4 – 5 faculty members to teach, and teach well, the wide spectrum of courses in the program.

2. A significant number of courses in biology will not only serve our biology students but also serve students in Environmental Science and Resource Management (ES&RM), Liberal Studies, Teaching and Learning Option (LSTL), and the General Education (GE). The rough and highly conservative estimates of enrollment in these disciplines are as follows:

Discipline	2002-03	2003-04	2004-05	2005-06	2006-07
Biology	30-40	60-65	75-85	90-95	100-120
ES&RM	25-30	45-50	56-60	63-65	70-75
LSTL	120	220	325	440	480
GE	535	1350	2240	2930	3650

Courses serving Biology as well as ES&RM are:

Required courses for BIO and ES&RM-

- Bio 200 Principles of Organismal and Population Biology (4)
- Bio 201 Principles of Cell and Molecular Biology (4)
- Bio 202 Biostatistics (3)
- Bio 330 Ecology and the Environment (4)

Required courses for ES&RM alone-

- Bio 432 Principles of Epidemiology and Environmental Health (3)
(this is also used as an elective for biology students)

Required 5 additional courses chosen from courses including biology courses for students in ES&RM, ES Option listed as follows:

- Bio 301 Microbiology (4)
- Bio 311 Plant Biology and Ecology (4)
- Bio 312 Animal Biology and Ecology (4)
- Bio 331 Marine Biology (4)
- Bio 331 Biotechnology in the 21 Century (2)
- Bio 333 Emerging Public Health Issues (2)

Bio 402 Toxicology (3)
Bio 428 Developmental Biology (4)
Bio 429 Biology of Cancer (3)

Note: All 4-unit courses have a lab component associated with them. Except Bio 301, which is also a required course for BS in Biology with an Emphasis in Cell and Molecular Biology, all the other biology courses listed above are also elective courses for biology students.

Required course for Biology and LSTL-
Bio 201 Principles of Cell and Molecular Biology (4)

GE courses-

Bio 100 General Biology (4)
Bio 200 Principles of Organismal and Population Biology (4)
Bio 202 Biostatistics (3)
Bio 212 Neurobiology and Cognitive Science (3)
Bio 330 Ecology and the Environment (4)
Bio 331 Biotechnology and the 21st Century (2)
Bio 332 Cancer and Society (2)
Bio 333 Emerging Public Health Issues (2)
Bio 346 Scientific and Professional Ethics (3)
Bio 430 Research Design and Data Analysis (3)
Bio 431 Bioinformatics (4)

Our plan is to hire as broadly trained individuals as possible to cover as many areas as needed to support the biology program and other programs within the university. For faculty positions for the 2002-03 AY, we would like to hire one person who is a plant specialist, who could teach plant biology, molecular plant physiology, biotechnology, general biology, organismal and population biology, and hopefully, ecology as well. For the second position, we would need to hire a physiologist who could also teach anatomy, human physiology, embryology, developmental biology, and neurobiology. In order to attract high quality scholars and professors to our campus, we need to provide a start-up fund for each faculty member (For purpose of comparison: SDSU's start-up for a Cell and Molecular Biologist is \$151,000; SFSU- \$100,000; CSUN-\$48,890.) and a research laboratory to each faculty member (For purpose of comparison: The research lab space per biologist within the CSU system ranges from 110-2000 sf.)

- B. The minimum lecturer-hiring over the next four years would depend on what faculty we could hire and their specialties as well as how many sections of courses will be offered. The anticipation is around two.
 - C. The minimum staff hiring over the next four years would be two technicians and one administrative assistant, the latter could be a shared position.
 - D. Each year, depending on the number of lab sections and number of lab courses offered, we also need to hire several Teaching Assistants from nearby university graduate student pool or from our own student seniors as Work-Study Assistants.
- 3) Discuss how the courses listed in Table 2 will be taught using the faculty/ lecturers/ staff in 1) and 2) above.

In the initial year, full-time biology faculty will primarily teach upper-division courses in biology. Later on, the full-time faculty members will cover the whole spectrum of biology courses, including all the GE courses offered by biology. The upper-division elective courses may have to be offered in alternate years during the initial phase of the program until we have enough enrollment and faculty.

Part-time faculty will teach either specialty courses in their discipline when needed or teach foundation and or GE courses in biology.

Biology as a whole is a discipline that offers many courses with laboratory component. Of the proposed courses, 17 of them contain laboratory component. Some of these may be offered with more than one section at a time, depending on the needs of students. Because of the extensive lab preparations involved in these lab courses, we need to hire two broadly experienced technicians to help to prep the labs and take care of biohazard treatment and disposal. Technicians are involved in all lab-containing courses. Responsibilities include ordering supplies and reagents required for the classes, keeping an inventory of all chemicals and reagents, prepping for lab sessions, testing to make sure labs work properly, supervising Work-Study Student Assistants and Teaching Assistants, properly storing supplies and chemical reagents, monitoring biosafety practices, handling biohazard materials by properly treating and disposal of them and regularly submitting reports of biohazard treatment and disposal, maintaining equipment in working conditions, and constantly collaborating and cooperating with faculty to make sure labs are run smoothly and according to proper protocols. Initially, the two technicians could be shared between Biology and Chemistry. One technician will be responsible for lab preps for Bio 100, 200, 201, 210, 211, 310, 311, 312, and 330, and the other technician will be responsible for lab preps for Bio 300, 301, 400, 401, 420, 422, 426 courses, which require more technical expertise in cell and molecular biology.

The administrative assistant staff will be responsible for all administrative assistance to the faculty, technical staff and students.

4) Additional Support Resources Required

The Science Building is under planning and will be completed by Fall, 2003. The initial plan offers 3 biology, 2 chemistry, 1 physics, 1 geology, and 1 computer labs. It also has a 100-seat auditorium for large lectures and 16 faculty offices. The science building has the top priority on the construction list and top capital outlay priority. Ten million dollars are already committed from the State of California for capital construction and the balance of fund will be coming from the Site-Authority. With the three proposed biology labs, on average, we have to offer 5 different lab courses per laboratory. If one considers that some of the courses will have multiple sections of labs, e.g., BIOL 100, 200, 201, 330, 301 and potentially BIOL 300, 400 and 401, then, it will become a stretch to depend on only three biology labs to keep the program going. It depends on when the science building is to be completed, we may have to find a temporary lab to carry out the lab activities in the first year or so. In order to attract high quality faculty members and ensure that they keep up with their areas of research and professional development, each faculty member should have a research laboratory space. As indicated above, within the CSU System, the research lab space per biology faculty member ranges from 110 – 2002 sf. Larger laboratory could be shared. These space needs could come from existing space on campus through renovation, or should be taken into consideration when the consecutive phases of the science building are planned. As the second phase of the science building goes into the planning stage, which will be several years from now, biology may need several more instructional labs, a green house and an animal facility.

As the Group 1 and Group 2 equipment funds do not cover supplies and reagents for biology labs, we need additional fund to cover our normal operational expenses. Part of the fund will be provided by CSUCI and the other part will be derived from lab fees collected from students.

During the first several years, however, the Biology program is capable of continual operation at the original level of program implementation by limiting the quantity of courses and sections offered. Implementation of proposed courses and sections offered will depend on actual budget and resources from the university. There is a need of a large lecture hall with a capacity of 200-300 people. It is

needed for large lectures like BIOL 100 and some of the GE classes that Biology will offer to the whole university.

Sample Four Year Course Plan

Year	Semester	Courses	Units
1	F	Biol 200 Org/Pop Bio	4
		Math 150 Calculus	4



Biology Course Offerings in 2002-2003								
	FALL		UNIT	WTU	SPRING		UNIT	WTU
Bio course	300L*	Cell Phy	4	5	301L*	Micro	4	5
	330L*	Ecology	4	5	400L	Mol Bio	4	5
	346	Ethics	3	3	202L*	Biostat	3	4
	410L	Computer	3	4	421	ViroI	3	3
	202L*	Biostat	3	4	423	C/M Neur	3	3
	302	Genetics	3	3	424	Hu Physio	3	3
Env Sci	402	Toxicology	3	3	432	Epidem	3	3
	310L	Animal Bio	4	5	311L	Plant Bio	4	5
Education	201L*	C/M Bio	4	5	201L*	C/M Bio	4	5
GE	212	Neurobio	3	3	333	Pub Health	2	2
	331	Biotech	2	2	332	Cancer/Soc	2	2
	332	Cancer/Soc	2	2	331	Biotech	2	2
	333	Pub Health	2	2	212	Neurobio	3	3
	100L*	Gen Bio	4	5	100L*	Gen Bio	4	5
SUM				51				50

Note indicates potential multiple sections labs

Course Offerings by Biology Program								
ODD YR								
	FALL		UNIT	WTU	SPRING		UNIT	WTU
Bio	200L*	Org/Pop Bio	4	5	201L**	C/MB	4	5
	210L	Hu A&P I	4	5	202L*	Biostat	3	4
	300L*	Cell Phy	4	5	211L	Hu A&P II	4	5
	330L*	Eco	4	5	301L*	Micro	4	5
	346	Ethics	3	3	302	Genetics	3	3
	401L(2)*	Biote/rDNA	5	7	400L*	Mol Bio	4	5
	410/430L	Comp	3	4	431L	Bioinform	4	5
	492L*/494*	Service L'g	2	2	497*	Service L'g	2	2
	499	Capstone	1	1	499	Capstone	1	1
Env Sci	402	Toxicology	3	3	432	Epidem	3	3
	310L	Animal Bio	4	5	311L	Plant Bio	4	5
Electives	420L	Immuno	4	5	312L	Marine Bio	4	5
	427L	Dev Bio	4	5	422L	Mol Plant	4	5
					425	Hu Gene	3	3
GE	212	Neuro	3	3	100L*	Gen Bio	4	5

Note: * means potential multiple sections.

** indicates multiple sections to biology and teaching credential students.

Course Offerings by Biology Program								
EVEN YR								
	FALL		UNIT	WTU	SPRING		UNIT	WTU
Bio	200L*	Org/Pop Bio	4	5	201L**	C/MB	4	5
	210L	Hu A&P I	4	5	202L*	Biostat	3	4
	300L*	Cell Phy	4	5	211L	Hu A&P II	4	5
	330L*	Eco	4	5	301L*	Micro	4	5
	346	Ethics	3	3	302	Genetics	3	3
	401L (2)*	Biote/rDNA	5	7	400L*	Mol Bio	4	5
	410L/430L*	Comp	3	4	431L	Bioinform	4	5
	492L/494*	Service L'g	2	2	497*	Service L'g	2	2
	499	Capstone	1	1	499	Capstone	1	1
Env Sci	402	Toxicology	3	3	432	Epidem	3	3
	310L	Animal Bio	4	5	311L	Plant Bio	4	5
Electives	421	Virol	3	3	312L	Marine Bio	4	5
	423	C/M Neur	3	3	426	Embryo	3	3
	424	Hu Physio	3	3	428	Bio Cancer	3	3
GE	212	Neuro	3	3	100L*	Gen Bio	4	5
	100L*	Gen Bio	4	5	332	Cancer/Soc	2	2
	331	Biotech	2	2	333	Pub Health	2	2
SUM				64				63

Note: * means potential multiple sections.

** indicates multiple sections to biology and teaching credential students.

BIOLOGY

Biology is the study of life, its variety and processes. It emphasizes the relationship between structure and function in living systems and their interactions with the environment. The discipline is dynamic and rapidly advancing with the development of biotechnology and information technology. The major in biological sciences is designed for students who wish to enter graduate or health professional schools, the teacher credential program, or to seek careers in science education, business, industry or government. The minor will allow students in other majors to get a solid background in biology with further room to explore in-depth knowledge in a selected area. The Biology Program provides its students with a strong theoretical foundation in biology, combined with extensive, hands-on laboratory experiences using state-of-the-art technology. Students take a series of core courses augmented by upper-division electives selected from areas of special interest.

DEGREES AND PROGRAMS OFFERED:

Bachelor of Science in Biology
Bachelor of Science in Biology with an Emphasis in Cell and Molecular Biology

Minor in Biology

Honors in Biology

Graduate Certificate in Biotechnology

CONTACT INFORMATION

Ching-Hua Wang, Professor of Biology
Ching-Hua.Wang@csuci.edu

REQUIREMENTS FOR THE BACHELOR OF SCIENCE DEGREE IN BIOLOGY (120 units):

COMMON LOWER DIVISION

REQUIREMENTS (31 units):

(12 units of the following will be counted toward lower division GE credits, 4 units in each of three different disciplines)

1. Biology
 - BIOL 200 Principles of Organismal and Population Biology...4
 - BIOL 201 Principles of Cell and Molecular Biology4
 - BIOL 202 Biostatistics3
2. Mathematics
 - MATH 150 Calculus I4
3. Chemistry
 - CHEM 121 General Chemistry I4
 - CHEM 122 General Chemistry II4
4. Physics
 - PHYS 200 General Physics I4
 - PHYS 201 General Physics II4

For General Biology and Pre-Professional Students:

UPPER DIVISION REQUIREMENTS (32 units):

1. Organic Chemistry
 - CHEM 311 & 312 Organic Chemistry I4
 - CHEM 314 & 315 Organic Chemistry II4
 (Organic Chemistry I & II taken at the 200 levels from community colleges are accepted as a year of organic chemistry for the Biology major.)
2. Biology
 - BIOL 300 Cell Physiology4
 - BIOL 302 Genetics and Evolution3
 - BIOL 330* Ecology and the Environment4
 - BIOL 346* Scientific and Professional Ethics3
 - BIOL 400 Molecular Biology and Molecular Genetics4
3. Computing in Biology
 - Select one of the following courses:
 - BIOL 410 Computer Applications in Biomedical Fields3
 - BIOL 430* Research Design and Data Analysis3
4. Service Learning
 - A minimum of 2 units taken from the following:
 - BIOL 494 Independent Research2
 - BIOL 497 Directed Study2
5. Capstone
 - BIOL 499 Senior Capstone Colloquium1
 (Courses with * are double-counted toward UD GE credits.)

ELECTIVES IN BIOLOGY (15 UNITS):

A minimum of 15 units chosen from 300 to 400 level upper division biology courses, with at least one lab-based course and only one course that could be taken at 300 level (no courses from BIOL 331 to 333 would be counted toward the major). CHEM 318 or CHEM 400 could also be taken to satisfy the electives.

REQUIRED SUPPORTING AND OTHER GE COURSES (42 units):

- ENGL 330 Writing in the Disciplines3
- Title V Courses6
- Other GE Courses in Categories A-E33

For Biology Students in Cell and Molecular Biology Emphasis:

UPPER DIVISION REQUIREMENTS (40-41 units):

1. Organic Chemistry and Biochemistry
 - CHEM 311 Organic Chemistry I3
 - CHEM 312 Organic Chemistry I Laboratory1
 - CHEM 318 Biological Chemistry3
 (Note: Students completing the following courses to satisfy this category will obtain a Minor in Chemistry in addition to a Major in Biology:
 - CHEM 311 Organic Chemistry I3
 - CHEM 312 Organic Chemistry I Laboratory1
 - CHEM 314 Organic Chemistry II3
 - CHEM 315 Organic Chemistry II Laboratory1
 - CHEM 400 Biochemistry4
 Organic Chemistry I & II taken at the 200 levels from community colleges are accepted as a year of organic chemistry for the Biology major.)
2. Biology
 - BIOL 300 Cell Physiology4
 - BIOL 301 Microbiology4
 - BIOL 302 Genetics and Evolution3
 - BIOL 330* Ecology and the Environment4
 - BIOL 346* Scientific and Professional Ethics3
 - BIOL 400 Molecular Biology and Molecular Genetics4

- BIOL 401 Biotechnology and Recombinant DNA Technology
3. Computing in Biology
Select one of the following courses:
BIOL 430* Research Design and Data Analysis3
BIOL 431* Bioinformatics.....4
4. Service Learning
A minimum of 2 units taken from the following:
BIOL 492 Biotech Internship 2-3
BIOL 494 Independent Research2
BIOL 497 Directed Study2
5. Capstone
BIOL 499 Senior Capstone Colloquium.....1
(Courses with * are double-counted toward UD GE credits.)

ELECTIVES IN BIOLOGY (10 UNITS):

A minimum of 10 units chosen from 400 level courses, excluding BIOL 410.

REQUIRED SUPPORTING AND OTHER GE COURSES (38-39 units):

- ENGL 330 Writing in the Disciplines3
Title V Courses6
Other GE Courses in Categories A-E.....29-30

REQUIREMENTS FOR MINOR IN BIOLOGY (21 units):

LOWER DIVISION REQUIREMENTS (8 units):

1. Biology
BIOL 200 Principles of Organismal and Population Biology...4
BIOL 201 Principles of Cell and Molecular Biology4

UPPER DIVISION REQUIREMENTS (13 units):

1. BIOL 300 Cell Physiology4
BIOL 302 Genetics and Evolution3
2. Biology Electives
A minimum of 6 units of 300-400 level biology courses, with no more than one course selected from BIOL 331-333, 340, 410 and 430.

REQUIREMENTS FOR CERTIFICATE IN BIOTECHNOLOGY (24-25 units):

(For students with a B.S. degree in biology pursuing a certificate in biotechnology)

1. B.S. degree in biology (may be concurrent);
2. Completion of the following courses with "C" or better grades:
CHEM 318 or 400 Biological Chemistry or Biochemistry I...3-4
BIOL 401 Biotechnology and Recombinant DNA Technology 5
BIOL 420 Cellular and Molecular Immunology.....3
BIOL 431 Bioinformatics.....4
3. Complete another 6 units of UD biology courses in consultation with the program director;
4. Complete a Biotech Internship course;
5. Complete the Capstone course;
6. Approval by the program director.

COURSE DESCRIPTIONS:

BIOL 100. GENERAL BIOLOGY (4)

An introduction to organismal biology, including the diversity, structure, and function of prokaryotes, protists, fungi, plants, and animals. Also includes the principles of evolution, ecology and population biology. No credit given toward the biology major. Weekly three-hour lectures and three-hour laboratories. A standard lab fee is required.

BIOL 200. PRINCIPLES OF ORGANISMAL AND POPULATION BIOLOGY (4)

An introduction to organismal biology, including the diversity, comparative structure, organ system function, development, phylogeny, taxonomy and systematics of prokaryotes, protists, fungi, plants, and animals. Discussion of the principles of evolution including speciation and natural selection, the environmental impact and ecosystem interaction of plants and animals, the behavior of animals, population genetics and population biology. Weekly three-hour lectures and three-hour laboratories. A standard lab fee is required.

BIOL 201. PRINCIPLES OF CELL AND MOLECULAR BIOLOGY (4)

Prerequisite: CHEM 121; BIOL 200 with "C" or better grade for biology majors. (No prerequisite for students in Liberal Studies, Teaching and Learning Option.)

This course will cover principles and applications of basic chemistry, biological macromolecules, prokaryotic and eucaryotic cell structure and function, homeostasis, metabolism including both respiration and photosynthesis, cell cycling, signal transduction, Mendelian genetics, molecular genetics including transcription and translation, and a brief introduction to virology and immunology. The philosophy of science, scientific method and experimental design are foundational to the course. Weekly three-hour lectures and three-hour laboratories. A standard lab fee is required.

BIOL 202. BIostatISTICS (3)

Use of probability and statistics in the description and analysis of biological data collected from laboratory and or field experiments. Weekly three-hour laboratory instruction and exercise. (Same as MATH 202)

BIOL 210. HUMAN ANATOMY AND PHYSIOLOGY I (4)

Prerequisite: BIOL 100.

Gross and microscopic anatomy and organ system of human body with integrated physiological functions of the nine body organ systems studied from organ system through cellular levels of organization including basic chemistry, cell metabolism, acid-base relationships, membrane function, basic genetics, alleles and

inherited disorders. No credit given toward the biology major. Weekly three-hour lectures and three-hour laboratories. A standard lab fee is required.

BIOL 211. HUMAN ANATOMY AND PHYSIOLOGY II (4)

Prerequisite: BIOL 210.

Continuation of BIOL 210. No credit given toward the biology major. Weekly three-hour lectures and three-hour laboratories. A standard lab fee is required.

BIOL 212. NEUROBIOLOGY AND COGNITIVE SCIENCE (3)

Prerequisite: BIOL 100.

Principles of brain organization and function underlying behavior. Topics include neuroanatomy and physiology of language, vision, sexual behavior, memory and abnormal behavior. No credit given toward the biology major. Weekly three-hour lectures. (Same as PSY 212)

BIOL 300. CELL PHYSIOLOGY (4)

Prerequisites: CHEM 122; CHEM 311 and 312 or concurrent enrollment; BIOL 201 with "C" or better grades.

Detailed study of the organization and functioning of cells and cellular organelles at the cellular and molecular levels, emphasizing experimental approaches and structural and functional relationships and their regulation and control. Topics include macromolecules, membrane phenomena, metabolism, enzyme kinetics, and cellular events associated with excitable cells and tissues. Individual research paper on a current aspect of cellular and molecular biology required. Weekly three-hour lectures and three-hour laboratories. A standard lab fee is required.

BIOL 301. MICROBIOLOGY (4)

Prerequisites: CHEM 122; BIOL 201 with "C" or better grades.

Study of microorganisms of the environment, including disease-causing organisms, their structures and functions and their interactions to their host animals and the environment. Weekly three-hours lectures and two one-and-a-half hour-laboratories. A standard lab fee is required.

BIOL 302. GENETICS AND EVOLUTION (3)

Prerequisites: CHEM 122; BIOL 201 with "C" or better grades.

Principles of classical transmission genetics, population genetics and evolution, with an introduction to modern molecular genetics. Weekly three-hour lectures.

BIOL 310. ANIMAL BIOLOGY AND ECOLOGY (4)

Prerequisites: BIOL 100 or BIOL 201.

Animal adaptation and diversity and their relationship to the development of evolutionary theory and the environment. Identification of common invertebrate and vertebrate animals. No credit given toward the biology major. Weekly three-hour lectures and three-hour laboratories with periodic field trips in local ecosystem and its animals. A standard lab fee is required.

BIOL 311. PLANT BIOLOGY AND ECOLOGY (4)

Prerequisite: BIOL 100 or BIOL 201.

A general introduction of diverse structures and functions of plants and their relationship to the environment. Identification of common, local native plants and plant communities, uses of native plants by Native Americans, and human and environmental impacts on native plant communities. No credit given toward the biology major. Weekly three-hour lecture and three-hour laboratories with periodic field trips. A standard lab fee is required.

BIOL 312. MARINE BIOLOGY (4)

Prerequisite: BIOL 201.

Overview of complexity of marine life including marine plants and animals and the processes that underlie their distribution and abundance in open ocean, coastal, and estuarine environments.

material at the molecular level, gene organization, structures and functions of DNA, RNA and proteins, gene transcription and expression, RNA processing, genomics and proteomics. Weekly three-hour lectures and three-hour laboratories. A standard lab fee is required.

BIOL 401. BIOTECHNOLOGY AND RECOMBINANT DNA TECHNOLOGY (5)

Prerequisites: CHEM 318 or 400; BIOL 300 and 302 with "C" or better grades.

Theory and practice of various biotechnologies and recombinant DNA technology applicable to research and development, drug discoveries, clinical therapies, preventative medicine, agriculture, criminal justice system, and a variety of other fields. Modern techniques in genomics and proteomics will be introduced in the laboratories. Weekly three-hour lectures and six-hour laboratories. A standard lab fee is required.

BIOL 402. TOXICOLOGY (3)

Prerequisites: CHEM 122; BIOL 201 with "C" or better grades.

An in depth study of toxic chemicals and their interactions within the ecosystems. Topics include the origin, fate, chemical and biological detection, and quantification of pollutants and toxins and their impact on organisms at the molecular, biochemical, cellular, physiological, organismal, and community levels of organization. Basic toxicology, genetic toxicology, environmental mutagenesis and the molecular basis of mutation induction will be covered. Weekly three-hour lectures.

BIOL 410. COMPUTER APPLICATIONS IN BIOMEDICAL FIELDS (3)

Prerequisites: BIOL 201 with "C" or better grades.

Applications of computers and data processing technology to the understanding and solving of specific problems in biomedical fields. Weekly three-hour laboratory instruction and exercise. (Same as COMP 410)

BIOL 420. CELLULAR AND MOLECULAR IMMUNOLOGY (4)

Prerequisites: CHEM 122; BIOL 301 with "C" or better grades.

Study of cellular and molecular aspects of the immune system and its responses against infectious agents and or environmental insults. Included are development of the organs and cells of the immune system, genetics of the molecules of the immune system and their functions and interactions during an immune response, immunological disorders such as immunodeficiencies, autoimmune diseases, transplantation, and contemporary immunological techniques used in clinical diagnosis and other modern research and development applications. Weekly three-hour lectures and three-hour laboratories. A standard lab fee is required.

BIOL 421. VIROLOGY (3)

Prerequisites: CHEM 122; BIOL 301 with "C" or better grades.

Study of aspects of molecular structure, genetics, and replication of viruses and other sub-viral agents such as prions and viroids, virus-host interactions, pathogenesis of viral infections, diagnostic virology, and antiviral vaccines and drugs; emphasis on human pathogens. Weekly three-hour lectures.

BIOL 422. MOLECULAR PLANT PHYSIOLOGY (4)

Prerequisites: CHEM 318 or 400; BIOL 311 recommended; BIOL 300 with "C" or better grades.

Study of principles and methods of plant physiology at molecular level combined with modern plant technology. Topics include plant tissue and cell culture, genetic engineering and transformation, plant defense and genomics, and applications of DNA technology. Weekly three-hour lectures and three-hour laboratories. A standard lab fee is required.

BIOL 423. CELLULAR AND MOLECULAR NEUROBIOLOGY (3)

Prerequisites: CHEM 122; BIOL 212 recommended; BIOL 300 with "C" or better grades.

Study of the nervous system at cellular and molecular levels, including cellular structure of neurons and other types of neuronal cells and their functions and interactions, neurotransmitters and their functions and regulation, chemical agents and their effects on the neuronal cells and their functions, and normal responses by the cells and the molecules of the nervous system and their response under adverse conditions. Weekly three-hour lectures.

BIOL 424. HUMAN PHYSIOLOGY (3)

Prerequisites: CHEM 122; BIOL 300 with "C" or better grades.

Study of human physiology at both the cellular and organ system levels, including neurophysiology, muscle physiology, cardiovascular physiology, respiration, kidney function, hormone function and reproduction. Weekly three-hour lectures.

BIOL 425. HUMAN GENETICS (3)

Prerequisites: CHEM 122; BIOL 300 and 302 with "C" or better grades.

Basic principles of human inheritance, including the transmission of genetic traits, chromosomal abnormalities and their effects, gene structure and function, pedigree analysis, gene mapping, cytogenetics, mutations and mutagenic agents, cancer genetics, molecular analysis of inherited diseases and genetically controlled phenomena in humans. Weekly three-hour lectures.

BIOL 426. EMBRYOLOGY (4)

Prerequisites: CHEM 122; BIOL 300 with "C" or better grades.

Studies in comparative gametogenesis, morphogenesis, and reproductive physiology. Weekly three-hour lectures and three hour laboratories. A standard lab fee is required.

BIOL 427. DEVELOPMENTAL BIOLOGY (3)

Prerequisites: CHEM 122; BIOL 300 with "C" or better grades.

Studies in human developmental sequences from fertilization to adolescence and examine how the developmental processes can be altered due to genetic, drug or other environmental factors. Other animal systems (fly, frog, chick, mouse) will also be studied to aid in understanding anatomical, physiological, genetic and molecular mechanisms operating during gametogenesis, fertilization, cleavage, gastrulation and organogenesis. Weekly three-hour lectures.

BIOL 428. BIOLOGY OF CANCER (2)

Prerequisites: CHEM 122; BIOL 300 with "C" or better grades.

Principles of oncology are examined. Included are mechanisms of oncogenesis at cellular and molecular levels, characteristics of cancer, advantages and disadvantages of various therapies of cancer treatment. Weekly two-hour lectures.

BIOL 430. RESEARCH DESIGN AND DATA ANALYSIS (3)

Prerequisites: BIOL 202 with "C" or better grades.

Discussion on experimental design, sampling methods, data collection, and methods of data analysis related to scientific fields. Weekly three-hour laboratory instruction and exercise. (Same as MATH 430)

BIOL 431. BIOINFORMATICS (4)

Prerequisites: CHEM 318 or 400; COMP 150 recommended; BIOL 400 with "C" or better grades.

Computational methods for analysis of biological systems at all levels of scale from macromolecules to ecosystems. Topics include development of algorithms, macromolecular sequence analysis to determine structure and function, study phylogenetic relationships, imaging in two to four dimensions, and mathematical modeling in biological sciences. Technology applicable to research and

development, gene discoveries, discoveries of new molecules, which could lead to drug discoveries, clinical therapies, and applications in preventative medicine, agriculture, criminal justice system, and a variety of other fields. Weekly four-hour laboratory instruction and exercise. A standard lab fee is required. (same as COMP 431)

BIOL 432. PRINCIPLES OF EPIDEMIOLOGY AND ENVIRONMENTAL HEALTH (3)

Prerequisites: CHEM 122; BIOL 201 with "C" or better grades. Distribution and dynamics of human health problems and principles and procedures used to determine circumstances under which disease occurs or health prevails and to aid in managing and planning health and environmental systems. The broadened scope of epidemiology is examined through case studies and community and environmental health approach. Weekly three-hour lectures.

BIOL 490. SPECIAL TOPICS (1-3)

Prerequisites: CHEM 122; BIOL 300 with "C" or better grades. Group study of a selected topic, the title of which is to be specified in advance. May be repeated for credits as topics change.

BIOL 491. SPECIAL LABORATORY TOPICS (1-3)

Prerequisites: CHEM 122; BIOL 300 with "C" or better grades. Group laboratory study of a selected topic, the title of which is to be specified in advance. May be repeated for credits as topics change. A standard lab fee is required.

BIOL 492. BIOTECH INTERNSHIP (2-3)

Prerequisites: CHEM 318 or 400; BIOL 400 and 401 with a minimum overall grade point average of 3.0 or program approval. Supervised work and study in work situations involving biological research, technical skills, and service learning. Up to three units may be applied toward degree in biology program. All students are required to attend the Biology Program Senior Capstone Colloquium scheduled at the end of each semester to present their projects. Graded credit/no credit.

BIOL 494. INDEPENDENT RESEARCH (2)

Prerequisites: CHEM 122 or 311 and 312, 318 or 400; BIOL 300 with a minimum overall grade point average of 3.0 or consent of instructor and program approval. Laboratory and/or library research in selected areas in biology conducted under the direction of a faculty member. A total of four units by taking the course twice may be applied toward graduation. All students are required to attend the Biology Program Senior Capstone Colloquium scheduled at the end of each semester to present their projects. Graded credit/no credit.

BIOL 497. DIRECTED STUDY (2)

Prerequisites: CHEM 122; BIOL 300 with "C" or better grades; Consent of instructor and program approval. Reading and library research in an area of biology conducted under the direction of a faculty member in Biology. No more than two units may be applied toward graduation. All students are required to attend the Biology Program Senior Capstone Colloquium scheduled at the end of each semester to present their projects. Graded credit/no credit.

BIOL 499. SENIOR CAPSTONE COLLOQUIUM (1)

Prerequisites: BIOL 492, 494 or 497 with credits. Oral presentation of completed or work-in-progress projects of BIOL 492, 494, or 497 courses. Only one unit may be applied toward graduation. Graded credit/no credit.

**Articulation of Biology and Other Required Science
and Mathematics Courses with the Local
Community Colleges**

CSU Northridge	BIOL 106/L Biological Principles I & Lab (4)	BIOL R120 & BIOL R120L Principles of Biology I (4)	BIOL 101 - Plant Biology (5) & BIOL 102 - Animal Biology (5) & BIOL 103 - Cell Biology (5,5)	BIOL 101 - Plant Biology (5) & BIOL 102 - Animal Biology (5) & BIOL 103 - Cell Biology (5,5)	BIOL V20A - General Biology I (5)	BIOL 200 - Organismal and Population Biology (4)	BIOL 201 Cell and Molecular Biology (4)	CSUCI
Moorpark	Chem 101/L General Chemistry I & Lab (5)	CHEM M1A	CHEM R120 - General Chemistry I (5)	CHEM 155 - General Chemistry I (5)	CHEM V1A & CHEM V1AL General Chemistry I (3) & General Chemistry Lab (2)	CHEM 121 General chemistry I (4)	CHEM 122 General Chemistry II (4)	
	Chem 102/L General Chemistry II & Lab (5)	CHEM M1B	CHEM R122 - General Chemistry II (5)	CHEM 156 - General Chemistry II (5)	CHEM V1B & CHEM V1BL General Chemistry II (3) & General Chemistry Lab (2)			
	Phys 100A General Physics I (3)	PHYS M10A	PHYS R101 - College Physics I (5) & PHYS R121 - Physics with Calculus I (5)	PHYS 105 - General Physics (4) & PHYS 110 - Introductory Physics (5)	PHYS V2A - General Physics I (4)	PHYS 200 General Physics I (4)	PHYS 201 General Physics II (4)	
	Phys 100B General Physics II (3)	PHYS M10B	PHYS R102 - College Physics II (5)	PHYS 106 - General Physics (4)	PHYS V2B - General Physics II (4)			
	Math 225A Calculus I (3)	MATH M16A	No course articulated May substitute: MATH 120 - Calculus with Analytic Geometry I (5)	No course articulated May substitute: MATH 130 - Calculus for Biological Sciences, Social Sciences and Business (4)	MATH V21A - Calculus with Analytic Geometry I (5) & MATH V46A - Applied Calculus I (3)	MATH 150 Calculus I (4)		
	Phys 100AL General Physics Lab (1)	PHYS M10AL	PHYS R101 - College Physics I (5) & PHYS R121 - Physics with Calculus I (5)	PHYS 105 - General Physics (4) & PHYS 110 - Introductory Physics (5)	PHYS V2AL - General Physics I Laboratory (1)			
	Phys 100BL General Physics Lab (1)	PHYS M10BL	PHYS R102 - College Physics II (5) or PHYS R122 - Physics with Calculus II (5)	PHYS 106 - General Physics (4) & PHYS 111 - Introductory Physics (5)	PHYS V2BL - General Physics II Laboratory (1)			
	Math 255B Calculus II (3)	MATH M16B	Highly recommended: No course articulated May substitute: MATH R121 - Analytic Geometry II Calculus with	No course articulated - May substitute: MATH 131 - Calculus for Biological Sciences, Social Sciences and Business (4)	MATH V46B - Applied Calculus II (5) & MATH V21B - Calculus with Analytic Geometry II (5)	MATH 151 Calculus II (4)		

CSUN	Alan Hancock	College of the Canyons	L.A. Pierce	Santa Monica	CSUCI
Biol 106/L Biological Principles I & Lab (4)	Biol 150	BIOSCI 106 - Organismic and Environmental Biology (4) & BIOSCI 107 - Molecular and Cellular Biology (4)	BIOLOGY 7 - General Biology II (5)	Biol 7 - General Biology II (5)	Biol 200 - Organismal and Population Biology (4)
Biol 107/L Biological Principles II & Lab (4)	Biol 150 & Biol 154 & Biol 155	BIOSCI 106 - Organismic and Environmental Biology (4) & BIOSCI 107 - Molecular and Cellular Biology (4)			Biol 210 Cell and Molecular Biology (4)
Chem 101/L General Chemistry I & Lab (5)	CHEM 150	BIOSCI 215 - General Zoology (4) & BIOSCI 218 - General Botany (4)			CHEM 121 General chemistry I (4)
Chem 102/L General Chemistry II & Lab (5)	CHEM 151	BIOSCI 215 - General Zoology (4) & BIOSCI 218 - General Botany (4)			CHEM 122 General Chemistry II (4)
Phys 100A General Physics I (3)	PHYS 141				PHYS 200 General Physics I (4)
Phys 100B General Physics II (3)	PHYS 142				PHYS 201 General Physics II (4)
Math 225A Calculus I (3)	n/a				MATH 150 Calculus I (4)

CSU San Bernardino	Moorpark	Oxnard	Santa Barbara	Ventura	CSUCI
Biol 200 - Biology of the Cell (5)	Biol M2A & Biol M2B or Biol M2A & BOT M1 & ZOO M1	Biol R120 & Biol R120L & Biol R122 & Biol R122L	Biol 101	Biol V20A & Biol V20B	Biol 201 Cell and Molecular Biol (4)
Biol 201 - Biology of the Organism (5)	Biol M2A & Biol M2B or Biol M2A & BOT M1 & ZOO M1	Biol R120 & Biol R120L & Biol R122 & Biol R122L			Biol 200 - Organismal and Population Biology (4)
Biol 202 - Biology of Populations (5)	Biol M2A & Biol M2B or Biol M2A & BOT M1 & ZOO M1	Biol R120 & Biol R120L & Biol R122 & Biol R122L			CHEM 121 General chemistry I (4)
Chem 215 - General Chemistry I (6)	CHEM M1A	CHEM R120			CHEM 122 General Chemistry II (4)
Chem 216 - General Chemistry II (6)	CHEM M1B	CHEM R122			
Group A					
Chem 221A-B - Organic Chemistry I & Lab (4)	CHEM M7A & CHEM M7B	CHEM R106 & CHEM R107			
Chem 222A-B - Organic Chemistry II & Lab (4)	CHEM M7A & CHEM M7B	CHEM R106 & CHEM R107			
Chem 223A-B - Organic Chemistry III & Lab (4)	CHEM M7A & CHEM M7B	CHEM R106 & CHEM R107			
Math 192 - Methods of Calculus (4)	MATH M16A & MATH M16B	NCC	NCC	MATH V46A	MATH 150 Calculus I (4)
Math 211 - Basic Concepts of Calculus (4)	MATH 25A	MATH R120	MATH 150	MATH V21A	MATH 151 Calculus II (4) recom
Phys					PHYS 200 General Physics I (4)
Phys					PHYS 201 General Physics II (4)
Phys					
Phys					
or					
PHYS 221 - General Physics I (5)	PHYS M20A & PHYS M20AL	PHYS R131	PHYS 121	PHYS V4 & V4L	
PHYS 222 - General Physics II (5)	PHYS M20B & PHYS M20BL	PHYS R132	PHYS 122	PHYS V5 & V5L	
Phys 2					
CSU S					

BIOL 200 - Biology of the Cell (5)	BIOL 150	BIOSCI 107	BIOLGY 6	BIOL 6	BIOL 210 Cell and Molecular Biology (4)
BIOL 201 - Biology of the Organism (5)	BIOL 154	BIOSCI 106	BIOLGY 6	BIOL 6	BIOL 200 - Organismal and Population Biology (4)
BIOL 202 - Biology of Populations (5)	BIOL 155	BIOSCI 106 or BIOSCI 215 & 216	BIOLGY 6	BIOL 6	CHEM 121 General chemistry I (4)
CHEM 215 - General Chemistry I (6)	CHEM 150	CHEM 201	CHEM 101	CHEM 11	CHEM 122 General Chemistry II (4)
CHEM 216 - General Chemistry II (6)	CHEM 151	CHEM 202	CHEM 102	CHEM 12	
Group A					
CHEM 221A-B - Organic Chemistry I & Lab (4)	NCC	CHEM 255 & CHEM 256	CHEM 211 & CHEM212	CHEM 21 & CHEM 22 & CHEM24	
CHEM 222A-B - Organic Chemistry II & Lab (4)	NCC	CHEM 255 & CHEM 256	CHEM 211 & CHEM212	CHEM 21 & CHEM 22 & CHEM24	
CHEM 223A-B - Organic Chemistry III & Lab (4)	NCC	CHEM 255 & CHEM 256	CHEM 211 & CHEM212	CHEM 21 & CHEM 22 & CHEM24	
CHEM 245	NCC	CHEM 221	NCC	NCC	
Group B (upper division Organic Chemistry)					
MATH 192 - Methods of Calculus (4)	MATH 135	MATH 240	NCC	NCC	MATH 150 Calculus I (4)
MATH 211 - Basic Concepts of Calculus (4)	MATH 181	MATH 211	MATH 261	MATH 7	MATH 151 Calculus II (4) recom
Phys 121 - Basic Concepts of Physics I (5)	PHYS 141 & PHYS 142	PHYSIC 110 & PHYSIC 111	PHYSICS 6 & PHYSICS 7	PHYSICS 6 & PHYSICS 7 or PHYSICS 8 & PHYSICS 9	PHYS 200 General Physics I (4)
Phys 122 - Basic Concepts of Physics II (4)	PHYS 141 & PHYS 142	PHYSIC 110 & PHYSIC 111	PHYSICS 6 & PHYSICS 7	PHYSICS 6 & PHYSICS 7 or PHYSICS 8 & PHYSICS 9	PHYS 201 General Physics II (4)
Phys 123 - Basic Concepts of Physics III (4)	PHYS 141 & PHYS 142	PHYSIC 110 & PHYSIC 111	PHYSICS 6 & PHYSICS 7	PHYSICS 6 & PHYSICS 7 or PHYSICS 8 & PHYSICS 9	
or					
Phys 221 - General Physics I (5)	PHYS 151	PHYSIC 220	PHYSICS 37A &	PHYSICS 1	
Phys 221 - General Physics II (5)	PHYS 152	PHYSIC 221	PHYSICS 38A & PHYSICS 38B	PHYSICS 3	
Phys 221 - General Physics III (5)	PHYS 153	PHYSIC 222	PHYSICS 39A & PHYSICS 39B	PHYSICS 2	

Chemistry 130A &	No equivalent course	No equivalent course	No equivalent course	No equivalent course
Chemistry 130B Mathematics 3A-B	No equivalent course MATH M25A - Calculus w/ Analytic Geometry I (5) & MATH M25B - Calculus w/ Analytic Geometry II (5)	No equivalent course MATH R120 - Calculus with Analytic Geometry I (5) & MATH R121 - Calculus with Analytic Geometry II (5)	No equivalent course MATH 150 - Calculus with Analytic Geometry I (5) & MATH 160 - Calculus with Analytic Geometry II (5)	No equivalent course MATH V21A - Calculus with Analytic Geometry I (5) & MATH V21B - Calculus with Analytic Geometry II (5)
or Mathematics 34A-B	MATH M16A - Applied Calculus I (3) & MATH M16B - Applied Calculus II (3)	MATH R106 - Mathematics for Business Applications (5) & Take MATH 34B at UCSB after transfer	MATH 130 - Calculus for Biological Sciences, Social Sciences, and Business (4) & MATH 131 - Calculus for Biological Sciences, Social Sciences and Business (4)	MATH V46A - Applied Calculus I (3) & MATH V46B - Applied Calculus II (3)
PSTAT 5A	MATH M15 - Introductory Statistics (5)	ECON R103 - Introductory Statistics for Busines and Economics(3) or MATH R105 - Introductory Statistics (4)	MATH 117 - Elementary Statistics (4) or MATH 117 HR - Elementary Statistics, Honors (4)	MATH V44 - Elementary Statistics (4)
EEMB 30 Mathematics 3C	No equivalent course In addition to MATH 25A-B, complete: MATH M25C - Calculus and Analytic Geometry III (5) & MATH 35 - Applied Differential Equations (3)	No equivalent course In addition to MATH R120 & MATH R121 complete: MATH R122 - Calculus with Analytic Geometry III (5)	No equivalent course MATH 160 - Calculus with Analytic Geometry II (5)	No equivalent course In addition to MATH V21A-B, complete: MATH V21C - Multi- variable Calculus and Linear Algebra (5) & MATH V24 - Differential Equations and Their Applications (5)

UCSB	Alan Hancock	College of the Canyons	L.A. Pierce	Santa Monica
MCDB 1A-AL	BIOL 150 - General Biology (4) & BIOL 154 - General Botany (5) & BIOL 155 - General Zoology (5)	BIOSCI 106 - Organismic and Environmental Biology (4) & BIOSCI 107 - Molecular and Cellular Biology (4)	BIOLGY 6 - General Biology I (5) & BIOLGY 7 - General Biology II (5): Take EEMB 5C/5CL at UCSB after transfer	BIOL 6 - General Biology I (5) & BIOL 7 - General Biology II (5): Take EEMB 5C/5CL at UCSB after transfer
MCDB 1B	BIOL 150 - General Biology (4) & BIOL 154 - General Botany (5) & BIOL 155 - General Zoology (5)	BIOSCI 106 - Organismic and Environmental Biology (4) & BIOSCI 107 - Molecular and Cellular Biology (4)	BIOLGY 6 - General Biology I (5) & BIOLGY 7 - General Biology II (5): Take EEMB 5C/5CL at UCSB after transfer	BIOL 6 - General Biology I (5) & BIOL 7 - General Biology II (5): Take EEMB 5C/5CL at UCSB after transfer
MCDB 1BL	BIOL 150 - General Biology (4) & BIOL 154 - General Botany (5) & BIOL 155 - General Zoology (5)	BIOSCI 106 - Organismic and Environmental Biology (4) & BIOSCI 107 - Molecular and Cellular Biology (4)	BIOLGY 6 - General Biology I (5) & BIOLGY 7 - General Biology II (5): Take EEMB 5C/5CL at UCSB after transfer	BIOL 6 - General Biology I (5) & BIOL 7 - General Biology II (5): Take EEMB 5C/5CL at UCSB after transfer
EEMB 2L	BIOL 150 - General Biology (4) & BIOL 154 - General Botany (5) & BIOL 155 - General Zoology (5)	BIOSCI 106 - Organismic and Environmental Biology (4) & BIOSCI 107 - Molecular and Cellular Biology (4)	BIOLGY 6 - General Biology I (5) & BIOLGY 7 - General Biology II (5): Take EEMB 5C/5CL at UCSB after transfer	BIOL 6 - General Biology I (5) & BIOL 7 - General Biology II (5): Take EEMB 5C/5CL at UCSB after transfer
EEMB 3-3L	BIOL 150 - General Biology (4) & BIOL 154 - General Botany (5) & BIOL 155 - General Zoology (5)	BIOSCI 106 - Organismic and Environmental Biology (4) & BIOSCI 107 - Molecular and Cellular Biology (4)	BIOLGY 6 - General Biology I (5) & BIOLGY 7 - General Biology II (5): Take EEMB 5C/5CL at UCSB after transfer	BIOL 6 - General Biology I (5) & BIOL 7 - General Biology II (5): Take EEMB 5C/5CL at UCSB after transfer
Physics 6A-AL	PHYS 141 - General Physics 1 (4) & PHYS 142 - General Physics 2 (4)	No equivalent, substitution: PHYSIC 110 - General Physics I (4) & PHYSICS 111 - General Physics II (4) & PHYSICS 111L - Lab (1)	No equivalent, substitution: PHYSICS 6 - General Physics I (4) & PHYSICS 7 - General Physics II (4)	PHYSICS 8 - General Physics with Calculus (4) & PHYSICS 9 - General Physics with Calculus (4) Or substitution: PHYSICS 6 - General Physics (4) & PHYSICS 7 - General Physics (4)
Physics 6B-BL	PHYS 141 - General Physics 1 (4) & PHYS 142 - General Physics 2 (4)	No equivalent, substitution: PHYSIC 110 - General Physics I (4) & PHYSICS 110L - General Physics II (4) & PHYSICS 111L - Lab (1)	No equivalent, substitution: PHYSICS 6 - General Physics I (4) & PHYSICS 7 - General Physics II (4)	PHYSICS 8 - General Physics with Calculus (4) & PHYSICS 9 - General Physics with Calculus (4) Or substitution: PHYSICS 6 - General Physics (4) & PHYSICS 7 - General Physics (4)
Physics 6C-CL	PHYS 141 - General Physics 1 (4) & PHYS 142 - General Physics 2 (4)	No equivalent, substitution: PHYSIC 110 - General Physics I (4) & PHYSICS 110L - General Physics II (4) & PHYSICS 111 - General Physics II (4) & PHYSICS 111L - Lab (1)	No equivalent, substitution: PHYSICS 6 - General Physics I (4) & PHYSICS 7 - General Physics II (4)	PHYSICS 8 - General Physics with Calculus (4) & PHYSICS 9 - General Physics with Calculus (4) Or substitution: PHYSICS 6 - General Physics (4) & PHYSICS 7 - General Physics (4)

Chemistry 1A-AL	CHEM 150 - General Chemistry 1 (5) & CHEM 151 - General Chemistry 2 (5)	CHEM 201 - General Chemistry I (6) & CHEM 202 - General Chemistry II (5)	CHEM 101 - General Chemistry I (5) & CHEM 102 - General Chemistry II (5)	CHEM 11 - General Chemistry I (5) & CHEM 12 - General Chemistry II (5)
&				
Chemistry 1B-BL	CHEM 150 - General Chemistry 1 (5) & CHEM 151 - General Chemistry 2 (5)	CHEM 201 - General Chemistry I (6) & CHEM 202 - General Chemistry II (5)	CHEM 101 - General Chemistry I (5) & CHEM 102 - General Chemistry II (5)	CHEM 11 - General Chemistry I (5) & CHEM 12 - General Chemistry II (5)
&				
Chemistry 1C-CL	CHEM 150 - General Chemistry 1 (5) & CHEM 151 - General Chemistry 2 (5)	CHEM 201 - General Chemistry I (6) & CHEM 202 - General Chemistry II (5)	CHEM 101 - General Chemistry I (5) & CHEM 102 - General Chemistry II (5)	CHEM 11 - General Chemistry I (5) & CHEM 12 - General Chemistry II (5)
Chemistry 6A	No equivalent courses	CHEM 255 - Organic Chemistry I (5)	CHEM 211 - Organic Chemistry for Science Majors I (5)	CHEM 21 - Organic Chemistry I (5)
Chemistry 6B	No equivalent courses	CHEM 256 - Organic Chemistry II (5) And take CHEM 6B at UCSB after transfer	CHEM 212 - Organic Chemistry for Science Majors II (5)	CHEM 24 - Organic Chemistry II Lab (2)
Chemistry 107A	No equivalent courses	No equivalent courses	CHEM 211 - Organic Chemistry for Science Majors I (5)	CHEM 21 - Organic Chemistry I (5)
&				
Chemistry 107B	No equivalent courses	No equivalent courses	CHEM 212 - Organic Chemistry for Science Majors II (5)	CHEM 22 - Organic Chemistry II Lecture (4)
or				
Chemistry 107C	No equivalent courses	No equivalent courses	No equivalent courses	No equivalent courses
&				
Chemistry 130B	No equivalent courses	No equivalent courses	No equivalent courses	No equivalent courses
Mathematics 3A-B	MATH 181 - Calculus 1 (5) & MATH 182 - Calculus 2 (5)	MATH 211 - Calculus I (5) & MATH 212 - Calculus II (5)	MATH 261 - Calculus I (5) & MATH 262 - Calculus II (5)	MATH 7 - Analytic Geometry and Calculus (5) & MATH 8 - Analytic Geometry and Calculus (5)
or				
Mathematics 34A-B	MATH 135 - Calculus with Applications (4) Take MATH 34 at UCSB after transfer	MATH 240 - Mathematical Analysis for Business and Social Science (5) Take MATH 34 at UCSB after transfer	No equivalent, substitution: MATH 261 - Calculus I (5) & MATH 262 - Calculus II (5)	MATH 23 - Mathematics for Business and Social Science (5) & MATH 24 - Calculus for Business and Social Science (5)
or				
PSTAT 5A	MATH 123 Elementary Statistics (4)	MATH 140 - Introductory Statistics (4)	MATH 227 - Statistics (4) or STAT 1 - Elementary Statistics I for the Social Sciences (3)	MATH 52 - Elementary Statistics (3)
EEMB 30	No equivalent courses	No equivalent courses	No equivalent courses	No equivalent courses
Mathematics 3C	MATH 183 - Linear Algebra and Multivariable Calculus (5) & MATH 184 - Differential Equations with Linear Algebra(5)	MATH 213 - Calculus III (5) & MATH 215 - Differential Equations (3)	MATH 263 - Calculus III (5) & MATH 275 - Ordinary Differential Equations (3)	In addition to MATH 7-8, complete: MATH 11 - Multivariable Calculus (5) & MATH 15 - Differential Equations (3)