**Revised November 2014**

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| Proposing New CSU Degree ProgramsBachelor’s and Master’s LevelsOffered through Self-Support and State-Support Modes |

This document presents the format, criteria, and submission procedures for CSU bachelor’s and master’s degree program proposals. Please see the [Academic Program Planning](http://www.calstate.edu/APP/) website for doctoral degree proposal formats. (<http://www.calstate.edu/APP/>)

**Templates for Doctoral Proposals**

* [CSU Ed.D. Programs](http://www.calstate.edu/app/EdD/)
* [UC-CSU Joint Doctoral Programs](http://www.ucop.edu/acadinit/uccsu/jointdochandbook030502.htm)
* [Joint Doctorates with Independent Institutions](http://www.calstate.edu/app/documents/Joint_Doc_Other.pdf)

**Criteria**

Proposals are subjected to system-level internal and external evaluation, through which reviewers seek evidence indicating that current campus budgetary support levels provide sufficient resources to establish and maintain the program. Review criteria include: curriculum, financial support, number and qualifications of faculty, physical facilities, library holdings, responsiveness to societal need and regional and workforce needs, academic assessment plans, and compliance with all applicable CSU policies, state laws, and accreditation standards.

**Procedures**

Before a proposal is submitted to the Chancellor’s Office, the campus adds the projected degree program to the campus academic plan. Subsequent to the CSU Board of Trustees approval of the projection, a detailed, campus-approved program implementation proposal is submitted to Chancellor’s Office for review and approval. Proposals are to be submitted in the academic year preceding projected implementation. Only programs whose implementation proposals have been approved by the CSU Chancellor may enroll students. [Campus Academic Plans](http://www.calstate.edu/BOT/agendas/Mar05/EdPol.pdf) appear in the Educational Policy Committee Agenda Item of the annual March meeting of the Board of Trustees.

**Submission**

1. The degree program proposal should follow the format and include information requested in this template. If the proposed program is subject to WASC Substantive Change, the Chancellor’s Office will accept the WASC Substantive Change Proposal format in place of the CSU format. If campuses choose to submit the WASC Substantive Change Proposal, they will also be required to submit a program assessment plan using the format found in the CSU program proposal template. For undergraduate degrees, the total number of units required for graduation must still be made explicit.
2. Submit **ONE** hard copy of the campus-approved degree implementation proposal, including documentation of campus approval, to:

Academic Programs and Faculty Development
CSU Office of the Chancellor
401 Golden Shore
Long Beach, California 90802-4210

1. Submit **ONE** electronic copy to APP@calstate.edu. A Word version is preferred.

**CSU DEGREE PROPOSAL**

**Faculty Check List**

**Please confirm (√) that the following are included in the degree proposal:**

**\_X\_\_\_\_The total number of units required for graduation is specified (not just the total for the major):**

 \_X\_\_ a proposed bachelor’s program requires no fewer than 120 semester units

 **\_\_\_ any** proposed bachelor’sdegree program with requirements exceeding 120 units must request an exception to the 120 semester unit limit policy

**\_\_X\_\_ Please specify the total number of prerequisite units required for the major.**

 **Note: The prerequisites must be included in the total program unit count.**

 **List all courses and unit counts that are prerequisite to the major:**

 **\_\_\_\_\_**See attached program materials**.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**\_\_X\_\_\_Title 5 minimum requirements for bachelor’s degree have been met, including:**

**\_\_\_** minimum number of units in major (BA 24 semester units), (BS 36 semester units)

 **\_\_\_** minimum number of units in upper-division (BA 12 semester units), (BS 18 semester units)

**\_\_NA\_ Title 5 requirements for proposed master’s degree have been met, including:**

**\_\_\_** minimum of 30 semester units of approved graduate work are required

**\_\_\_\_** no more than 50% of required units are organized primarily for undergraduate students

**\_\_\_\_** maximum of 6 semester units are allowed for thesis or project

 **\_\_\_\_** Title 5 requirements for master’s degree culminating experience are clearly explained.

 **\_\_\_\_** for graduate programs, at least five-full time faculty with terminal degrees in appropriate disciplines are on staff.

**\_\_NA\_\_\_For self-support programs:**

 **\_\_\_\_** specification of how all required EO 1099 criteria are met

 **\_\_\_\_** the proposed program does not replace existing state-support courses or programs

 **\_\_\_\_** explanation of why state funds are either inappropriate or unavailable

 **\_\_\_\_** a cost-recovery program budget is included\*

 **\_\_\_\_** student per-unit cost is specified

 \_\_\_\_ total cost for student to complete the program is specified

\* Cost Recovery Budget Elements

* Revenue and Enrollment Projections
* Direct Expenses
Instructional and Operational Costs
* Indirect Expenses
Campus partners
Campus reimbursement general fund
Extended Education overhead
Chancellor’s Office overhead
* Reinvestment funds for program development

**CSU Degree Program Proposal Template**

**Revised November 2014**

**Please Note:**

* Campuses may mention proposed degree programs in recruitment material if it is specified that enrollment in the proposed program is contingent on final program authorization from the CSU Chancellor’s Office.
* Approved degree programs will be subject to campus program review within five years after implementation. Program review should follow system and Board of Trustee guidelines (including engaging outside evaluators) and should not rely solely on accreditation review.
* ***Please refer to the document “Tips for Completing a Successful Program Proposal” (which follows this document) before completing the Program Proposal Template.***
1. **Program Type (Please specify any from the list below that apply—delete the others)**

a. State-Support

c. Delivery Type: Fully face-to-face

g. New Program

1. **Program Identification**
2. Campus: CSULB
3. Full and exact degree designation and title (e.g. Master of Science in Genetic Counseling, Bachelor of Arts with a Major in History).

Bachelor of Arts in Biochemistry

1. Date the Board of Trustees approved adding this program projection to the campus Academic Plan.

January 2016

1. Term and academic year of intended implementation (e.g. fall 2016).

Fall 2018

1. Total number of units required for graduation. This will include all requirements (and campus-specific graduation requirements), not just major requirements.

120 units

1. 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 Chemistry and Biochemistry

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

Dr. Douglas McAbee, Professor

Dr. Eric Sorin, Associate Professor

Dr. Chris Brazier, Professor and Chair

1. 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.

See letter from Dr. Kris Slowinski, Associate Dean, College of Natural Sciences & Mathematics

1. Any other campus approval documents that may apply (e.g. curriculum committee approvals).
Department meeting minutes from Sept 16, 2016

**3 Curriculum changes:**

a. New program: B.A. in Biochemistry. Dr. McAbee announced the curriculum proposal for BA degree in Biochemistry. A new PChem class (CHEM379) will be offered for bioscience major. BA biochemistry students will only take CHEM443 lecture and a 1- unit lab course (CHEM442). A curriculum booklet may be provided, and better advising needs to be done in both department and college levels. Question about

the multiple PChem courses: CHEM379 will not be offered until Fall 2018.

\*\*\*Vote (Approve Proposal): All ayes; 0 nays; 0 abstention

1. Please specify whether this proposed program is subject to WASC Substantive Change review. The campus may submit a copy of the WASC Sub-Change proposal in lieu of this CSU proposal format. If campuses choose to submit the WASC Substantive Change Proposal, they will also be required to submit a program assessment plan using the format found in the CSU program proposal template.

Not applicable

1. Optional: Proposed Classification of Instructional Programs and CSU Degree Program Code

 26.0202

Campuses are invited to suggest one CSU degree program code and one corresponding CIP code. If an appropriate CSU code does not appear on the system-wide list at: <http://www.calstate.edu/app/resources.shtml>, you can search CIP 2010 at <http://nces.ed.gov/ipeds/cipcode/Default.aspx?y=55> to identify the code that best matches the proposed degree program. The Classification of Instructional Programs (CIP) is a National Center for Education Statistics (NCES) publication that provides a numerical classification and standard terminology for secondary and postsecondary instructional programs. The CSU degree program code (based on old HEGIS codes) and CIP code will be assigned when the program is approved by the Chancellor.

1. **Program Overview and Rationale**
2. Provide 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. A comprehensive rationale also explains the relationship between the program philosophy, design, target population, and any distinctive pedagogical methods.

The Bachelor of Arts in Biochemistry is designed to best accommodate students who plan on attending professional schools, including common medical programs (for example, M.D., D.D.S., Pharm.D., O.D., P.A.), while also providing an alternative educational pathway for those interested in pursuing administrative/business careers in scientific settings. The proposed B.A. Biochemistry program is modeled after a number of similar degree programs at local and national universities including CSU East Bay, UC Riverside, Baylor, Rice, and the University of Washington. The aim is to serve students who desire a strong scientific education emphasizing Chemistry & Biochemistry but who do not intend to pursue doctoral research programs or careers in scientific research. We currently offer a B.S. Biochemistry degree that is focused more on preparing students for research careers and does not offer students the flexibility to explore classes outside of University general education requirements and those of their major. Student feedback has already demonstrated strong student interest in a B.A. Biochemistry program, which will allow students to pursue professional school prerequisites, a background in business, or a desired minor while fulfilling their major course requirements. A survey conducted among the CHEM441B student cohort of spring 2016 indicated that 53% of the B.S. Biochemistry and 15% of the B.S. Biology major students would have enrolled for the BA Biochemistry program. The proposed program will require lower division coursework similar to our existing degree programs, allowing students the flexibility to change majors early in their academic careers, and will consist of standard undergraduate courses established at CSU Long Beach and being taken by B.S. Biochemistry majors, while requiring fewer upper division laboratory and lecture courses and thereby allowing for a broad spectrum of potential elective courses to be pursued. Our department has approved this new program unanimously.

1. Provide the 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).

Bachelor of Arts in Biochemistry

(120 units)

All students must achieve at least a 2.0 grade-point average in both (1) the entire college record, (2) all units attempted at CSULB, and (3) all upper division major courses. In addition, students must achieve a grade of C or better in all courses in the major.

Lower Division

Take all the following courses:

BIOL 211 Introduction to Evolution and Diversity (4)

Prerequisite/Corequisite: CHEM 111A with a grade of “C” or better

BIOL 212 Introduction to Cell and Molecular Biology (4)

Prerequisites: BIOL 211, CHEM 111A with grades of “C” or better. Prerequisite/Corequisite: CHEM 111B with a grade of “C” or better.

Take either:

CHEM 111A General Chemistry (5)

Prerequisites: a passing score on the Chemistry Placement Examination. Corequisite: MATH 109 or higher.

and

CHEM 111B General Chemistry (5)

Prerequisites: CHEM 111A and MATH 113 or MATH 115 or MATH 119A or MATH 122 all with a grade of “C” or better.

or

CHEM 112A Advanced General Chemistry (5)

Prerequisite: department consent

and

CHEM 112B Advanced General Chemistry (5)

Prerequisite: CHEM 112A with a grade of “C” or better.

Take either:

MATH 119A Survey of Calculus 1 (3)

Prerequisite: Appropriate MDPT placement or a grade of "C" or better in MATH 113.

and

MATH 119B Survey of Calculus 2 (3)

Prerequisite: a grade of “C” or better in MATH 119A or MATH 122.

or

MATH 122 Calculus 1 (4)

Prerequisite: Appropriate MDPT placement or a grade of “C” or better in MATH 111 and MATH 113.

and

MATH 123 Calculus 2 (4)

Prerequisite: a grade of “C” or better in MATH 122.

Take either:

PHYS 100A General Physics (4)

Prerequisite: MATH 109 or MATH 113 or MATH 119A or MATH 122 with a grade of “C” or better.

PHYS 100B General Physics (4)

Prerequisite: PHYS 100A with a grade of “C” or better.

or

PHYS 151 Mechanics and Heat (4)

Prerequisite/Corequisite: MATH 122

PHYS 152 Electricity and Magnetism (4)

Prerequisite: PHYS 151 with a grade of “C” or better; Prerequisite/Corequisite: MATH 123.

CHEM 220A Organic Chemistry 1 (3)

Prerequisites: CHEM 111B with a grade of “C” or better. Corequisites: CHEM 224 is required for students repeating course.

CHEM 220B Organic Chemistry 2 (3)

Prerequisite: CHEM 220A with a grade of “C” or better.

Corequisite: CHEM 320L except for students who previously earned a grade of “C” or better in CHEM 320L.

Upper Division:

Take all of the following:

BIOL 340 Molecular Cell Biology (3)

Prerequisites: BIOL 211, BIOL 212 all with grades of “C” or better.

CHEM 320L Organic Chemistry Laboratory for Chemistry and Biochemistry Majors (2)

Prerequisite: CHEM 220A

Corequisite: CHEM 220B, except for students who have previously earned a grade “C” or better in CHEM 220B.

Take either:

CHEM 361 Chemical Communications (3)

Prerequisites: GE Foundation requirement. Students must have scored 11 or higher on the GWAR Placement Examination or completed the necessary portfolio course that is a prerequisite for a GWAR Writing Intensive Capstone.

Prerequisite/Corequisite: CHEM 220A

or

NSCI 361 Scientific Research Communications (3)

Prerequisite: G.E. foundation courses; score of 11 or higher on the GWAR Placement Examination or successfully completed the necessary portfolio course that is a prerequisite for a GWAR Writing Intensive Capstone.

CHEM 379 Physical Chemistry for the Biosciences (4)

Prerequisites: CHEM 111B OR 112B, MATH 119B or 123, and PHYS 100B or 152, all with a grade of “C” or better.

CHEM 441A Biological Chemistry (3)

Prerequisite: CHEM 220B with a grade of “C” or better.

CHEM 441B Biological Chemistry (3)

Prerequisite: CHEM 441A with a grade of “C” or better.

CHEM 442 Methods in Biochemistry (2)

Prerequisites: CHEM 441A and CHEM 361, all with a grade of “C” or better.

CHEM 461 Chemistry Capstone (1)

Prerequisite: department consent.

Take at least 3 units of upper division electives chosen from:

BIOL 342/342L, BIOL 370, BIOL 416, BIOL 430, BIOL 431, BIOL 432, BIOL 433, BIOL 443, BIOL 445, BIOL 473; CHEM 331, CHEM 332, CHEM 420, CHEM 480, CHEM 496, CHEM 498, CHEM 498H, CHEM 499; NSCI 496.

1. **Curriculum –** *(These requirements conform to the revised 2013 WASC Handbook of Accreditation)*

a. These program proposal elements are required:

* Institutional learning outcomes (ILOs)
* Program learning outcomes (PLOs)
* Student learning outcomes (SLOs)

Describe outcomes (also sometimes known as goals) for the 1) institution, 2) program, and for 3) [student learning](http://www.calstate.edu/acadaff/sloa/index.shtml). Institutional learning outcomes (ILOs) typically highlight the knowledge, skills, and dispositions all students are expected to have upon graduating from an institution of higher learning. Program learning outcomes (PLOs) highlight the knowledge, skills, and dispositions students are expected to know as program graduates. PLOs are more narrowly focused than ILOs. Student learning outcomes (SLOs) clearly convey the specific and measureable knowledge, skills, and/or behaviors expected and guide the type of assessments to be used to determine if the desired the level of learning has been achieved.

Institutional learning outcomes: - Graduates will be:

1. Well-prepared in communication, numeracy and critical thinking skills to successfully join the workforce of California and the world or to pursue advanced study
2. Critically and ethically engaged in global and local issues
3. Knowledgeable and respectful of the diversity of individuals, groups, and cultures
4. Accomplished at integrating the skills of a liberal education with disciplinary or professional competency
5. Skilled in collaborative problem-solving, research, and creative activity

Program learning outcomes (BA biochemistry degree): Students will be able to:

1. Explain and draw inferences from the physical and chemical behavior of matter, including the chemical basis of biological phenomena.
2. Explain and integrate the basic concepts of analytical, inorganic, organic, and physical chemistry and biochemistry.
3. Set up and operate various scientific apparatus used in the study of chemistry and biochemistry.
4. Obtain and interpret data from various scientific instruments.
5. Think logically and clearly articulate their thoughts in oral and written form and to critically evaluate experimental data and the scientific literature.

Student learning outcomes. By obtaining a BA biochemistry degree from the Department of Chemistry and Biochemistry, students will be able to:

1. Explain the central concepts of biological energy and the transformation of energy from one form to another, of catalysis in biological systems, and energy coupling of chemical processes in metabolic pathways.
2. Explain the core concepts of macromolecular structure and function including metabolic pathways for formation and breakdown of macromolecules, the dependency of macromolecular function on its structure, the manner in which macromolecules interact, and the modes of metabolic regulation.
3. Explain the core concepts of biological information including the genomic information storage, the transfer of information from the genome to macromolecules, genomic transmission from one generation to the next, and the modes by which the genome is maintained.
4. Explain the core concept of organismal and molecular evolution and how organisms and cells evolve through natural section.
5. Explain the core concept of biological homeostasis, the link between steady-state processes and homeostasis, and how homeostasis is controlled and regulated at the cellular, tissue, and organismal levels.
6. Analyze quantitative measurements; work effectively as teams on a common project, and implement essential safety and ethical practices in doing science.
7. Explain logically and clearly scientific information by oral and written communication, articulate their thoughts, and critically evaluate experimental data and the scientific literature.

**4b. Comprehensive assessment plan**

These program proposal elements are required:

* Comprehensive assessment plan addressing all assessment elements;
* Matrix showing where student learning outcomes are introduced (I), developed (D), and mastered (M)

Include plans for assessing institutional, program, and student learning outcomes. Key to program planning is creating a comprehensive assessment plan addressing multiple elements, including strategies and tools to assess student learning outcomes, (directly related to overall institutional and program learning outcomes). Constructing an assessment matrix, showing the relationship between all assessment elements, is an efficient and clear method of displaying all assessment plan components.

Creating a curriculum map matrix, identifying the student learning outcomes, the courses where they are found, and where content is “Introduced,” “Developed,” and “Mastered” insures that all student learning outcomes are directly related to overall program goals and represented across the curriculum at the appropriate times. Assessment of outcomes is expected to be carried out systematically according to an established schedule.

The Department of Chemistry & Biochemistry has articulated general assessment policies for its undergraduate programs, which will also apply to the BA biochemistry program. These policies are as follows:

* For all major courses, standardized exams published by the American Chemical Society (ACS) are used as final examinations, where appropriate, for tracking learning outcomes over time.
* For disciplines in which ACS exams may not be appropriate, faculty will develop standardized exams for those disciplines to track learning outcomes over time.
* Instructors must place sufficient grading-weight on those standardized exams to ensure that students treat them “seriously”.
* When feasible, ACS exam results will be submitted to the ACS for analysis.
* For General Chemistry courses, faculty who consistently teach that course will develop a separate standardized exam and report findings annually to the Department’s Assessment Committee.

Assessment of SLOs for the BA biochemistry program are outlined in Table I below. In general, content knowledge, critical thinking, problem solving, and effective communication of the core scientific concepts and essential skills (teamwork, safety, communication, ethical conduct) in biochemistry will be assessed across the program curriculum by exams, course assignments and projects, and laboratory exercises. Students will be exposed to program content not just in lecture sections but also in hands-on laboratory experiences (both lower-division and upper-division). Students emerging from the BA biochemistry program will be enabled to successfully enter the job force or graduate/professional schools in the molecular life sciences.

*Table I: Comprehensive Assessment Plan Connecting ILO, PLO, and SLO*

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *a* | *b* | *c* | *d* | *e* | *f* | *g* | *h* | *i* | *j* | *k* |
| *ILOs* | *PLOs* | *SLOs* | *Course**where each SLO is assessed* | *Assessment activity/**assignment used to measure each SLO* | *Assessment tool used to measure outcome success* | *Assessment schedule – how often SLOs will be assessed* | *How data/**findings will be quantitatively or qualitatively reported* | *Designated personnel to collect, analyze, and interpret student learning outcome data*  | *Program**data/**findings**dissemination schedule* |  *Closing the loop strategies* |
| D | I, II | 1 | CHEM 379, 441A | Exams, problem solving sets | Exam scores, rubrics | Yearly formative assessments; summative assessments twice in 7 year period. | 80% will meet competency standards | Faculty Curriculum Committee | Semester following assessment | Faculty will complete narratives on how curriculum should be revised as needed |
| D | I, II | 2 | CHEM 441A, 441B | Exams, projects, problem-solving sets | Exam scores, rubrics | Yearly formative assessments; summative assessments twice in 7 year period. | 80% will meet competency standards | Faculty Curriculum Committee | Semester following assessment | Faculty will complete narratives on how curriculum should be revised as needed |
| D | I, II | 3 | CHEM 441B. 442 | Exams, projects, problem-solving sets, lab reports | Exam scores, rubrics | Yearly formative assessments; summative assessments twice in 7 year period. | 80% will meet competency standards | Faculty Curriculum Committee | Semester following assessment | Faculty will complete narratives on how curriculum should be revised as needed |
| D | I, II | 4 | BIOL 340 | Exams, projects | Exam scores, rubrics | Yearly formative assessments; summative assessments twice in 7 year period. | 80% will meet competency standards | Faculty Curriculum Committee | Semester following assessment | Faculty will complete narratives on how curriculum should be revised as needed |
| D | I, II | 5 | CHEM 441A | Exams, projects, problem-solving sets | Exam scores, rubrics | Yearly formative assessments; summative assessments twice in 7 year period. | 80% will meet competency standards | Faculty Curriculum Committee | Semester following assessment | Faculty will complete narratives on how curriculum should be revised as needed |
| B, D, E | III, IV | 6 | CHEM 442 | Exams, problem solving sets, lab reports | Exam scores, rubrics | Yearly formative assessments; summative assessments twice in 7 year period. | 80% will meet competency standards | Faculty Curriculum Committee | Semester following assessment | Faculty will complete narratives on how curriculum should be revised as needed |
| A, E | I, II, IV, V | 7 | CHEM 441A, 442 | Exams, projects, problem-solving sets, lab reports | Exam scores, rubrics | Yearly formative assessments; summative assessments twice in 7 year period. | 80% will meet competency standards | Faculty Curriculum Committee | Semester following assessment | Faculty will complete narratives on how curriculum should be revised as needed |

A summary of the required courses for the BA biochemistry program and the assessment tools used in these courses is shown in Table II.

Table II. Curriculum Mapping Matrix. SLOs introduced (I), developed (D), and mastered (M).

|  |  |  |
| --- | --- | --- |
| **Units** | **Course Number/Title** | **Student Learning Outcomes** |
|  |  | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 5 | CHEM 111A or 112A General Chemistry I | *I* |  |  |  |  | *I* |  |
| 5 | CHEM 111B or 112B General Chemistry II | *I* |  |  |  |  | *I* |  |
| 4 | BIOL 211 Intro Evolution and Diversity |  |  | *I* | *I* |  |  |  |
| 4 | BIOL 212 Intro Cell and Molecular Biology |  | *I* | *D* | *D* | *I* |  |  |
| 4 | MATH 119A or 122 Calculus I |  |  |  |  |  | *I* |  |
| 4 | MATH 119B or 123 Calculus II |  |  |  |  |  | *D* |  |
| 4 | PHYS 100A or 151 General Physics I | *D* |  |  |  |  | *D* |  |
| 4 | PHYS 100B or 152 General Physics II | *D* |  |  |  |  | *D* |  |
| 3 | CHEM 220A Organic Chemistry I | *D* | *I* |  |  |  |  |  |
| 3 | CHEM 220B Organic Chemistry II |  | *D* |  |  |  |  |  |
| 2 | CHEM 320L Organic Chemistry Lab | *D* | *D* |  |  |  | *D* |  |
| 3 | BIOL 340 Molecular Cell Biology |  |  | *D* | *M* | *D* |  |  |
| 3 | CHEM 361 or NSCI 361 Chemical Communications |  |  |  |  |  |  | *D* |
| 4 | CHEM 379 Physical Chemistry for the Biosciences | *M* |  |  |  |  | *D* |  |
| 3 | CHEM 441A Biological Chemistry I | *M* | *D* |  |  | *M* |  | *D* |
| 3 | CHEM 441B Biological Chemistry II | *M* | *M* | *M* |  |  | *M* | *M* |
| 2 | CHEM 442 Methods in Biochemistry |  | *M* | *M* |  |  | *M* | *M* |
| 1 | CHEM 461 Chemistry Capstone |  |  |  |  |  | *M* | *M* |

1. Indicate total number of units required for graduation.

120 units

1. Include a justification for any baccalaureate program that requires more than 120-semester units or 180-quarter units. Programs proposed at more than 120 semester units will have to provide either a Title 5 justification for the higher units or a campus-approved request for an exception to the Title 5 unit limit for this kind of baccalaureate program.

Not applicable

1. If any formal options, concentrations, or special emphases are planned under the proposed major, identify and list the required courses. 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.

Not applicable

1. List all requirements for graduation, including electives, for the proposed degree program, specifying course catalog numbers, course titles, total units required for completion of the degree, major requirements, electives, and prerequisites or co-requisites (ensuring there are no “hidden prerequisites that would drive the total units required to graduate beyond the total reported in 4c above). Include proposed catalog descriptions of all new courses.

(WASC 2013 CFR: 2.1, 2.2)

See current catalog (attached). All required courses and specified elective options are existing courses.

1. List any new courses that are: (1) needed to initiate the program or (2) needed during the first two years after implementation. Include proposed catalog descriptions for new courses. For graduate program proposals, identify whether each new course would be at the graduate-level or undergraduate-level.

CHEM 379. Physical Chemistry for the Biosciences (4)

Prerequisites: CHEM 111B, CHEM 220A, MATH 119B or 123, and PHYS 100B or 152, all with grades of C or better. Principles of chemical thermodynamics and kinetics, quantum chemistry, chemical bonding, and spectroscopy, with applications in the biological sciences. Letter grade only (A-F). (Lecture 4 hrs.)

CHEM 442. Methods in Biochemistry (2)

Prerequisites: CHEM 361 and CHEM 441A both with grades of C or better. Modern laboratory methods used in biochemistry and molecular biology. Letter grading only (A-F). (Lecture 1 hour, laboratory, 3 hours) Course fee may be required. Course open only to BA biochemistry students.

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

(WASC 2013 CFR: 2.2b)

A “roadmap” for the BA biochemistry degree program, including major, GE, and elective courses, is provided in section 4n below. The sequence of program courses to be offered in the first three years of the program, along with probable faculty teaching assignments, is listed here. The course order is dictated by program course prerequisites and specifies only program-required courses.

Semester 1

CHEM 111A or 112A, General Chemistry, Dr. Shahab Derahkshan

MATH 119A or 122, Calculus I, Dept Mathematics and Statistics instructional faculty

Semester 2

CHEM 111B or 112B, General Chemistry, Drs. Stephen Mezyk/Eric Sorin

MATH 119B or 123, Calculus II, Dept of Mathematics and Statistics instructional faculty

Semester 3

CHEM 220A, Organic Chemistry, Dr. Jason Schwans

BIOL 211, Intro Evolution and Diversity, Dept Biological Sciences instructional faculty

Semester 4

CHEM 220B, Organic Chemistry, Dr. Michael Schramm

CHEM 320L, Organic Chemistry Laboratory, Dr. Gary Shankweiler

BIOL 212, Intro Cell Molecular Biology, Dept Biological Sciences instructional faculty

PHYS 100A or 151, General Physics, Dept Physics and Astronomy instructional faculty

Semester 5

CHEM 361 Chemical Communications or NSCI Scientific Research Communications, Dept Chemistry & Biochemistry instructional faculty

BIOL 340, Cell and Molecular Biology, Dr. Editte Gharakhanian

PHYS 100B or 152, General Physics, Dept Physics and Astronomy instructional faculty

Semester 6

CHEM 441A, Biological Chemistry, Dr. Deepali Bhandari

CHEM 379, Physical Chemistry, Dr. Eric Sorin

1. For master’s degree proposals, include evidence that program requirements conform to the minimum requirements for the culminating experience, as specified in [Section 40510](http://www.calstate.edu/APP/documents/Title5_MastersDegree_requirements.doc) of [Title 5 of the California Code of Regulations](http://government.westlaw.com/linkedslice/search/default.asp?RS=GVT1.0&VR=2.0&SP=CCR-1000&tempinfo=TOC).

Not applicable

1. For graduate degree proposals, cite the corresponding bachelor’s program and specify whether it is (a) subject to accreditation and (b) currently accredited.

(WASC 2013 CFR: 2.2b)

Not applicable

1. For graduate degree programs, specify admission criteria, including any prerequisite coursework.

(WASC 2013 CFR: 2.2b)

Not applicable

1. For graduate degree programs, specify criteria for student continuation in the program.

Not applicable

1. For undergraduate programs, specify planned provisions for articulation of the proposed major with community college programs.

All lower division courses listed for the major either have or are in the process of acquiring articulation agreements with community college programs.

1. Describe advising “roadmaps” that have been developed for the major.

**2018-2019 University Catalog Roadmaps - College of Natural Sciences and Mathematics**

**Bachelor of Arts in Biochemistry - 4 Year Plan, 120 units**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Course** | **Units** |  | **Course** | **Units** |
|  |  |  |  |  |
| *Semester 1* |  |  | *Semester 2* |  |
| Composition or Oral Communication CHEM 111A or 112A General ChemistryMATH 119A or 122 Calculus I (GE B.2)GE Class | 353-43 |  | CHEM 111B or 112B General ChemistryCritical ThinkingMATH 119B or 123 Calculus IIOral Communication or Composition | 533-43 |
| **Total Units** | 14-15 |  | **Total Units** | 14-15 |
|  |  |  |  |  |
| *Semester 3* |  |  | *Semester 4* |  |
| CHEM 220A Organic Chemistry BIOL 211 Biological ScienceGE ClassGE Class | 3433 |  | CHEM 220B Organic ChemistryCHEM 320L Organic Chemistry LabBIOL 212 Biological SciencePHYS 100A or 151 General PhysicsGE Class | 32443 |
| **Total Units** | 13 |  | **Total Units** | 16 |
|  |  |  |  |  |
| *Semester 5* |  |  | *Semester 6* |  |
| CHEM 361 (GE capstone) BIOL 340 Molecular Cell BiologyUpper Division GE ClassPHYS 100B or 152 General PhysicsUpper Division GE Class | 33333 |  | CHEM 441A Biol Chem Upper Division ElectiveElectiveCHEM 379 Physical ChemistryGE Capstone Course | 33343 |
| **Total Units** | 15 |  | **Total Units** | 16 |
|  |  |  |  |  |
| *Semester 7* |  |  | *Semester 8* |  |
| CHEM 441B Biol ChemCHEM 442 Biochemistry Lab CHEM/BIOL ElectiveGE Class GE Capstone Course | 32333 |  | Upper Division Elective Upper Division Elective Upper Division Elective CHEM 461Chemistry CapstoneElectiveElective | 333133 |
| **Total Units** | 14 |  | **Total Units** | 16 |

1. Describe how accreditation requirements will be met, if applicable, and anticipated date of accreditation request (including the WASC Substantive Change process).

(WASC 2013 CFR: 1.8)

Not applicable

**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.

 *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.

1. **Societal and Public Need for the Proposed Degree Major Program**
2. List other California State University campuses currently offering or projecting the proposed degree major program; list neighboring institutions, public and private, currently offering the proposed degree major program.

Other CSU Campuses: CSU East Bay

Neighboring Institutions: None

1. Describe differences between the proposed program and programs listed in Section 5a above.

The BA Biochemistry program at CSU East Bay, which is a very distant sister campus, is similar to our proposed program with some distinct differences: their program requires students to complete a computer science course and an Advanced Biochemistry Laboratory (beyond the standard General Biochemistry Laboratory), and their program restricts students to selecting electives from a relatively short list of courses in the biological and biochemical sciences, making their BA Biochemistry program similar in many ways to traditional BS Biochemistry programs. Our proposed program (a) does not require the two courses listed above that the CSU East Bay program requires and (b) would allow our BA Biochemistry majors to complete elective courses from a much broader range of departments and fields, thus fostering their preparation for applying and moving forward into professional schools, business/administrative industrial positions, and other non-research oriented careers.

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

B.S. Biochemistry

B.S. Biology, option in Molecular Cell Biology and Physiology

1. Describe community participation, if any, in the planning process. This may include prospective employers of graduates.

The Department of Chemistry and Biochemistry Advisory Board is comprised of alumni and friends of the department who are leaders in industry and academia associated with the general fields of chemistry, biochemistry, and molecular biology. The Advisory Board has provided input as to the professional qualities, experiences, and skills they deem important for students emerging out of our programs to be competitive in careers in molecular life sciences. Courses that cultivate many of their recommended content knowledge and skills are incorporated into this program. In addition, we have endeavored to match the core elements for undergraduate biochemistry education as recommended by the *American Society for Biochemistry* *and* *Molecular Biology* (ASBMB) and *the American Chemical Society* (ACS).

1. Provide applicable workforce demand projections and other relevant data.

Despite the sluggish state economy over the last decade, California has remained a national leader in biotechnology with more than 2,300 biomedical companies and nearly 153,000 workers in 2011,1 and a 4% employment growth between 2009 and 2013.2 In 2015, the number of employees in the biomedical industries alone had reached over 270, 000,2  and the US Department of Labor and Statistics estimates that the field of biochemistry will experience a 19% job growth between now and 2022.3   It is thus expected that well-prepared undergraduates with a wide range of backgrounds and interests will continue to be needed to fill positions statewide on clinical, laboratory, administrative, financial, sales, and manufacturing fronts.  Professional schools (e.g., medical, dental, PharmD programs) are seeking applicants with an exposure to multidisciplinary studies, not merely to traditional single-subject disciplines.  The proposed BA Biochemistry program requirements promote this multidisciplinary approach demanded by professional schools.

1. **Student Demand**
2. Provide 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.

Our Department currently offers three Bachelor’s degrees of varying popularity: a B.S. in Biochemistry (currently 113 pre-majors and 255 declared majors), a B.S. in Chemistry (43 pre-majors and 75 declared majors), and a B.A. in Chemistry (11 pre-majors and 36 declared majors), via which we have graduated an average of 73 students annually over the past five years, with approximately 82% of these graduates completing B.A. Chemistry or B.S. Biochemistry degrees. Among our graduating students in these two areas, which will provide the primary pool of our own students interested in the proposed B.A. Biochemistry program, we estimate that about 10% move on to pursue graduate level (M.S. or Ph.D.) training in their field of study, while more than half of these students declare one of these two majors with the intention of attending professional school or graduate studies in the medical or health sciences. Currently, no Southern California CSU campus offers a B.A. in Biochemistry, although two (Dominguez Hills and San Bernardino) offer a Biochemistry option to their B.A. Chemistry degree programs. Having a separate, stand-alone B.A. in Biochemistry will facilitate the development of groups of classes outside the major (“tracks”) that students may wish to pursue, such as pre-pharmacy or business-oriented studies. In addition, the primary rationale for the new degree is to provide additional options better suited to the needs of current CSULB students. We also believe the B.A. in Biochemistry will attract incoming students considering their educational options, especially those transferring from community colleges. Finally, it is worth noting that our current B.S. Biochemistry program was recently certified by the ASBMB. Maintaining the rigor of such a program with more than 250 declared majors is a constant challenge faced by our Department, and we anticipate that a significant portion of these students would opt for the proposed B.A. program, thus allowing us to maintain and further enhance our ASBMB-certified B.S. Biochemistry program. Faculty in our Department have already received highly positive feedback from our current undergraduate population.

1. Identify how issues of diversity and access to the university were considered when planning this program. Describe what steps the program will take to insure ALL prospective candidates have equitable access to the program. This description may include recruitment strategies and any other techniques to insure a diverse and qualified candidate pool.

We anticipate the pool of prospective students for the BA biochemistry program will include some students currently in the BS biochemistry, BA chemistry, and BS chemistry programs whose career interests will be best served by the BA biochemistry program. The issues of diversity and access to the university for this program are the same as for the department, college, and university. For many years, our department has actively engaged minority and women students in chemistry and biochemistry through various sponsored programs (e.g., MARC, RISE), and CSULB has been designated as a Hispanic Serving Institution. Through appropriate advising activities and department information, the program will encourage minority and women students to consider this major as a means toward success in their chosen career goals.

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

N/A

1. Describe professional uses of the proposed degree program.

By maximizing the elective units available to future B.A. Biochemistry majors, the proposed program will prepare our students for graduate study in molecular life sciences and for careers in many health-related fields (medicine, dentistry, pharmacy); for the business and administrative side of the life sciences industry; or for any related areas these students choose to focus their elective units and extracurricular time and effort.

1. Specify the expected number of majors in the initial year, and three years and five years thereafter. Specify the expected number of graduates in the initial year, and three years and five years thereafter.

Expected majors: 100, 150, and 200, respectively

Expected graduates: 0, 30, and 80, respectively (non-cumulative)

1. **Existing Support Resources for the Proposed Degree Major 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.

1. List 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, there must be a minimum of five full-time faculty members with the appropriate terminal degree. (Coded Memo EP&R 85-20)

Dr. Deepali Bhandari, Assistant Professor, Tenure-Track, Ph.D. Molecular Biology, Loyola University Chicago, 2009

Dr. Chris Brazier, Professor, Tenured, PhD Physical Chemistry, University of Southampton, 1984

Dr. Shahab Derakhshan, Associate Professor, Tenured, PhD Inorganic Chemistry, University of Waterloo, 2005

Dr. Marco Lopez, Professor, Tenured, PhD Organic Chemistry, UC San Diego, 1982

Dr. Eric Marinez, Associate Professor, Tenured, PhD Organic Chemistry, University of Southern California, 1999

Dr. Doug McAbee, Professor, Tenured, PhD Biochemistry, University of Texas Southwest Medical College, 1985

Dr. Stephen Mezyk, Professor, Tenured, PhD Physical Chemistry, University of Melbourne, 1990

Dr. Ken Nakayama, Professor, Tenured, PhD Organic Chemistry, UCLA, 1986

Dr. Vas Narayanaswami, Associate Professor, Tenured, PhD Biochemistry, Indian Institute of Technology, Madras, 1998

Dr. Michael Schramm, Associate Professor, Tenured, PhD Organic Chemistry, University of Chicago, 2005

Dr. Jason Schwans, Assistant Professor, Tenure-Track, PhD Bio-organic Chemistry, University of Chicago, 2003

Dr. Young-Seok Shon, Professor, Tenured, PhD Organic Chemistry, University of Houston, 1999

Dr. Kasha Slowinska, Professor, Tenured, PhD Analytical Chemistry, UC Berkeley, 2003

Dr. Eric Sorin, Associate Professor, Tenured, PhD Chemical Physics, Stanford, 2007

Dr. Enrico Tapavicza, Assistant Professor, Tenure-Track, PhD Computational Chemistry, Ecole Polytechnique Federale de Lausanne, Switzerland, 2008

Dr. Hadi Tavassol, Assistant Professor, Tenure-Track, PhD Materials Science, University of Illinois, Urbana-Champaign, 2014

Dr. Fangyuan Tian, Assistant Professor, Tenure-Track, PhD Analytical Chemistry, University of Delaware, 2014

Dr. Paul Weers, Professor, Tenured, PhD Biochemistry, Utrecht University, 1994

Ms. Andrea Chen, Lecturer, MS Organic Chemistry, CSU Long Beach, 2004

Dr. Hosun Choo, Lecturer, PhD Physical Chemistry, University of Houston, 2000

Mr. Thach Ho, Lecturer, MS Organic Chemistry, CSU Long Beach, 1995

Dr. Jean Lee-Lin, Lecturer, PhD Organic Chemistry, University of Southern California, 1988

Dr. Sunggon Lim, Lecturer, PhD Organic Chemistry, Yonsei Universtiy South Korea, 2005

Dr. Surya Manandhar, Lecturer, PhD Biochemistry, Kharkiv State University Ukraine, 1990

Ms. Marjan Mohammadi, Lecturer, MS Physical Chemistry, University of Waterloo Ontario Canada, 2005

Mr. Pat Pierce, Lecturer, MS Biochemistry, CSU Long Beach, 2004

Dr. Gary Shankweiler, Lecturer, PhD Organic Chemistry, New Mexico State University, 1986

Ms. Sarah Zigmont, Lecturer, MS Biochemistry, University of Scranton, PA, 2000

1. Describe facilities that would be used in support of the proposed program.

Lecture courses in the BA biochemistry program are taught in a variety of classrooms across the CSULB campus. Classroom capacity ranges from 20 to 200 seats. All lecture rooms and halls are equipped with computer-assisted video and audio presentation hardware, overhead projectors, ample white board space, and data ports. About one-third of the rooms are also equipped with document viewers. Wireless internet access is available everywhere on campus.

The university has designated science as its top priority for capital investments including the $28 million Molecular Life Sciences Center (MLSC) and the $105 million Hall of Science (HSCI) with 164,369 assignable square feet of space completed and equipped with the latest instrumentation in 2004 and 2011, respectively. All teaching labs used by BA biochemistry program courses are housed in MLSC or HSCI. Teaching lab sections accommodate 8-24 students per lab section, depending on the course. The department provides GA support for all BA biochemistry program course labs along with TA support for lower-division courses.

1. Provide evidence that the institution provides adequate access to both electronic and physical library and learning resources.

Library documentation attached at the end of this document.

1. Describe available academic technology, equipment, and other specialized materials.

A main mission of the Department of Chemistry and Biochemistry is to train undergraduate students for entry into doctoral study and professional careers. Designated teaching laboratory space (700-1500 square feet) in MLSC or HSCI is used for students in all the department’s undergraduate programs. HSCI contains core instrument laboratories, including the *Center for Education in Proteomics Analysis* (CEPA) and the *Institute for integrated Research in Materials, Environments, and Societies* (IIRMES). BA biochemistry students will use some of the equipment in IIRMES and CEPA for experiments done in CHEM 444L. All research instrumentation in the college and department is available as needed for instructional purposes for students in the BA biochemistry program.

Major instrumentation in the department includes the following:

Spectrophotometers: ultraviolet-visible, infrared, fluorescence, circular dichroism, nuclear magnetic resonance, and electron paramagnetic resonance.

Mass spectrometers: gas chromatography-MS, matrix-assisted laser desorption/ ionization time-of-flight (MALDI-TOF) MS, inductively-coupled plasma MS.

Microscopes: transmission, scanning, and scanning-tunneling electron microscopes, epifluorescence, light microscopes, atomic force microscope.

Chromatography: high-performance liquid chromatography, fast protein liquid chromatography, ion chromatography.

Electrophoresis: horizontal gel electrophoresis, one and two-dimensional polyacrylamide gel electrophoresis, capillary electrophoresis, rapid transfer/blotting systems, Li-COR Odyssey imaging system.

X-ray Diffraction: crystallography and powder diffraction systems. Calorimetry: isothermal titration calorimeter, differential scanning calorimeter.

Other Instrumentation: dynamic light scattering; liquid scintillation and gamma counters; thermogravimetric analysis; cyclic voltammetry; distributed computing resources for biomolecular modeling; a variety of low-, high-, and ultra-speed centrifuges equipped with a range of rotors; cold rooms and common culture facilities for mammalian, insect, yeast, and bacterial cells.

1. **Additional Support Resources Required**

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.

1. Describe additional faculty or staff support positions needed to implement the proposed program.

None.

1. Describe 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. Major capital outlay construction projects are those projects whose total cost is $610,000 or more (as adjusted pursuant to Cal. Pub. Cont. Code §§ 10705(a); 10105 and 10108).

None.

1. Include a report written in consultation with the campus librarian which indicates any necessary library resources not available through the CSU library system. Indicate the commitment of the campus to purchase these additional resources.

None.

1. Indicate 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.

1. **Self-Support Programs** (not applicable)
2. Confirm that the proposed program will not be offered at places or times likely to supplant or limit existing state-support programs.
3. Explain how state-support funding is either unavailable or inappropriate.
4. Explain how the program is different, in one or more of the following ways, from state-supported campus offerings operating on campus:
	1. Primarily designed for career enrichment or retraining
	2. Program location is significantly removed from state-supported campus facilities
	3. The program client group receives educational or other services at a cost beyond what could be reasonably provided under state support.
5. For self-support programs, please provide information on the per-unit cost to students and the total cost to complete the program (in addition to the required cost recovery budget elements listed in the CSU degree proposal faculty check list found earlier in this document).

**Submit completed proposal packages to:**

APP@calstate.edu

Academic Programs and Faculty Development

CSU Office of the Chancellor

401 Golden Shore

Long Beach, CA 90802-4210

## Contact Us

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