

CALIFORNIA STATE UNIVERSITY, EAST BAY

Designation Code: 2008-09 **CAPR 09**

Date Submitted: November 6, 2008

TO: The Academic Senate
FROM: Committee on Academic Planning & Review (CAPR)
SUBJECT: MS in Biotechnology
PURPOSE: For Action by the Academic Senate
ACTION
REQUESTED: That the Academic Senate Approve the proposed MS in Biotechnology

At the CAPR meeting of November 6th, the committee members voted unanimously to approve the MS in Biotechnology for placement on the Academic Plan. The first program review will be 2014-15 to coincide with the other degree programs in Biology.

Program submission documents can be found on the CAPR Sharepoint site within the November 6th workspace at:

<https://sharepoint.csueastbay.edu/sites/AcademicSenate/capr/CAPR%20Meeting/default.aspx?InstanceID=20081106>

See also 08-09 CIC 11

Program Type

√ New Program

1. Program Identification

- a. Campus: **East Bay**
- b. Full and exact degree designation and title (e.g. Master of Science in Genetic Counseling, Bachelor of Arts with a Major in History): **Master of Science in Biotechnology**
- c. Date the Board of Trustees approved adding this program projection to the campus Academic Plan:
- d. Term and academic year of intended implementation (e.g. Fall 2007): **Fall 2009**
- e. Name of the department(s), division, or other unit of the campus that would offer the proposed degree major program. Please identify the unit that will have primary responsibility: **Department of Biological Sciences, College of Science**
- f. Name, title, and rank of the individual(s) primarily responsible for drafting the proposed degree major program: **Donald Gailey, Professor and Chair, Department of Biological Sciences**
- g. Statement from the appropriate campus administrative authority that the addition of this program supports the campus mission and will not impede the successful operation and growth of existing academic programs. (CPEC “**Appropriateness to Institutional and Segmental Mission**”) (see attached)
- h. Any other campus approval documents that may apply (e.g. curriculum committee approvals): (see attached)
- i. Please specify whether this proposed program is subject to WASC Substantive Change review: **N/A**
- j. Optional: Proposed Classification of Instructional Programs ([CIP Code](#)) and CSU Degree [Program Code](#) :
Program Code: 04991
(CIP) Code: 26.1201

3. Program Overview and Rationale

a. Rationale, including a brief description of the program, its purpose and strengths, fit with institutional mission, and a justification for offering the program at this time. The rationale may explain the relationship among the program philosophy, design, target population, and any distinctive pedagogical methods. (CPEC “**Appropriateness to Institutional and Segmental Mission**”)

The San Francisco Bay Area is home to more than 600 biotechnology companies (Ernst & Young), ranging in size and scope from start-up therapeutics research and development, to large-scale production and drug manufacturing. Since 1985, the CSUEB Department of Biological Sciences has offered the “Certificate in Biotechnology,” a 34-quarter-unit postbaccalaureate program aimed at preparing students with an intensive academic and hands-on laboratory background for entry into the biotechnology workforce as technicians and research associates. The Biotechnology Certificate Program (BCP) has provided training for over 300 students, nearly all of whom proceeded to jobs in industry; its success is documented in publication: S. Benson And C.

Baysdorfer (2000) "Biotechnology Training: A Model Program at California State University, Hayward," *Journal of Industrial Microbiology and Technology* 24:364-366. This is a proposal to elevate the core curriculum of the BCP to Master's Degree status by requiring an additional 13 units of course concentration, with primary focus on the requirement of a University Thesis. The rationale is obvious; students of the BCP will have the option to proceed to the M.S. in Biotechnology with the distinction of completing a research thesis and thus increasing their qualifications and competitiveness for entry into the biotechnology workforce. This fits well with the Department's long-term goal of expanding training in biotechnology in order to meet both increasing demand in student enrollment, and the projected, ever-increasing need for new employees in the biotechnology industry (Ernst & Young).

The Master of Science in Biotechnology degree will be offered alongside the department's general Master of Science in Biological Science. It represents the department's initial move to a major designation in its Master's Degree program and it is specifically intended for students seeking career opportunities in the biotechnology industry, or to provide the opportunity for advancement for students already employed in the industry. As such, the degree curriculum is fixed, and with no elective courses. In practice, the degree's core curriculum is the selfsame curriculum required for the Certificate in Biotechnology, developed historically for providing the student with a rigorous academic and hands-on laboratory experience appropriate for a wide variety of laboratory "bench science" biotechnology positions. The additional requirement of BIOL 6822 Colloquium in Biotechnology (see below) is invoked to achieve concordance with the Sloan Foundation's "Professional Science Master's (PSM)" model, in which the degree curriculum should involve an integrative educational approach to include education and training in business aspects of the industry. The additional requirement of the University Thesis is not only in keeping with the Department's thesis research requirement for the M.S. degree, it is concordant with the Sloan PSM model which also includes workplace internship. This will especially hold true when thesis research is accomplished under the supervision of the student's employer (a provision of the proposed curriculum, see below). As such, the unit requirement for the Master of Science in Biotechnology will be slightly higher – 47 quarter units – than the Department's general M.S. in Biological Sciences which is a 45 quarter unit program.

Proposed catalog description, including program description, degree requirements, and admission requirements. For master's degrees, please also include catalog copy describing the culminating experience requirement(s).

Admission Requirements

1. The M.S. in Biotechnology degree program in the Department of Biological Sciences is open to graduates of accredited institutions who have a four-year B.S. in Biology or Biochemistry (or the equivalent), and who have achieved a GPA of at least 2.75 in all undergraduate work and an average of 3.0 in all biological science courses taken as an upper division student. Applicants must have completed the following courses (or equivalents), each with the grade "B" or better: BIOL 3121 Principles of Genetics, BIOL 3405 Microbiology, BIOL 4455 Molecular Cell Biology, and CHEM 4411 General Biochemistry. Omissions, if any, will be treated as course deficiencies and must be completed by the time of classification (see below).

~~**2. Generally, all applicants should have completed undergraduate courses equivalent to those required of all biological science majors at CSUEB.**~~ In addition to filing the university application and fee, students must make application apply to the Department of Biological

Sciences for admission to graduate standing in the M.S. in Biotechnology degree program. Application forms are available through the department office or by accessing the Biology Department website. ~~In addition to the course and GPA requirements for admission, the applicant must submit to the Department the following items: departmental application, GRE scores of the General Test, and three letters of reference. No action will be taken by the department until the application file is complete; this is the applicant's responsibility. All students admitted to the program will receive "Conditionally Classified Graduate" status. Students applying to the M.S. in Biotechnology degree program must also apply to the departmental Biotechnology Certificate Program.~~ Applications are only accepted for admission for fall quarter each year. In addition to the GPA requirements in #1 above, the department requires that the following be sent directly to the Department of Biological Sciences:

- departmental application
- GRE General Test Scores (target scores are in the upper 30th percentile; significant deviation from target scores may be grounds for denial of admission)
- three letters of reference
- statement of purpose

Applicant files will not be reviewed or processed until the application file is complete; this is the applicant's responsibility. During the admission process, students interested in the M.S. in Biotechnology program are urged to discuss with the Biotechnology Certificate Program Director the possibility of carrying out thesis research at a biotechnology job site or with a faculty member who might serve as thesis advisor.

3. All students admitted to the program will be admitted as "Conditionally Classified Graduate" students.

4. Any student not admitted to the program because of incomplete application, deficiency, or failure to meet deadlines is urged to enroll in the university as an "Unclassified Post-baccalaureate" student pending completion and/or reconsideration of the application for classification.

5. No more than 13 quarter units of courses applicable toward the master's degree completed before admission to the degree program will be counted toward the degree.

6. Students applying to the M.S. in Biotechnology program must also apply to the departmental Biotechnology Certificate Program.

Degree Requirements

A "Conditionally Classified Graduate" student must become a fully "Classified Graduate" student in the program by completing the following, as set forth in 1, 2, 3, and 4 below, if applicable, within four quarters of acceptance into the program or the "Conditional Classification" will expire and the student will be placed in "Unclassified Post-baccalaureate" status. It is the responsibility of the student to make sure these requirements are met within the specified time limits.

1. Establish a *three-person graduate advisory committee for the University Thesis*. Two faculty members from the Department of Biological Sciences will serve as members of the graduate advisory committee, and one of these two will normally be the major advisor in guiding the student in graduate training and the program. One to two other members of the committee member will be chosen in consultation with the major advisor; students employed in the biotechnology industry are encouraged to develop a thesis research plan with the job supervisor and obtain company approval for carrying out thesis research in the company laboratory environment. In such cases, the job supervisor will serve on the graduate advisory committee, and this committee will administer the oral examination at the completion of the thesis.

2. Complete basic course deficiencies. If the student has been admitted to the program with any specified course deficiencies, these courses must be completed by the end of the fourth quarter following admission to the program. In addition, the student's advisory committee may also determine that there are other course deficiencies that need to be satisfied.

2 3. Research proposal. ~~Students wishing to be a fully "Classified Graduate"~~ The student must submit a formal research proposal to the departmental Graduate Committee. The department office, or Graduate Coordinator, or Director of the Biotechnology Certificate Program has examples of proposals and their format. The proposal must be approved by the student's advisory committee (Item 1, above) and submitted to the Graduate Coordinator by the first day of the quarter in which the student wants to begin taking thesis units. If the work is to be done in an ~~industry-laboratory off-campus location~~, a letter of agreement must be included that indicates a mutual understanding and responsibility between the off-campus supervisor, ~~the company,~~ CSUEB Cal State East Bay, and the student.

3 4. University Writing Skills Requirement. The University Writing Skills Requirement must be satisfied. (See Graduate and Post-baccalaureate Studies chapter at the beginning of the graduate section of the catalog.)

5. Exiting the degree program with the departmental Biotechnology Certificate. Upon completion of the 34-unit Core Curriculum, ~~the a student may choose to exit the M.S. in Biotechnology program with the departmental Biotechnology Certificate.~~ Students choosing this alternative, however, may continue in the degree program by establishing the above three criteria for continuation in the program, and by working within the University regulations for degree continuation, and time limit for degree completion.

4. Curriculum

Goals for the (1) program and (2) [student learning outcomes](#). Program goals are very broad statements about what the program is intended to achieve, including what kinds of graduates will be produced. Student learning outcomes are more specific statements that are related to the program goals but that more narrowly identify what students will know and be able to do upon successful completion of the program.

(1) Program goals: (a) **To prepare students with skill sets that will increase their competitiveness for entry into the biotechnology workforce. This includes hands-on training in laboratory skills, and experience in the academic skills required to understand the cell and molecular underpinnings that drive Research and Development in the industry.** (b) **To provide students already in the biotechnology workforce the opportunity for advancement by distinction of the M.S. in Biotechnology.**

(2) Student Learning Outcomes: Students graduating with the M.S. in Biotechnology will be able to: (1) use the scientific method to examine questions about cellular and molecular mechanisms of life processes concerning the normal vs. diseased state; (2) use laboratory instrumentation and understand molecular diagnostic procedures widely applied in the biotechnology industry; (3) communicate orally and in written form an assessment of primary scientific literature and experimental data, whether in an industrial process or basic research laboratory environment; (4) demonstrate in written form advanced knowledge of cellular and subcellular processes, and the experimental methodologies used to investigate them.

a. Plans for assessing program goals and student learning outcomes. Some planners find it helpful to develop matrices in which student learning outcomes and required courses are mapped, indicating where content related to the learning outcomes is introduced, reinforced, and practiced at an advanced level in required courses. (CPEC "Maintenance and Improvement of Quality")

Formative assessment and evaluation: The initial number of students participating in this

proposed M.S. program is expected to be relatively small. As a result, it will not be realistic, or useful, to apply any broad-based analysis. Instead, students will be assessed quarterly in their classroom performance relative to the minimum expectation of maintaining a B average. Students with unsatisfactory, or borderline grade performance will be required to meet with the Biotechnology Graduate Coordinator for assessment and planning advice. Since students will be concurrently enrolled in the M.S. in Biotechnology degree program and the Biotechnology Certificate Program, and since the curriculum for both is fixed (see below), students will progress through the program(s) as a cohort. Thus, the performance of an individual student will be compared with others in the cohort. Performance of M.S. in Biotechnology students will also be compared as a group to students in the general M.S. and M.A. programs in Biological Sciences.

Summative assessment and evaluation: Evaluation of the individual student's overall performance will come from a comprehensive assessment of grades, and mastery of the scientific method through evaluation of the writing and oral defense of a research thesis.

b. Total number of units required for the major: **47 quarter units.**

c. Include a justification for any baccalaureate program that requires more than 120-semester units or 180-quarter units.

d. If any formal options, concentrations, or special emphases are planned under the proposed major, identify and explain fully. Optional: You may propose a CSU degree program code and CIP code for each concentration that you would like to report separately from the major program, if the option is approximately equivalent to a degree currently listed on the CSU application-booklet degree program table. If you do not find an appropriate CSU degree program code at:

http://www.calstate.edu/app/documents/HEGIS-CIP2000_102406.xls, you can search CIP 2000 at <http://nces.ed.gov/pubs2002/cip2000/> to help identify the code that best matches the proposed curriculum.

No formal options, concentrations, or special emphases are planned for the initiation of this proposed M.S. program.

e. A list of all courses *required* for the major, specifying catalog number, *title*, units of credit, and prerequisites or co-requisites (ensuring that there are no "hidden" prerequisites that would drive the total units required to graduate beyond the total reported in 4c above).

**Quarter Unit requirements of the Master of Science in Biotechnology degree program = 47
Core Curriculum (34 units):**

BIOL 4450 Cell Culture Techniques (4)

BIOL 4485 PCR, DNA Sequencing and Fragment Analysis (4)

BIOL 4490 Bioinformatics (4)

BIOL 6141 Advanced Molecular Techniques (4)

BIOL 6147 Functional Genomics (4)

BIOL 6151 Cell and Molecular Biology I (5)

BIOL 6152 Cell and Molecular Biology II (5)

CHEM/BIOL 6430 Protein Chemistry Techniques (4)

Concentration (13 units):

BIOL 6822 Biotechnology Colloquium (4)

BIOL 6910 University Thesis (9)

Note that there are no "hidden" prerequisites that would drive the total units required to graduate beyond the stated 47 quarter units.

f. List of *elective* courses that can be used to satisfy requirements for the major, specifying catalog number, title, units of credit, and prerequisites or co-requisites. Include proposed catalog descriptions of all new courses. For graduate program proposals, identify whether each course is a graduate or undergraduate offering.

Note: With regard to Sections 4f and 4g, a proposed program should take advantage of courses already offered in other departments when subject matter would have considerable overlapping content.

None.

g. List of any new courses that are: (1) needed to initiate the program and (2) needed during the first two years after implementation. Only include proposed catalog descriptions for new courses. For graduate program proposals, identify whether each course is a graduate-level or undergraduate-level offering.

BIOL 6822 Biotechnology Colloquium (4) – New

h. Attach a proposed course-offering plan for the first three years of program implementation, indicating, where possible, likely faculty teaching assignments.

The 34-unit Core Curriculum will be offered annually.

Fall 09: BIOL 4485 (Baysdorfer); BIOL 4490 (Staff); BIOL 6151 (Stone)

Winter 10: BIOL 6141 (Gallegos); BIOL 6152 (Curr)

Spring 10: BIOL 4450 (Benson); BIOL 6147 (Stone); CHEM 6430 (Staff)

The 13-unit Concentration Curriculum is BIOL 6822 (Baysdorfer, Spring 10, or as warranted by student demand since this course will be open to all graduate students), and BIOL 6910, supervisory time for thesis experimentation and writing.

j. For master's degree proposals, include evidence that program requirements conform to the minimum requirements for the culminating experience, as specified in [Section 40510](#) of [Title 5 of the California Code of Regulations](#).

The Master of Science in Biotechnology shall require successful formulation, data collection, writing, and oral defense of a research thesis (which conforms to the criteria as specified in Section 40510 of Title 5 of the California Code of Regulations).

k. Admission criteria, including prerequisite coursework.

Admission requires graduation from an accredited institution with a four-year baccalaureate degree in Biology or Biochemistry (or equivalent), and achievement of a GPA of at least 2.75 in all undergraduate work and an average of 3.0 in all biological science courses taken as an upper division student. Applicants must have completed the following courses (or equivalents), each with the grade "B" or better: BIOL 3121 Principles of Genetics; BIOL 3405 Microbiology; BIOL 4455 Molecular Cell Biology; CHEM 4411 General Biochemistry. In addition to the course and GPA requirements, an applicant must forward a departmental application, GRE scores of the General Test, and three letters of reference to the department.

Criteria for student continuation in the program.

A "Conditionally Classified Graduate" student must become a fully "Classified Graduate" student in the program by completing the following.

1. *Establish a graduate advisory committee for the University Thesis.* Two faculty members from the Department of Biological Sciences will serve as members of the graduate advisory committee, and one of these two will normally be the major advisor in guiding the student in graduate training and the program. One to two other members of the committee will be chosen in consultation with the major advisor; students employed in the biotechnology industry are encouraged to develop a thesis research plan with the job supervisor and obtain company approval for carrying out thesis research in the company laboratory environment. In such cases, the job supervisor will serve on the graduate advisory committee, and this committee will administer the oral examination at the completion of the thesis.

2. Research proposal. Students wishing to be a fully “Classified Graduate” must submit a formal research proposal to the departmental Graduate Committee. The department office or Graduate Coordinator has examples of proposals and their format. The proposal must be approved by the student’s advisory committee (Item 1, above) and submitted to the Graduate Coordinator by the first day of the quarter in which the student wants to begin taking thesis units. If the work is to be done in an industry laboratory, a letter of agreement must be included that indicates a mutual understanding and responsibility between the off-campus supervisor, the company, CSUEB, and the student.

3. University Writing Skills Requirement. The University Writing Skills Requirement must be satisfied. (See Graduate and Post-baccalaureate Studies chapter at the beginning of the graduate section of the catalog.)

l. For undergraduate programs, planned provisions for articulation of the proposed major with community college programs: N/A

m. If there is a [Lower-Division Transfer Pattern](http://www.calstate.edu/AcadAff/ldtp.shtml) (LDTP) for this major, indicate the relationship between the LDTP and the requirements presented in this proposal. Information on LDTP is available at: <http://www.calstate.edu/AcadAff/ldtp.shtml> N/A

n. Advising “roadmaps” that have been developed for the major.

Since the M.S. in Biotechnology will have a fixed curriculum, and since students will proceed through the curriculum as a cohort, the advising “roadmap” is straightforward.

Year 1: The 34-unit core curriculum as presented in Item 4i above.

Year 2: Completion of the University Thesis and BIOL 6822

o. Provision for meeting accreditation requirements, if applicable, and anticipated date of accreditation request (including the WASC Substantive Change process).

Accreditation Note:

Master’s degree program proposals

If subject to accreditation, establishment of a master’s degree program should be preceded by national professional accreditation of the corresponding bachelor’s degree major program.

(Accreditation note finished on next page.)

Fast-track proposals

Fast-track proposals cannot be subject to specialized accreditation by an agency that is a member of the Association of Specialized and Professional Accreditors unless the proposed program is already offered as an authorized option or concentration that is accredited by an appropriate specialized accrediting agency.

5. Need for the Proposed Degree Major Program

(CPEC “Societal Need,” “Number of Existing Programs in the Field,” and “Advancement of the Field”)

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.

CSU campuses: Two campuses, Fresno State and San Jose State, offer the newly recognized CSU degree “Master of Biotechnology (MBt),” with neither “Science” nor “Arts” distinction. The Channel Islands campus offers the “Master of Science in Biotechnology and Bioinformatics” degree.

Neighboring institutions: no comparable degree program.

b. Differences between the proposed program and programs listed in Section 5a above.

Fresno State University: Modeled to be in accord with the Sloan Foundation Professional Science Master's (PSM), the MBt is very similar to the M.S. in Biotechnology proposed here. Distinctive differences include a few agricultural, plant, and food science courses (not offered at CSUEB mainly because of the department and college's significantly smaller size); and two Master's level business courses in "New Ventures." In the program proposed here, the department avoids requiring Master's level business courses with their distinctive business-course prerequisites. Alternatively, the department has created BIOL 6822 Colloquium in Biotechnology, in which will be presented an overview of the "business of biotechnology" with sessions led by distinguished business agents from the biotechnology industry. The Fresno State MBt requires a University Thesis.

San Jose State University: Also modeled to be in accord with the Sloan PSM, this MBt has a number of distinctive differences. It is much more "business oriented," with nearly one-half the degree requirement in business courses and a business-related internship in the biotechnology industry. The degree program is managed through Continuing Education and carries a fee of \$27,500.

Channel Islands: Also modeled to be in accord with the Sloan PSM, this program requires a balance of coursework in both sciences and business. Although requiring an internship in industry, it offers the choice of concentration in Biotechnology or Bioinformatics. Although the degree is designated "Master of Science," there is no requirement for University Thesis. Therein is the most significant difference between Channel Island's degree and the M.S. proposed here: the CSUEB M.S. in Biotechnology will require a University Thesis.

c. List of other curricula currently offered by the campus that are closely related to the proposed program.

There are two curricula closely related to this proposed degree program—both offered through the department: (1) The Biotechnology Certificate Program curriculum (which is the proposed M.S. in Biotechnology Core Curriculum, see above); (2) the existing "Master of Science" general curriculum which allows for an area of research specialization and relevant coursework, as approved by the student's graduate advisory committee.

d. Community participation, if any, in the planning process. This may include prospective employers of graduates.

No community participation in the planning process.

e. Applicable workforce demand projections and other relevant data.

The projected growth of the biotechnology industry and workplace opportunities in California is widely accepted (e.g., "California's Biotechnology Workforce Training Needs for the 21st Century," 2006, by Koehler and Koehler Jones, Sacramento, CA). The San Francisco Bay Area alone is home to more than 600 companies with a common need for skilled laboratory technicians and research associates.

f. If the program was proposed to meet society's need for the advancement of knowledge, please specify the need and explain how the program meets that need: N/A

Note: Data Sources for Demonstrating Evidence of Need

APP Resources Web <http://www.calstate.edu/app/resources.shtml>

[US Department of Labor, Bureau of Labor Statistics](#)

[California Labor Market Information](#)

[Labor Forecast](#)

6. Student Demand (CPEC “Student Demand”)

a. Compelling evidence of student interest in enrolling in the proposed program. Types of evidence vary and may include national, statewide, and professional employment forecasts and surveys; petitions; lists of related associate degree programs at feeder community colleges; reports from community college transfer centers; and enrollments from feeder baccalaureate programs, for example.

The department has more than a 20-year successful track record in training students for placement in the biotechnology workforce through the Biotechnology Certificate Program (BCP). In 2006-07 the BCP enrollment was increased to 20, and in 2007-08 to 24. With continued growth in the industry, the department anticipates growing student demand for both the BCP and the proposed Master’s degree. Historically, 5-6 students/yr in the BCP have been co-admitted to our regular M.S. general program. Increasing the BCP size has increased the number of students interested in a Master’s degree, roughly 10-12/yr. These are the students precisely for whom this new M.S. in Biotechnology degree program is targeted. Historically, the small size of the department has been a limiting factor in generating student degrees and has been the “bottleneck” in linking students with faculty mentors for thesis research. By promoting thesis research at the job site, this will allow the department to experience significant gains in degree production without placing any additional strain on current resources.

b. Issues of access considered when planning this program: **No issues of access perceived.**

c. For master’s degree proposals, the number of declared undergraduate majors and the degree production over the preceding three years for the corresponding baccalaureate program, if there is one.

Over the last three years, the number of declared undergraduate Biology majors has averaged approximately 500/yr, and the Bachelor’s degree production is approximately 100/yr.

d. Professional uses of the proposed degree program.

Enhanced student competitiveness for placement in the biotechnology workforce as Research & Development laboratory technicians and research associates. For students who already have jobs in industry, distinction of the M.S. in Biotechnology will enhance likelihood of job advancement.

e. 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.

Expected number of majors: Y1 = 5; Y3 = 10; Y5 = 12.

Expected number of graduates: Y1 = 3; Y3 = 5; Y5 = 10.

7. Existing Support Resources for the Proposed Degree Major Program (CPEC “Total Costs of the Program”)

Note: Sections 7 and 8 should be prepared in consultation with the campus administrators responsible for faculty staffing and instructional facilities allocation and planning. A statement from the responsible administrator(s) should be attached to the proposal assuring that such consultation has taken place.

a. Faculty who would teach in the program, indicating rank, appointment status, highest degree earned, date and field of highest degree, professional experience, and affiliations with other campus programs. For master's degrees, include faculty publications or curriculum vitae.

Note: For all proposed graduate degree programs, a minimum of five full-time faculty members with the appropriate terminal degree should be on the program staff.

(Code Memo EP&R 85-20)

Department of Biological Sciences Faculty:

Professors

Christoph W. Baysdorfer, Ph.D. (1984) University of California, Berkeley, Comparative Biochemistry

Stephen C. Benson, Ph.D. (1973) University of California, Santa Barbara; Biochemistry and Molecular Biology

Assistant Professors

Kenneth Curr, Ph.D. (2003) Albert Einstein College of Medicine, Virology

Maria E. Gallegos, Ph.D. (1998) University of Wisconsin, Madison, Cellular and Molecular Biology

Claudia Uhde-Stone, Doctor of Natural Science (1998) University of Bielefeld, Germany

NOTE: CVs attached.

b. Space and facilities that would be used in support of the proposed program.

The space and facilities will be the exact space and facilities used for delivery of the current Biotechnology Certificate Program and the M.S. in Biological Sciences program. No alternative arrangements will be necessary.

c. A report provided by the campus Library, detailing resources available to support the program (discussion of subject areas, volume counts, periodical holdings, etc. are appropriate).

No additional or new library resources will be required to support the proposed program. The program will utilize the exact same library resources that are currently in existence for support of the Biotechnology Certificate program and the M.S. in Biological Sciences program. Given this fact, no detailed Library resources report is deemed necessary.

d. Existing academic technology, equipment, and other specialized materials currently available.

“Smart Room” lecture rooms and halls for PowerPoint/online presentations. Biology curriculum focuses on hands-on laboratory experiences with appropriate equipment and instrumentation to support curricular needs of Cell & Molecular Biology, Ecology & Conservation Biology, Microbiology, Biomedical Laboratory Sciences, Forensics, and Physiology.

**8. Additional Support Resources Required
(CPEC “Total Costs of the Program”)**

Note: If additional support resources will be needed to implement and maintain the program, a statement by the responsible administrator(s) should be attached to the proposal assuring that such resources will be provided.

a. Any special characteristics of the additional faculty or staff support positions needed to implement the proposed program. **None needed.**

b. The amount of additional lecture and/or laboratory space required to initiate and to 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.

None.

c. A report written in consultation with the campus librarian, indicating any additional library resources needed. Indicate the commitment of the campus either to purchase or borrow through interlibrary loan these additional resources.

Additional library resources not required.

d. Additional academic technology, 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.

None required, either for implementation, or for first two years after initiation of program.

CATALOG COPY:

Biotechnology

Department Information

Department of Biological Sciences

College of Science

Office: North Science 429

Phone: (510) 885-3471

Website: <http://www.sci.csueastbay.edu>

Professors Emeriti

Stephen C. Benson, Ph.D. University of California, Santa Barbara

Beverly A. Dixon, Ph.D. University of Georgia

Richard A. Symmons, Ph.D. University of California, Davis

Professors

Christoph W. Baysdorfer, Ph.D. University of California, Berkeley

Donald A. Gailey, Ph.D. University of California, Los Angeles

Michael S. Hedrick, Ph.D. University of British Columbia

Christopher L. Kitting, Ph.D. Stanford University

Carol R. Lauzon, Ph.D. University of Vermont

Maria C. Nieto, Ph.D. University of California, Berkeley

Susan B. Opp, Ph.D. University of Massachusetts

Associate Professors

Caron Y. Inouye, Ph.D. University of California, Los Angeles

Erica L. Wildy, Ph.D. Oregon State University

Assistant Professors

Kenneth Curr, Ph.D. Albert Einstein College of Medicine, New York

Maria E. Gallegos, Ph.D. University of Wisconsin, Madison

James Murray, Ph.D. University of Washington

Claudia Uhde-Stone, Ph.D. University of Bielefeld (Germany)

Lecturer

David C. Rosen, Ph.D. University of California, Berkeley

Graduate Coordinator: Maria Nieto

Please consult the 2010-2011 online catalog for any changes that may occur.

M.S. in Biotechnology

Program Description

The Master of Science in Biotechnology degree offers students the opportunity to obtain advanced academic and research experience in the specialized area of biotechnology, with focus on pharmaceuticals development, agricultural improvements, industrial processing, diagnostic and therapeutic medicine, forensic identification, genomics and bioinformatics. The program prepares students for careers or further education in these areas.

Biotechnology capitalizes on understanding mechanisms of cellular and molecular biology in the development of new technologies. The degree offers background and training for entry into the biotechnology workforce or entry into a suitable Ph.D. program.

Student Learning Outcomes

Students graduating with the M.S. in Biotechnology will be able to: (1) use the scientific method to examine questions about cellular and molecular mechanisms of life processes concerning the normal vs. diseased state; ~~specifically, they will be able to formulate testable biological hypotheses, analyze empirical data, and synthesize the results of an analysis;~~ (2) use laboratory instrumentation and understand molecular diagnostic procedures widely applied in the biotechnology industry; describe the design and results of an observational or experimental analysis in a well-organized manner using the scientific paper format; (3) communicate orally and in written form ~~the analysis of collected data, or an assessment of primary scientific literature and experimental data, whether in an industrial process or basic research laboratory environment; and to judge the value of the information presented in relation to particular biological questions;~~ (4) demonstrate in written form advanced knowledge ~~of about~~ cellular and subcellular processes, and the experimental methodologies used to investigate them.

Career Opportunities

The M.S. in Biotechnology degree program is designed to accommodate two distinguishing career tracks: (1) direct entry into the biotechnology workforce; (2) entry into a Ph.D. program.

Faculty

M.S. in Biotechnology faculty members come from the faculty of the Department of Biological Sciences, comprised of 14 full-time professors at Cal State East Bay who are committed to excellence in teaching and research, many with federal, state, and private research grant support.

Related Programs

The M.S. and M.A. degree programs in Biological Science are designed for students who seek advanced training in departmental areas such as environmental biology, ecology, population biology, marine biology, physiology, neurobiology, and areas of general cell and molecular biology with less direct focus on humans, including genetics, microbiology and virology. Students interested in these areas ought to consider pursuing the M.S. or M.A. in Biological Science and should refer to that section of the Biological Science chapter in the graduate section of this catalog. The Biotechnology Certificate Program is a one-

year postbaccalaureate program designed to prepare students for direct entry into the biotechnology workforce. With careful planning, the biotechnology certificate may be combined with an M.S. in Biotechnology degree.

Research Facilities

Equipment and laboratory space for student research and training in biotechnology is housed in BioCore, a central core facility that includes state-of-the-art equipment for DNA sequencing, real-time PCR gene analysis, cell analysis by flow cytometry and differential display, and HPLC. Included are a cell culture facility, imaging facility, and a trace DNA lab. M.S. in Biotechnology faculty also maintain independent research labs with instrumentation to sponsor student research within the individual faculty member's area of expertise.

Research and Financial Support

Research space will be available to all "Classified Graduate" students in the M.S. in Biotechnology program, either in laboratory facilities provided by a biotechnology company or the major advisor's research lab. Graduate research grants are available annually on a competitive basis through Academic Programs and Graduate Studies and can be used to purchase supplies or pay travel expenses for graduate research. In addition, research assistantships are available for some students through faculty research grants. Teaching assistantships may become available for a given quarter. As financial aid within the department is limited, you may want to contact the Financial Aid Office regarding other assistance from the University Work-Study Program, loans and scholarships.

Admission Requirements

1. The M.S. in Biotechnology degree program in the Department of Biological Sciences is open to graduates of accredited institutions who have a four-year B.S. degree in Biology or Biochemistry (or the equivalent), and who have achieved a GPA of at least 2.75 in all undergraduate work and an average of 3.0 in all biological science courses taken as an upper division student. Applicants must have completed the following courses (or equivalents), each with the grade "B" or better: BIOL 3121 Principles of Genetics, BIOL 3405 Microbiology, BIOL 4455 Molecular Cell Biology, and CHEM 4411 General Biochemistry. Omissions, if any, will be treated as course deficiencies and must be completed by the time of classification (see below).
2. In addition to filing the university application and fee, students must apply to the Department of Biological Sciences for admission to graduate standing in the M.S. in Biotechnology degree program. Application forms are available through the department office or by accessing the Biology Department website. Applications are only accepted for admission for fall quarter each year. In addition to the GPA requirements in #1 above, the department requires that the following be sent directly to the Department of Biological Sciences:
 - departmental application
 - GRE General Test Scores (target scores are in the upper 30th percentile; significant deviation from target scores may be grounds for denial of admission)
 - three letters of reference
 - statement of purpose

Applicant files will not be reviewed or processed until the application file is complete; this is the applicant's responsibility. During the admission process, students interested in the M.S. in Biotechnology program are urged to discuss with the Biotechnology Certificate Program Director the possibility of carrying out thesis research at a biotechnology job site or with a faculty member who might serve as thesis advisor.

3. All students admitted to the program will be admitted as "Conditionally Classified Graduate" students.

4. Any student not admitted to the program because of incomplete application, deficiency, or failure to meet deadlines is urged to enroll in the university as an “Unclassified Post-baccalaureate” student pending completion and/or reconsideration of the application for classification.
5. No more than 13 quarter units of courses applicable toward the master’s degree completed before admission to the degree program will be counted toward the degree.
6. Students applying to the M.S. in Biotechnology program must also apply to the departmental Biotechnology Certificate Program.

Degree Requirements

A “Conditionally Classified Graduate” student must become a fully “Classified Graduate” student in the program as set forth in 1, 2, 3, and 4 below, if applicable, within four quarters of acceptance into the program or the “Conditional Classification” will expire and the student will be placed in “Unclassified Post-baccalaureate” status. It is the responsibility of the student to make sure these requirements are met within the specified time limits.

1. *Establish a three-person graduate advisory committee.* Two faculty members from the Department of Biological Sciences will serve as members of the graduate advisory committee, and one of these two will be the major advisor in guiding the student in graduate training and the program. One other committee member will be chosen in consultation with the major advisor; students employed in the biotechnology industry are encouraged to develop a thesis research plan with the job supervisor and obtain company approval for carrying out thesis research in the company laboratory environment. In such cases, the job supervisor will serve on the graduate advisory committee, and this committee will administer the oral examination at the completion of the thesis.
2. *Complete basic course deficiencies.* If the student has been admitted to the program with any specified course deficiencies, these courses must be completed by the end of the fourth quarter following admission to the program. In addition, the student’s advisory committee may also determine that there are other course deficiencies that need to be satisfied.
3. *Research proposal.* The student must submit a formal research proposal to the departmental Graduate Committee. The department office, Graduate Coordinator, or Director of the Biotechnology Certificate Program has examples of proposals and their format. The proposal must be approved by the student’s advisory committee (item 1 above) and submitted to the Graduate Coordinator by the first day of the quarter in which the student wants to begin taking thesis units. If the work is to be done in an off-campus location, a letter of agreement must be included that indicates a mutual understanding and responsibility between the off-campus supervisor, Cal State East Bay, and the student.
4. *University Writing Skills Requirement.* The University Writing Skills Requirement must be satisfied. (See Graduate and Post-baccalaureate Studies chapter at the beginning of the graduate section of this catalog.)
5. *Exiting the degree program with the departmental Biotechnology Certificate.* Upon completion of the 34-unit Core Curriculum, a student may choose to exit the M.S. in Biotechnology program with the departmental Biotechnology Certificate. Students choosing this alternative, however, may continue in the degree program by establishing the above criteria for continuation in the program, and by working within the University regulations for degree continuation, and time limit for degree completion.

Advanced to Candidacy

The student must have:

1. attained "Classified Graduate" standing
2. completed at least 12 quarter units of satisfactory work beyond the baccalaureate degree within the 34-unit Core Curriculum. At least 3 quarter units of graduate level coursework in residence at Cal State East Bay must be included. (You must maintain a 3.00 GPA in your degree coursework to remain in good standing.)
3. received approval from the advisory committee of an individual thesis research program.

Curricular Requirements

A total of 47 quarter units is required beyond the baccalaureate with a GPA of 3.0 and above, with no grade lower than "B" in courses included in the program, and with specific requirements as follows:

1. University Thesis (BIOL 6910, for a total of 9 units)
Complete copies of the University Thesis must be submitted, in accordance with the rules set forth by the Thesis Editor in the Office of the Associate Vice President, Academic Programs and Graduate Studies, to the chair of the candidate's advisory committee by the sixth week of the quarter at the end of which the degree is desired
2. Completion of the following Biotechnology Core Curriculum (34 units):

BIOL 4450 Cell Culture Techniques (4 units)
BIOL 4485 PCR, DNA Sequencing and Fragment Analysis (4 units)
BIOL 4490 Bioinformatics (4 units)
BIOL 6141 Advanced Molecular Techniques (4 units)
BIOL 6147 Functional Genomics (4 units)
BIOL 6151 Cell and Molecular Biology I (5 units)
BIOL 6152 Cell and Molecular Biology II (5 units)
CHEM 6430 Protein Chemistry Techniques (4 units)
3. Completion of BIOL 6822 Colloquium in Biotechnology (4 units)
Note: A student may choose to receive the departmental Biotechnology Certificate by completing the 34-unit Core Curriculum, without completing BIOL 6822 and BIOL 6910 University Thesis.
4. An oral examination administered by the advisory committee covering the candidate's area of specialization and thesis research.

Granting the Degree

Upon successful completion of the above requirements the department will recommend that the candidate be granted the M.S. in Biotechnology degree.

Other Degree Requirements

In addition to departmental requirements, every student must also satisfy the university requirements for graduation which are described in the Graduate and Post-baccalaureate Studies chapter at the beginning of the graduate section of this catalog. These requirements include the 32-unit residence requirement, the five-year rule on currency of subject matter, the minimum number of units of 6000-level courses, the 3.00

GPA, and the University Writing Skills Requirement (UWSR). For information on meeting the University Writing Skills Requirement, see the testing Web site at www.testing.csueastbay.edu or call 510.885.3661.

Graduate Courses

See the undergraduate and graduate Biological Science chapters for Biology (BIOL) course descriptions.