

**April 10, 2014**

**MEMORANDUM**

**TO:** Dr. Lynn Williams, Chair  
Academic Senate

**FROM:** J. Constable, Chair   
University Budget Committee

**RE: Proposed B.S. in Biochemistry**

At its meeting on 9 April 2014 the University Budget Committee provided a second reading to the proposed B.S. degree in Biochemistry offered through the Department of Chemistry. This new option was initiated by the Chemistry faculty to meet an increasing student interest in the union of Biology and Chemistry for health science careers. After discussion between the UBC and the Department of Chemistry (Dr. S. Attar and Dr. A. Hassan) the following motion was passed:

The University Budget Committee finds that there are no substantial negative budgetary implications related to the implementation of the proposed BS in Biochemistry. The Committee noted that the degree requires a single new non-laboratory course and is largely re-structure of existing chemistry courses with an increased fraction of biology courses. The Committee requests that the Dean of the College of Science and Mathematics provide written approval of the program to ensure that should any transient increases in costs occur during program's start-up period that the College will support the program; and (ii) the program be subject to University Budget Committee review during the third year of operation to assess its budget.

If you have any further questions regarding the review of this program please do not hesitate to contact me by email ([jconstable@csufresno.edu](mailto:jconstable@csufresno.edu)) or phone (278-2410).

**Cc:** Dr. A. Hoff, Provost of California State University Fresno  
Dr. S. Elrod, Dean of the College of Science and Mathematics  
Dr. A. Attar, Chair of the Department of Chemistry

**February 12, 2014**

**MEMORANDUM**

**TO:** Dr. John Constable, Chair  
University Budget Committee

**FROM:** Kevin Ayotte, Vice Chair *KA*  
Academic Senate

**RE:** **Bachelor of Science in Biochemistry – Academic Policy & Planning Committee**

At its meeting of February 10, 2014, the Executive Committee of the Academic Senate recommended the Bachelor of Science in Biochemistry be sent to the University Budget Committee for approval.


attachment

KA:vb

January 29, 2014

**MEMORANDUM**

**TO:** Prof. Lynn Williams  
Chair, Academic Senate

**FROM:** Prof. Michael Botwin   
Chair, Academic Policy & Planning Committee

**RE:** **Bachelor of Science in Biochemistry**

At the December 5, 2013 meeting of the Academic Policy and Planning Committee unanimously supported the proposal for the Bachelor of Science in Biochemistry by the Department of Chemistry. We recommend that this proposal be forwarded to the Academic Senate for approval pending review by the University Budget Committee.

cc: Prof. John Constable, Chair, University Budget Committee  
Prof. Saeed Attar, Chair, Department of Chemistry  
Prof. Joy Goto, Department of Chemistry  
Dean Susan Elrod, College of Science and Mathematics

TO: Curriculum Review Committees  
FROM: Chemistry Department  
DATE: September 19, 2013  
RE: BS Biochemistry Degree Proposal

The Chemistry Department is proposing the formation of a new BS Biochemistry degree program that builds on existing courses and faculty expertise within the department.

The last 20 years have seen an enormous growth in careers and research in biochemistry and biotechnology. Nearly half of the research taking place in the department is taking place at this interface between chemistry and biology.

The department currently serves students interested in these areas through its existing BS Chemistry and BA Chemistry programs, some with BA Chemistry / BS Biology double majors. The BS Chemistry program is a traditional chemistry degree that does include sufficient biological and biochemical coursework within the 120 unit degree requirement, though students frequently take additional courses in these areas. The BA Chemistry program was originally intended for pre-health professional students, but does not include sufficient physical chemistry and lacks the BS degree title.

The department's last two external reviews have each recommended that the department develop a BS Biochemistry degree to better serve students interested in careers at the interface of biology and chemistry. After years of work and hiring, the department now has a sustainable, rigorous plan for the degree along with the faculty expertise to support this degree.

The proposed BS Biochemistry program will be a significant improvement for students interested in these areas. The BS Biochemistry carries 11 more units of biology and at least 6 more unit of biochemistry courses than the BS Chemistry program. The BS Biochemistry carries at least two more units of physical chemistry and more structured upper-division chemistry elective requirements than the BA Chemistry program.

Initially, we anticipate that students for this program will come from the BA Chemistry program. Over time the degree program, which is unique in the central valley but common in other areas, is likely to attract other excellent students to Fresno State.

# Undergraduate Program Proposal

Process ID	Activity Name	Create Date
4342	Office of the Dean of Undergraduate Studies	11/08/2013 9:42 AM

**Academic Org ID:** Chemistry [178]

**College/School:** Science and Mathematics [66]

**Effective Term/Year:** Fall 2014

**Program Type/Name:** Major / BS Biochemistry

## Description:

### Proposed Catalog Description:

#### Bachelor of Science in Biochemistry Degree Requirements

The Bachelor of Science in Biochemistry is intended for students who plan to pursue a career in biochemical research, chemistry research, and suitable for student pursuing health professions (medical, pharmaceutical, dental, and other clinical and health professions): The B.S. program is a comprehensive, multi-disciplinary program to prepare students for graduate study in pursuit of a Master of Science (M.S.) or Doctor of Philosophy (Ph.D.) in areas related to biochemistry.

Note: Biochemistry majors may not take courses listed in category A or B for CR/NC grades.

#### A. The B.S. Biochemistry Major requirements (50-54 units)

##### Core Program

CHEM 1A, 1B, 102, 110A, 112, 128A, 128B, 129A, 129B, 155A, 155B, 156

Select two additional upper-division CHEM courses (4-7 units): CHEM 106, 106S, 111, 123, 124, or 190 or other approved courses.

Select two additional upper-division BIOL courses (6-7 units): BIOL 102, 103, 104, 120, or other approved courses.

#### B. Additional requirements (25-28 units)

BIOL 1A, 1B, 1BL

MATH 75, 76

PHYS 2A, 2B (or PHYS 4A, 4AL, 4B, 4BL, 4C strongly recommended)

#### C. Remaining General Education requirements\* (42 units)

#### D. Free Elective Units (0-3 units)

Total (minimum 120 units)

\*Of the 51 required General Education units, 9 units will be satisfied by the following courses in the major and additional requirements:

3 units of CHEM 1A or PHYS 2A or (PHYS 4A and 4AL) in G.E. Breadth B1;

3 units of BIOL 1A in G.E. Breadth B2;

3 units of MATH 75 in G.E. Foundation B4.

The following is an example of a four-year program for the B.S. in Biochemistry.

First Semester - Fall	Units
CHEM 1A	5
MATH 75	4
ENGL 5B or 10	3
General Education	3
	15
Second Semester - Spring	Units

CHEM 1B	5	
MATH 76	4	
PHYS 2A	4	
General Education		3
		16

Third Semester - Fall	Units	
CHEM 128A	3	
PHYS 2B	4	
BIOL 1A	4	
General Education		3
		14

Fourth Semester - Spring	Units	
CHEM 128B	3	
CHEM 129A	2	
BIOL 1B, 1BL	5	
Electives or General Education	6	
		16

Fifth Semester* - Fall	Units	
**CHEM 155A	3	
CHEM 129B	2	
CHEM 102	5	
**CHEM 110A	3	
Electives or General Education	6	
		16

Sixth Semester* - Spring	Units	
***CHEM 155B	3	
***CHEM 156	3	
***CHEM 112	3	
Electives or General Education	6	
		15

Seventh Semester - Fall	Units	
Electives or General Education	14	
		14

Eighth Semester - Spring	Units	
Electives or General Education	14	
		14

\*=It is important to fulfill the upper-division writing skills requirement by exam or W class during the junior year. \*\*=Offered fall semester only. \*\*\*=Offered spring semester only.

TO: Curriculum Review Committees  
FROM: Chemistry Department  
DATE: September 19, 2013  
RE: BS Biochemistry Degree Proposal

The Chemistry Department is proposing the formation of a new BS Biochemistry degree program that builds on existing courses and faculty expertise within the department.

The last 20 years have seen an enormous growth in careers and research in biochemistry and biotechnology. Nearly half of the research taking place in the department is taking place at this interface between chemistry and biology.

The department currently serves students interested in these areas through its existing BS Chemistry and BA Chemistry programs, some with BA Chemistry / BS Biology double majors. The BS Chemistry program is a traditional chemistry degree that does include sufficient biological and biochemical coursework within the 120 unit degree requirement, though students frequently take additional courses in these areas. The BA Chemistry program was originally intended for pre-health professional students, but does not include sufficient physical chemistry and lacks the BS degree title.

The department's last two external reviews have each recommended that the department develop a BS Biochemistry degree to better serve students interested in careers at the interface of biology and chemistry. After years of work and hiring, the department now has a sustainable, rigorous plan for the degree along with the faculty expertise to support this degree.

The proposed BS Biochemistry program will be a significant improvement for students interested in these areas. The BS Biochemistry carries 11 more units of biology and at least 6 more unit of biochemistry courses than the BS Chemistry program. The BS Biochemistry carries at least two more units of physical chemistry and more structured upper-division chemistry elective requirements than the BA Chemistry program.

Initially, we anticipate that students for this program will come from the BA Chemistry program. Over time the degree program, which is unique in the central valley but common in other areas, is likely to attract other excellent students to Fresno State.

**Proposal: Bachelor of Science in Biochemistry**  
Department of Chemistry  
California State University, Fresno

**1. Program Type:** New Program; State-Support program

**2. Program Identification**

- a. Campus: **California State University, Fresno**
- b. Full and exact degree designation and title: **Bachelor of Science in Biochemistry**
- c. Date the Board of Trustees approved adding this program projection to the campus Academic Plan: *To be determined (expected – March 2014).*
- d. Term and academic year of intended implementation: **Fall 2014**
- e. Total number of units required for graduation. This will include all requirements, not just major requirements. **120 semester units**
- f. 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**
- g. Name, title, and rank of the individual(s) primarily responsible for drafting the proposed degree major program: **Joy J. Goto, Ph.D., Associate Professor**
- h. 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 attached letters of support from: Dr. Saeed Attar, Chair, Department of Chemistry, Dr. Alejandro Calderon-Urrea, Chair, Department of Biology, and Carol Doyle, Science Librarian, Henry Madden Library.*
- i. Any other campus approval documents that may apply (e.g. curriculum committee approvals). **Approval will be procured electronically by all committees via BizFlow.**
- j. Please specify whether this proposed program is subject to WASC Substantive Change review. The campus is required to either attach a copy of the WASC Sub-Change proposal or submit that document in lieu of the CSU proposal format.  
**This proposed program is not subject to WASC Substantive Change Review.**
- k. Optional: Proposed Classification of Instructional Programs and CSU Degree Program Code:     **CSU Code: 04141           CIP: 26.0202**



### 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.

**Program Rationale:** The Chemistry Department is proposing the formation of a new Bachelor of Science in Biochemistry degree program that builds on existing courses and faculty expertise within the department. The last 20 years have seen an enormous growth in careers and research in biochemistry and biotechnology. Nearly half of the research in the department is at the interface between chemistry and biology.

The department currently serves students interested in these areas through its existing B.S. Chemistry and B.A. Chemistry, some are B.A. Chemistry and B.S. Biology double majors. The B.S. Chemistry program is a traditional chemistry degree that does include sufficient biochemical coursework within the 120-unit degree requirement, though students frequently take additional courses in these areas. The B.A. Chemistry program was originally intended for pre-health professional students, but does not include sufficient physical chemistry and lacks the B.S. degree title without further rigor in chemistry courses. (For a comparison see Section 5C. pages 18-19).

The department's last two external reviews have each recommended that the department develop a B.S. Biochemistry degree to better serve students interested in careers at the interface of biology and chemistry. The department now has a sustainable, rigorous plan for the degree along with the faculty expertise necessary to support this degree.

The proposed B.S. Biochemistry program will be a significant improvement for students interested in these areas. The B.S. Biochemistry carries 11 more units of biology and at least 6 more units of biochemistry courses than the B.S. Chemistry program. The B.S. Biochemistry carries at least two more units of physical chemistry and more structured upper-division chemistry elective requirements than the B.A. Chemistry program.

Initially, we anticipate that students for this program will come from the B.A. Chemistry program. Over time the degree program, which is unique in the Central Valley but common in other areas, is likely to attract other excellent students to Fresno State.

**Program Overview:** The purpose of the Bachelor of Science in Biochemistry program is to prepare and train undergraduates with the knowledge and technical skills related to areas of chemistry (analytical, general, organic, physical) and biochemistry. Undergraduates will become adept at comprehending, analyzing, and synthesizing solutions to complex scientific problems using their critical analytical and quantitative skills acquired from this program. Scientific and biomedical research require students skilled in comprehending problems that require multidisciplinary technical knowledge and application and testing of creative thought processes. The B.S. Biochemistry program will prepare students to face these challenges and prepare them for careers in biomedical research, medicine, pharmacy, dentistry, other health professions and the pursuit of advanced Ph.D. degrees.

The Chemistry department is committed to fulfilling the University mission by advancing student success and preparing them to meet the scientific challenges of the present and future. The B.S. Biochemistry program will have a transformative impact on the students in this diverse region, many of who aspire to be health professionals and science researchers in their local communities, while also distinguishing the University and region by focusing on biomedical problems with a global impact.

The B.S. Biochemistry curriculum has been designed to integrate knowledge and technical skills for a comprehensive multi-disciplinary program. Our new B.S. Biochemistry program would be the first of its kind in the Central Valley, providing a distinctive opportunity to our local population of students. Our new program will support an environment of intellectual strength and student success with meaningful faculty-student mentoring, which can only benefit the University and region to fulfilling the vision to power the New California for the 21<sup>st</sup> century.

The following is from: <http://www.fresnostate.edu/president/mission/>

**University Mission:** California State University, Fresno powers the New California through learning, scholarship, and engagement. The University faculty, staff, and administrators work together to:

- Make student success our first priority;
- Embrace a culture of diversity, internationalization, and inclusion;
- Advance our established distinction in liberal arts and sciences, professional programs, and community engagement;
- Produce transformative scholarly research and creative works that target regional issues with global significance;
- Exemplify the ethical stewardship of capital and human resources; and,
- Develop institutional, community, and intellectual leaders

### **Vision**

California State University, Fresno will become nationally recognized for education that transforms students and improves the quality of life in the region and beyond; for leadership that drives economic, infrastructure, and human development; and for institutional responsiveness that fosters creativity, generates opportunity for all, and thrives on change. Drawing from the rich human diversity of experiences, values, world views, and cultures that make up the fabric of the Central Valley, we will power the New California through the 21<sup>st</sup> century.

- b. Proposed catalog description, including program description, degree requirements, and admission requirements.

**Proposed Catalog Description:**

**Bachelor of Science in Biochemistry Degree Requirements**

The Bachelor of Science in Biochemistry is intended for students who plan to pursue a career in biochemical research, chemistry research, and suitable for student pursuing health professions (medical, pharmaceutical, dental, and other clinical and health professions). The B.S. program is a comprehensive, multi-disciplinary program to prepare students for graduate study in pursuit of a Master of Science (M.S.) or Doctor of Philosophy (Ph.D.) in areas related to biochemistry.

**Note:** Biochemistry majors may not take courses listed in category A or B for CR/NC grades.

**A. The B.S. Biochemistry Major requirements (50-54 units)**

*Core Program*

CHEM 1A, 1B, 102, 110A, 112, 128A, 128B, 129A, 129B, 155A, 155B, 156

Select two additional upper-division CHEM courses (4-7 units): CHEM 106, 106S, 111, 123, 124, or 190 or other approved courses.

Select two additional upper-division BIOL courses (6-7 units): BIOL 102, 103, 104, 120, or other approved courses.

**B. Additional requirements (25-28 units)**

BIOL 1A, 1B, 1BL

MATH 75, 76

PHYS 2A, 2B (or PHYS 4A, 4AL, 4B, 4BL, 4C strongly recommended)

**C. Remaining General Education requirements\* (42 units)**

**D. Free Elective Units (0-3 units)**

**Total (minimum 120 units)**

\*Of the 51 required General Education units, 9 units will be satisfied by the following courses in the major and additional requirements:

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3 units of BIOL 1A in G.E. Breadth B2;

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<b>First Semester – Fall</b>	<i>Units</i>
CHEM 1A	5
MATH 75	4
ENGL 5B or 10	3
<u>General Education</u>	<u>3</u>
	15

<b>Second Semester – Spring</b>	<i>Units</i>
CHEM 1B	5
MATH 76	4
PHYS 2A	4
<u>General Education</u>	<u>3</u>
	16

<b>Third Semester – Fall</b>	<i>Units</i>
CHEM 128A	3
PHYS 2B	4
BIOL 1A	4
<u>General Education</u>	<u>3</u>
	14

<b>Fourth Semester – Spring</b>	<i>Units</i>
CHEM 128B	3
CHEM 129A	2
BIOL 1B and 1BL	5
<u>Electives or General Education</u>	<u>6</u>
	16

<b>Fifth Semester* – Fall</b>	<i>Units</i>
**CHEM 155A	3
CHEM 129B	2
CHEM 102	5
**CHEM 110A	3
<u>Electives or General Education</u>	<u>6</u>
	16

<b>Sixth Semester* – Spring</b>	<i>Units</i>
***CHEM 155B	3
***CHEM 156	3
***CHEM 112	3
<u>Electives or General Education</u>	<u>6</u>
	15

<b>Seventh Semester – Fall</b>	<i>Units</i>
<u>Electives or General Education</u>	<u>14</u>
	14

<b>Eighth Semester – Spring</b>	<i>Units</i>
<u>Electives or General Education</u>	<u>14</u>
	14

\*=It is important to fulfill the upper-division writing skills requirement by exam or W class during the junior year. \*\*=Offered fall semester only. \*\*\*=Offered spring semester only.

#### 4. Curriculum

- a. Missions, Goals for the (1) program and (2) student learning outcomes.

##### **Mission Statement of the Chemistry Department:**

The mission of the Department of Chemistry is to provide students with the appropriate level of modern and comprehensive chemical education required for life and work in our technologically advanced society. To accomplish this the department offers courses for students planning to be professional chemists, for students planning careers in the medical professions and careers in teaching, for students requiring a basic chemical science background for other majors, and for students fulfilling their general education science requirements.

##### **Mission Statement of the College of Science and Mathematics:**

The College of Science and Mathematics provides study for students in the areas of biology, chemistry, computer science, earth & environmental sciences, mathematics, physics, and psychology by offering courses in the majors. Support courses for non-science majors such as agriculture, engineering, and the health professions and courses for the general education of all university students are also offered through the college. In doing so, our goal is to provide professional training at the undergraduate and graduate levels; to serve as a foundation for a career in science/mathematics, to provide pre-professional training in preparation for careers in medicine, dentistry, pharmacy, veterinary medicine, forensic science and other professions or for continued study at the graduate level.

Furthermore, students and faculty members in the college conduct research and scholastic activities in their academic areas and in solving applied scientific problems of the region. These research activities are carried out among campus scientists along with investigators at other research centers.

The College of Science and Mathematics is involved with the school systems in science and mathematics teacher education. The recruitment, retention, and education of underrepresented minorities and females in science and mathematics are also major emphases.

**Programs Goals:** The goals of the program in Biochemistry are to prepare undergraduate students with the relevant and applicable **knowledge** in the core chemistry and biochemistry areas (i.e. general, analytical, biochemistry, organic, and physical); the **critical thinking skills** and the **technical laboratory skills** in preparation to **contribute to society** and work in the health professions (e.g. medical, pharmaceutical, dental, osteopathy, ophthalmology, and other health-related professions), as skilled biochemists and science researchers, or for entry into graduate degree programs (M.S. or Ph.D.).

### Student Learning Outcomes (SLOs)

- SLO1 Students will apply their understanding of chemical and biochemical terminology, concepts, theories, and skills to solve problems and evaluate the significance of data.
- SLO2 Students will apply their understanding of chemical and biochemical terminology, concepts, theories, and skills to conduct experimental laboratory work of high quality.
- SLO3 Students will identify, find, and use chemical and biochemical information from reference materials and the peer-reviewed literature.
- SLO4 Students will clearly, effectively, and professionally communicate their scientific opinions, understanding and results in common written and oral formats.
- SLO5 Students will function effectively in collaborative and group work environments in lecture, study; and laboratory settings. This often includes the ability to work on a component of a larger project and connect their work with the results and work of other students and reports in the peer-reviewed literature.

- b. Descriptions and plans for assessing the B.S. Biochemistry program goals and student learning outcomes (SLOs).

The following is a proposed comprehensive assessment plan addressing multiple elements, including the direct and indirect measurements to assess SLOs directly related to overall the overall program goals. The matrices show the relationship between all assessment elements mapping student learning outcomes, the courses where they are found and indicating where course content related to the learning outcomes is Introduced (I), Developed (D), and Mastered (M) to present a comprehensive picture of program assessment.

Student Learning Outcomes	1A Lec Gen Chem	1A Lab Gen Chem	1B Lec Gen Chem	1B Lab Gen Chem	128A Lec Org Chem	129A Lab Org Chem	128B Lec Org Chem	129B Lab Org Chem	102 Lec&Lab Quant Analytic	110A Lec Physical	112 Lec Biophysical	155A Lec Biochem	155B Lec Metab Physiol	156 Lab Biochem
Apply 1	I	I	D	D	D	D	D	D	D	D	M	D	M	M
Experiment 2		I		D		D		D	D					M
Literature 3	I	I	I	I	I	I	I	D	D	D	M	D	M	M
Communic. 4				I		I		D	D					M
Collaborate 5		I		I		D		D	D			D	M	M

**Direct Measures:** The majority of assessment measures for the BS Biochemistry program take place during the CHEM 156 Biochemical Laboratory Techniques. This course and its independent research project serves as a capstone experience for students in this program.

- A. **Biochemistry Exam (SLO1)** – This exam will consist of validated multiple choice questions taken from biochemistry test banks. It will be administered to students in CHEM 155B near the end of the course. It is expected that students passing the course will score above 50% correct responses on the exam.
- B. **Laboratory Work, Notebook, and Data Review (SLO2, SLO5)**- Students will be scored on writing a protocol for describing the steps, reagents, conditions and use of instrumentation for a procedure conducted during CHEM 156 laboratory. A rubric will be used to score the work. It is expected that students passing the course will score above 70% on the assignment. The rubric is calibrated by all biochemistry faculty evaluating ~3-5 works on the protocol assignment, comparing the scores anytime the assignment or rubrics are updated.
- C. **Final Group Written Report Rubric (SLO1, SLO3, SLO4)** – Students will write a group report on a culminating independent experiment conducted during CHEM156. Student reports will be scored on the ability to accurately report data as compared to notebook data, including a thorough materials and methods section, and including content, integration and critical analysis of their own work in the context of other groups' results. A rubric will be used to score the work. It is expected that students passing the course will score above 70% on the assignment. The rubric is calibrated by all biochemistry faculty evaluating ~3-5 works on the protocol assignment, comparing the scores anytime the assignment or rubrics are updated.
- D. **Oral Presentation Rubric (SLO1, SLO3, SLO4)** – A 15 minute oral presentation is given at the end of CHEM 156. The student's presentation will be scored using the attached oral presentation rubric. The rubric is calibrated by all biochemistry faculty evaluating 3-5 presentations and comparing scores any time instructional faculty, the assignment, or the rubric are updated. It is expected that 70% of students passing the class will have scores of 21 or above.

#### **Indirect Measures**

- E. **Alumni and Employer Feedback** – At least once every five years the department will conduct surveys or focus groups with alumni and their employers using either surveys or focus groups. These mechanisms will allow the department to reevaluate the target student outcomes to match changing needs in the chemistry community.
- F. **Graduating Students Feedback** -- The department will ask for feedback from graduating students using surveys or focus groups to evaluate their perception of whether the degree has adequately prepared them for their chosen career. This may include job placement and graduate/professional school admission rates.

- G. Existing Student Feedback – At least once every five years, the department will hold a focus group with existing biochemistry majors. This will provide an opportunity to identify emerging problems quickly before they show up in tracked data.
- H. Faculty Feedback – The department will periodically collect feedback from permanent and temporary faculty and instructors on their perceptions of student strengths and weaknesses.

The following matrices summarizes the SLOs with the direct and indirect measures proposed for evaluation of the B.S. Biochemistry program.

Assessment Activity	Direct Measures				Indirect Measures			
	A-Biochem Exam	B- Lab Work	C- Lab Report	D- Oral presentation	E -Alumni and Employers	F -Graduating Students	G-Current Students	H-Faculty
Student Learning Outcomes								
Write	✓		✓	✓	✓	✓		✓
Experiment		✓	✓	✓	✓	✓		✓
Integrate			✓	✓	✓	✓		✓
Communicate			✓	✓	✓	✓		✓
Collaborate		✓			✓	✓		✓

The **Assessment Timeline** is based on the department’s external program review cycle, repeating each five to seven years beginning with the year following the completion of the department’s self-study.

Data for all direct measures will be collected on an annual basis and stored for future review by the assessment committee. Surveys or focus groups with graduating students will be conducted annually and the data will be stored for future review by the assessment committee. The following timeline outlines the schedule for review of that data by the department assessment committee.



**First Year (AY 2015-2016)**

- Review of SLO1 – Problem Solving & Data Interpretation using data from methods A,C,F
- Faculty Discussion of Student Outcomes (Method H)

**Second Year (AY 2016-2017)**

- Review of SLO2 – Laboratory Work using data from methods B, F
- Current Student Survey / Focus Group (Method G)
- Faculty Discussion of Student Outcomes (Method H)

**Third Year (AY 2017-2018)**

- Review of SLO3 – Literature Skills using data from methods C, F
- Alumni & Employer Survey / Focus Groups (Method E)
- Faculty Discussion of Student Outcomes (Method H)

**Fourth Year (AY 2018-2019)**

- Review of SLO4 – Communication Skills using data from methods C, D, F
- Current Student Survey / Focus Groups (Method G)
- Faculty Discussion of Student Outcomes (Method H)

**Fifth Year (AY 2019-2020)**

- Review of SLO5 – Group Work using data from methods B, C, F
- Faculty Discussion of Student Outcomes (Method H)

**Process for Closing the Loop**

The Chemistry Department Assessment Committee will be responsible for collecting and summarizing assessment data each semester. Assessment results will be reported at regular department meetings. Near the end of each spring semester, a department meeting will be dedicated to reviewing assessment results, determining what changes, if any, the results suggest, and adjusting the next year's assessment activities as needed. The minutes of this meeting will provide the basis for the department chair's annual report on assessment activities.

Program Goals	SLOs	Course(s) Where SLOs can be Assessed	How often will the SLO be assessed?	Type of Direct Assessment Activity	Type of tool used to score/eval. the activity	How Data will be Assessed and Reported
Relevant and applicable knowledge in the core chemistry and biochemistry areas.	SLO1	CHEM 112, 155B, 156	Once during 2015-2016.	Exam (A), Written Report (C)	A point system will be used to score the activities. Levels either in grades or percentages will be evaluated as passing.	Passed at 50% level.
Critical thinking skills	SLO3	CHEM 112, 155B, 156	Once during 2017-2018.	Written Report (C)	A point system will be used to score the activities. Levels either in grades or percentages will be evaluated as passing.	Number/percentage scoring above the average score.
	SLO5	CHEM 156	Once during 2019-2020.	Lab protocol work (B), Written Report (C)	A point system will be used to score the activities. Levels either in grades or percentages will be evaluated as passing	Passed at 50% level.
Technical laboratory skills	SLO2	CHEM 156	Once during 2016-2017.	Lab protocol work (B),	A point system will be used to score the activities. Levels either in grades or percentages will be evaluated as passing	Passed at 50% level.
Contribute to society as future health professionals, scientists, and graduate students.	SLO4	CHEM 156	Once during 2018-2019.	Written Report (C), Oral Presentations (D)	A point system will be used to score the activities. Levels either in grades or percentages will be evaluated as passing	Score totals as meet, exceeds, or does not meet expectations.

- c. Indicate total number of units required for graduation. **120 semester units**
- d. Include a justification for any baccalaureate program that requires more than 120-semester units or 180-quarter units. *Not applicable.*
- e. If any formal options, concentrations, or special emphases are planned under the proposed major, identify and explain fully. *Not applicable.*
- f. List all requirements for graduation, including electives, for the proposed degree program.

<i>Required Courses for Graduation</i>						
<i>Catalog #</i>	<i>Title</i>	<i>Units</i>	<i>Major Reqmt.? (Y/N)</i>	<i>Pre-Req. unless noted. CoReq noted.</i>	<i>Elective (Y/N)</i>	<i>New Course (Y/N)</i>
CHEM 1A	General Chemistry	5	Yes	High school chemistry	No	No
CHEM 1B	General Chemistry	5	Yes	CHEM1A	No	No
CHEM 102	Quantitative Analytical Chemistry	5	Yes	CHEM1B and 128A	No	No
CHEM 110A	Physical Chemistry	3	Yes	MATH76, CHEM128A, PHYS2A&2B	No	No
CHEM 112	Biophysical Chemistry	3	Yes	CHEM 108	No	Yes
CHEM 128A	Organic Chemistry	3	Yes	CHEM 1B	No	No
CHEM 128B	Organic Chemistry	3	Yes	CHEM 128A	No	No
CHEM 129A	Organic lab	2	Yes	CHEM 128A (co-req)	No	No
CHEM 129B	Organic lab	2	Yes	CHEM 128A,129A (pre-reqs) and CHEM 128B (co-req)	No	No
CHEM 155A	Fundamental of Biochem	3	Yes	CHEM 128B	No	No
CHEM 155B	Physiological Chem and Metabolism	3	Yes	CHEM 155A	No	No

<i>Catalog #</i>	<i>Title</i>	<i>Units</i>	<i>Major Reqmt? (Y/N)</i>	<i>Pre Req unless noted. CoReq noted.</i>	<i>Elective (Y/N)</i>	<i>New Course (Y/N)</i>
CHEM 156	Biochemical Laboratory Techniques	3	Yes	CHEM 155A, 102, 129A, upper-division W course.	No	No
CHEM (106, 111, 123, 124, 190 or other approved courses)	Upper-division electives. (Analytical Measurements Lab, Physical Chem Lab, Advanced Inorganic, Synthesis and Characterization, Independent Study)	4-7	Yes	Varies.	Yes	No
BIOL 1A	Introductory Biology	4	Yes	No	No	No
BIOL 1B+1BL	Introductory Biology and laboratory	3+2	Yes	No	No	No
BIOL (102, 103, 104, 120 or other approved courses)	Upper-division electives (Genetics, Cellular Biol, Genetics & Cell lab, Microbiology)	6-7	Yes	Varies.	Yes	No
MATH 75	Calculus I	4	Yes	No	No	No
MATH 76	Calculus II	4	Yes	MATH75	No	No
PHYS 2A	General Physics	4	Yes	MATH75 (co-req)	No	No
PHYS 2B	General Physics	4	Yes	PHYS2A	No	No
G.E.	General Education	42*			Yes	No
Total Units Required for Degree Completion		120				
<i>Catalog Description of All New Courses: CHEM 112 (Biophysical Chemistry)</i>		Prerequisites: Chem 108 or 110A. Principles of thermodynamics, equilibria, kinetics applied to biological processes and systems, including proteins, nucleic acids, and membranes. Microscopic structure and assembly, statistical analyses, spectroscopy, photobiology, and biological magnetic resonance.				

\*Of the 51 required General Education units, 9 units will be satisfied by the following courses in the major and additional requirements: 3 units of CHEM 1A or PHYS 2A in G.E. Breadth B1; 3 units of BIOL 1A in G.E. Breadth B2; 3 units of MATH 75 in G.E. Foundation B4.

- g. 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.

The only new course required for the proposed program is Chem 112 (Biophysical Chemistry). This is the second semester of physical chemistry area in the program, and will initially only be offered during the spring semester. Chem 108 and Chem 110A (Introductory Physical Chemistry) for B.A. and B.S. chemistry majors, respectively, are pre-requisite courses to Chem 112 and are only offered during the fall semester. CHEM 110A is required for the B.S. Biochemistry major.

The following is a new course and the proposal will be submitted, together with this new program proposal, to the College and University curriculum committees during fall 2012 for approval and addition to the B.S. Biochemistry program.

**Chemistry 112 (Biophysical Chemistry, 3 units)**

**Catalog Description** (maximum 40 words): Prerequisites: Chem 108 or 110A. Principles of thermodynamics, equilibria, kinetics applied to biological processes and systems, including proteins, nucleic acids, and membranes. Microscopic structure and assembly, statistical analyses, spectroscopy, photobiology, and biological magnetic resonance.

- h. Proposed course-offering plan for the first three years of program implementation, indicating likely faculty teaching assignments.

The faculty teaching assignments will vary throughout the first three years of the program implementation, as indicated in the table. We have adequate staffing to fully support the program, which includes: 15 full-time faculty (11 tenured faculty; 4 tenure-track faculty) and 16 part-time lecturers (M.S. or Ph.D. in Chemistry or related chemistry field, e.g. Biochemistry, Biophysics).

<i>Catalog #</i>	<i>Title</i>	<i>Faculty teaching assignments (subject to change)</i>
<i>CHEM 1A</i>	<i>General Chemistry</i>	Choi, Gandler, Golden, Ng, Person, and Chem Staff
<i>CHEM 1B</i>	<i>General Chemistry</i>	Choi, Gandler, Golden, Ng, Person, and Chem Staff
<i>CHEM 102</i>	<i>Quantitative Analytical Chemistry</i>	Choi, Ng, Person

<i>Catalog #</i>	<i>Title</i>	<i>Faculty teaching assignments (subject to change)</i>
CHEM 110A	<i>Physical Chemistry (fall)</i>	Hasson, Krishnan, and Chem Staff
CHEM 112	<i>Biophysical Chemistry (spring)</i>	Krishnan or Chem staff
CHEM 128A	<i>Organic Chemistry</i>	Attar, Chen, Gandler, and Maitra
CHEM 128B	<i>Organic Chemistry</i>	Attar, Chen, Gandler, and Maitra
CHEM 129A	<i>Organic lab</i>	Attar, Chen, Gandler, Maitra, and Chem Staff
CHEM 129B	<i>Organic lab</i>	Attar, Chen, Gandler, Maitra, and Chem Staff
CHEM 155A	<i>Fundamental of Biochem (fall)</i>	Brooks, Dejean, Goto, and Chem Staff
CHEM 155B	<i>Physiological Chem and Metabolism (spring)</i>	Brooks, Dejean, Goto, and Chem Staff
CHEM 156	<i>Biochemical Laboratory Techniques (spring)</i>	Brooks, Dejean, Goto, and Chem Staff
CHEM (106, 111, 123, 124, 190 or other approved courses)	<i>Upper-division electives. (Analytical Measurements Lab, Physical Chem Lab, Advanced Inorganic, Synthesis and Characterization, Independent Study)</i>	Varies. Chemistry full-time tenured or tenure-track faculty.

- i. 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. **Not applicable.**
- j. For graduate degree proposals, cite the corresponding bachelor's program and specify whether it is (a) subject to accreditation and (b) currently accredited. **Not applicable.**
- k. For graduate degree programs, specify admission criteria, including any prerequisite coursework. **Not applicable.**
- l. For graduate degree programs, specify criteria for student continuation in the program. **Not applicable.**
- m. For undergraduate programs, specify planned provisions for articulation of the proposed major with community college programs.

Most community college transfer students will have completed their general chemistry, math, and physics requirements. If the organic chemistry lecture and laboratory requirements are not complete, articulation through the CHEM 128A, 128B, 129A, 129B may require an extra year for completion of the proposed program. Articulation schedules will also be discussed with chemistry department faculty colleagues from the local community colleges (e.g. Fresno City College: Dr. Kirk Kawagoe and Willow Community College: Shawn Fleming, M.S.)

n. Advising "roadmaps" that have been developed for the major.

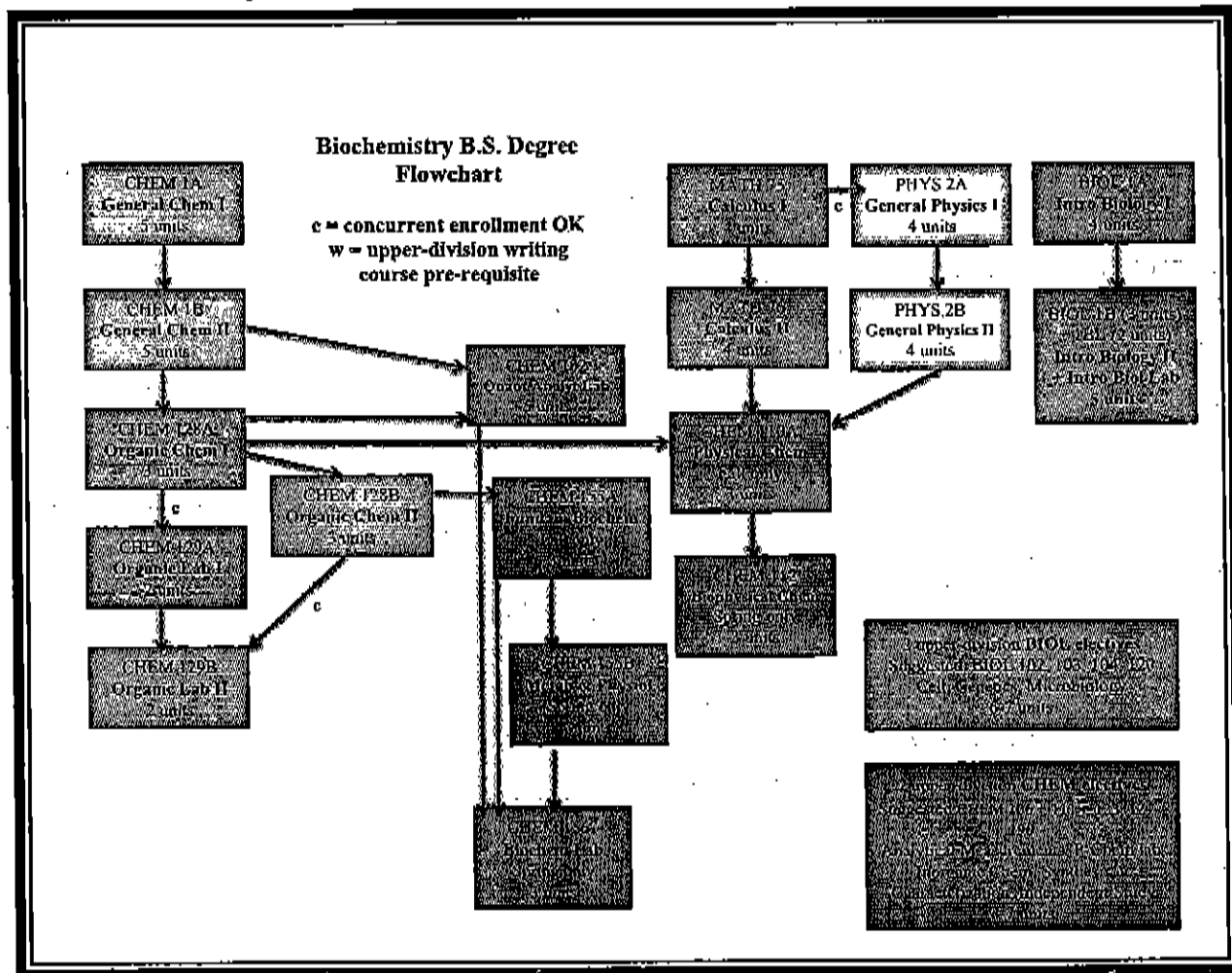
<b>B.S. Biochemistry - Advising Roadmap - Recommended Course Sequence</b>					
<b>Freshman Year (31 units)</b>					
Fall	Course	Units	Spring	Course	Units
CHEM 1A	General Chem+lab	5	CHEM 1B	General Chem+lab	5
MATH 75	Calculus I	4	MATH 76	Calculus II	4
ENGL 5B or 10	Academic Literacy	3	PHYS 2A	General Physics+lab	4
G.E.	General Education	3	G.E.	General Education	3
	Total:	15		Total:	16
<b>Sophomore Year (30 units)</b>					
Fall	Course	Units	Spring	Course	Units
CHEM 128A	Organic Chem	3	CHEM 128B	Organic Chem	3
PHYS 2B	Gen'l Physics+lab	4	CHEM 129A	Org Chem Lab	2
BIOL 1A	Intro Biology+lab	4	BIOL 1B+1BL	Intro Bio (3) + lab (2)	5
G.E.	General Education	3	G.E.	General Education	3
			G.E.	General Education	3
	Total:	14		Total:	16
<b>Junior Year (31 units)</b>					
Fall	Course	Units	Spring	Course	Units
CHEM 155A*	Fundam. of Biochem	3	CHEM 155B**	Physio Chem & Metabolism	3
CHEM 129B	Org Chem Lab	2	CHEM 156**	Biochem Lab	3
CHEM 102	Quant Analyt Chem	5	CHEM 112**	Biophysical Chemistry	3
CHEM 110A	Physical Chem	3	BIOL	Upper-Division Bio	3
G.E.	General Education	3	G.E.	General Education	3
	Total:	16		Total:	15
<b>Senior Year (28 units)</b>					
Fall	Course	Units	Spring	Course	Units
CHEM	Upper-Division Chem	3	CHEM	Upper-Division Chem	3
BIOL	Upper-Division Bio	3	BIO	Upper-Division Bio	3
G.E. or electiv	G.E. or elective	9	G.E. or electiv	G.E. or elective	8-9
	Total:	14		Total:	14
<b>Total Units: 120 units</b>					

<sup>w</sup>=It is important to fulfill the upper-division writing skills requirement by exam or W class by or during the junior year.

\*=Offered fall semester only.

\*\*=Offered spring semester only.

The following is another version of a roadmap that may be used for advising:



o. Describe how accreditation requirements will be met, if applicable, and anticipated date of accreditation request (including the WASC Substantive Change process). *Not applicable.*

**5. Societal and Public Need for the Proposed Degree Major Program**

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

The following 13 CSU campuses currently offer a Bachelor of Science Biochemistry degree program: Chico, Dominguez Hills, East Bay, Fullerton, Long Beach, Los Angeles,



Northridge, Pomona, Sacramento, San Francisco, San Luis Obispo, San Marcos and Sonoma. In addition, these programs also have a B.A. Chemistry and B.S. Chemistry degree offering, in addition to their B.S. Biochemistry.

The following six CSU campuses currently offer a Bachelor of Science in Chemistry with biochemistry emphasis/option: Bakersfield, Channel Islands, Humboldt, San Bernardino, San Diego, and San Jose. No other 2-year or 4-year comprehensive institution in the nearby central valley vicinity offers a B.S. Biochemistry degree. UC Merced only offers a B.S. Chemistry degree with a biochemistry emphasis track.

If the new program is approved, California State University, Fresno, would be the first and only 4-year comprehensive University in the Central Valley to offer a B.S. Biochemistry degree program.

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

There is very little difference in the major chemistry courses and electives in the proposed B.S. Biochemistry degree at California State University, Fresno compared with each of the 13 CSU campuses that currently offer a B.S. Biochemistry degree. The only difference noted is the difference in the semesters of physical chemistry. Most require only one semester of physical chemistry but the proposed program includes a second semester of physical chemistry, specifically biophysical chemistry (CHEM 112 – proposed new course in our Department, currently only offered at the graduate level).

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

The table included below compares the proposed B.S. Biochemistry program with the current B.A. and B.S. Chemistry programs. The major differences are: the inclusion of two semesters of physical chemistry including physical chemistry (CHEM 110A) and Biophysical Chemistry (CHEM 112) compared to the B.A. major; (2) the two biochemistry courses and metabolism and physiology (CHEM 153) and a biochemistry laboratory course (CHEM 156) compared to the B.S. Chem major; and (3) the inclusion of 4-7 units more structured upper-division chemistry elective requirements, and 6-7 more units upper-division biology elective requirements compared to the current B.A. and B.S. Chemistry programs.

These differences in course requirements broaden and add further rigor to the B.S. Biochemistry major. Many students may choose the B.S. Biochemistry but we still anticipate a vigorous B.A. Chemistry student population and B.S. Chemistry degree programs. We do not predict the replacement of one program over the other, but this will be an important point to monitor throughout the implementation of the new program. Also, of note, most other CSU programs that offer B.S. Biochemistry majors, also offer the B.A. Chem, along with the B.S. Chem programs within their Chemistry Department programs.

	B.S. Biochem	B.S. Chem	B.A. Chem
<b>CORE Chemistry courses (by area)</b>			
General Chemistry	1A, 1B	1A, 1B	1A, 1B
Qualitative Analytical Lab	102	102	102
Analytical Measurements Lab		106 or 106S	
Intro Physical Chemistry			108
Physical Chemistry	110A	110A & 110B	
Physical Chemistry Lab		111	
Biophysical Chemistry	112		
Advanced Inorganic Chem		123	
Synthesis & Characterization Lab		124	
Organic Chemistry	128A & 128B	128A & 128B	128A & 128B
Organic Chemistry Lab	129A & 129B	129A & 129B	129A & 129B
Fundamentals of Biochemistry	155A	155A	155A
Physiological Chem & Metabolism	155B		155B
Biochem Lab Techniques	156		156
Upper-division Chem Electives	4-7 units	6 units	
Upper-division Bio Electives	6-7 units		6-7 units
Math	75 & 76	75, 76, & 77	75 & 76
Physics	2A & 2B	4A/L, 4B/L, 4C/L	2A & 2B
Biology	1A & 1B, 1BL		1A & 1B, 1BL
General Education	42 units	45 units	42 units
<b>Total Units</b>	<b>120 units</b>	<b>120 units</b>	<b>120 units</b>

- d. Community participation, if any, in the planning process. This may include prospective employers of graduates.  
The following community members have been contacted to request input and feedback on the proposed program.
- Diane Anderson, President, APPL Inc., Clovis, California
  - Mike Brechmann, Scientist, BSK Laboratories, Inc. Fresno, California
  - Michael Cleary, Ph.D., Chemistry, Gallo Winery, Modesto, California
  - Kirk Kawagoe, Ph.D., Chemistry Department, Fresno City College
  - Shaun Fleming, Chemistry Department, Willow International Community College Center, Clovis, California
- e. Applicable workforce demand projections and other relevant data.

**Note: Data Sources for Demonstrating Evidence of Need**

The California Labor Market Information source indicates that California has the highest quotient of employed biochemists and biophysicists in the United States. As of May 2012 there were 5,980 employed biochemists and biophysicists, ahead of New Jersey (3,980), Massachusetts (3,080), New York (2,010) and Pennsylvania (1,430).

The US Department of Labor, Bureau of Labor Statistics indicates a 30.8% increase in forecasted employment need and change between 2010-2020 for the occupation of biochemist and biophysicist in the United States.

In February 2012, the President's Council of Advisors on Science and Technology (PCAST; [www.WhiteHouse.gov/OSTP/PCAST](http://www.WhiteHouse.gov/OSTP/PCAST)), Executive Office of the President, reported to the President the recommendation to produce one million additional college graduates with degrees in science, technology, engineering, and mathematics (STEM).

These two major current and future employment data statuses and projections, along with the PCAST report are strong support for the need of trained biochemists. This new proposed program would enhance and support the goal of increasing the number of STEM majors, as well as preparing students as future working scientists and biochemists, for California and the nation.

## 6. Student Demand

- a. 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.

The most compelling evidence for student interest is an informal survey of our undergraduate majors in the existing chemistry program in our department. An anonymous and informal survey was given and collected from ~71 undergraduate majors (mostly B.A. chemistry and a few double majors in (B.A.) Chemistry and (B.S.) Biology. The surveys were conducted between 2008 and 2013. The undergraduates were students from the B.A. chemistry major courses, including CHEM 108 (Introductory Physical Chemistry) and CHEM 153 (Physiological Chemistry and Metabolism).

Please see the summary of the results, after the example of the informal survey, on the next several pages.

The survey consisted of the following text and questions:

The Chemistry Department is proposing to develop a BS Biochemistry degree program and this questionnaire is to help assess student interest in such a degree, which will be in addition to our present BS and BA Chemistry degrees. The BS Biochemistry degree will be a more rigorous degree program than our current BA degree with additional proposed courses in areas such as biophysical chemistry, and additional electives in chemistry and/or biology.

Students who would benefit from a BS Biochemistry degree would be those who want:

- A. a strong background in chemistry, but with a more biological emphasis.
- B. to seek admission into graduate school in areas such as biochemistry, molecular biology, and biotechnology.
- C. to strengthen their credentials for admission to professional health degree programs (medicine, pharmacy, dentistry etc.)
- D. a biochemistry background which includes more opportunities for higher level laboratory and elective courses to strengthen employment opportunities.

PLEASE ANSWER THE FOLLOWING QUESTIONS IN THE BLANK SPACES PROVIDED, USING THE FOLLOWING FIVE POINT SCALE:

- 5 Very high
- 4 High
- 3 Moderate (Maybe)
- 2 Low
- 1 None/Not at all

- 1. If it had been offered when you began your college career, how interested would you have been in pursuing a BS Biochemistry Degree? \_\_\_\_\_
- 2. How well does the degree you are presently seeking meet your needs? \_\_\_\_\_
- 3. How well would the BS Biochemistry degree meet your needs? \_\_\_\_\_
- 4. Using the letters A-D above, which reason would be the strongest for seeking a BS Biochemistry degree? \_\_\_\_\_

What is your current major:

- \_\_\_\_\_ BS Chemistry
- \_\_\_\_\_ BA Chemistry
- \_\_\_\_\_ BS Biology
- \_\_\_\_\_ Others

When do you plan to graduate?

What are your future plans?

- \_\_\_\_\_ Immediate Employment
- \_\_\_\_\_ Graduate School
- \_\_\_\_\_ Admission to a Professional School (Med, Pharm, etc.)
- \_\_\_\_\_ Others, unsure

WHAT ARE YOUR THOUGHTS ABOUT THE PROPOSED PROGRAM. IS IT A GOOD IDEA? ARE THERE MANY PEOPLE (IN OTHER MAJORS FOR EXAMPLE) INTERESTED IN A B.S. BIOCHEMISTRY PROGRAM?

\_\_\_\_\_

### Informal Survey Summary

The survey can be summarized as follows (see average of responses, below), focusing on the average responses to questions #1-4.

*Overall, students surveyed would likely choose the B.S. biochemistry major, though many see their current major meeting their needs though also indicating a B.S. biochemistry would be slightly better at meeting their needs. Their enthusiasm for the new major is also indicated in the free comments section of the survey (several responses are included).*

*The most compelling evidence of the need for the new program is the reason why students would choose the new major, with 56% indicating it would strengthen their credentials for admission into health professional schools, while also supporting those seeking admission into graduate school (19%) and seeking employment (19%).*

(Questions #1-3 are on a Likert scale (1 = none; 4 = high; 5 = very high))

**Question #1:** If it had been offered when you began your college career, how interested would you have been in pursuing a BS Biochemistry Degree? **4.00**

**Question #2:** How well does the degree you are presently seeking meet your needs? **3.79**

**Question #3:** How well would the BS Biochemistry degree meet your needs? **4.13**

**Question #4:** Using the letters A-D above, which reason would be the strongest for seeking a BS Biochemistry degree? (shown as a % of the total response; N=71)

- A. a strong background in chemistry, but with a more biological emphasis. (6%)
- B. to seek admission into graduate school in areas such as biochemistry, molecular biology, and biotechnology. (19%)
- C. to strengthen their credentials for admission to professional health degree programs (medicine, pharmacy, dentistry etc.) (56%)
- D. a biochemistry background which includes more opportunities for higher level laboratory and elective courses to strengthen employment opportunities. (19%)

Free responses to thoughts about the proposed B.S. biochemistry program:

"I think it's a great idea. I have many friends who had to choose between bio and chem majors, but if it were combined, it would be easier."

"Everything is going towards biotech or biochem, a B.S. biochem degree would probably facilitate better advancement in employment or education opportunities."

"A degree in Biochem would be fantastic because indeed, I have heard many students in other majors say that they would be interested in a Biochem degree if it were offered."

"I think it is a good idea, especially for students who plan to be in the health field."

- b. Identify how issues of diversity and access to the university were considered when planning this program.

California State University, Fresno is located in the central San Joaquin Valley. Fresno is the 5th largest city in California as of January 1, 2013 (population ~508,453 according to the Department of Finance, State of California). Data from the Office of Institutional Effectiveness (OIE) at Fresno State ([http://www.fresnostate.edu/academics/oie/documents/data-documents/Fall\\_2011/College\\_Profile/CSM\\_Fall11.pdf](http://www.fresnostate.edu/academics/oie/documents/data-documents/Fall_2011/College_Profile/CSM_Fall11.pdf)) indicate the fall 2011 entering full-time freshmen in the College of Science and Mathematics consisted of 73% first generation college attendees, with 81% from the Fresno service area (includes Fresno, Madera, Tulare, and Kings Counties). On a similar note, ~81% of our transfer students in the CSM were also from the Fresno service area.

We have initiated the B.S. Biochemistry program to serve our local population of students which are a diverse group of highly qualified students.

- c. 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. *Not applicable.*
- d. Describe professional uses of the proposed degree program.

The following professions and areas of research where the B.S. Biochemistry degree is instrumental: pharmaceutical, medicine, microbiology, physiology, pharmacology, biomedical management, immunology, pharmacology, molecular biology, biotechnology, diagnostics, clinical chemistry, toxicology, basic research.

With the appropriate choice of electives, undergraduate majors can meet the requirements for admission into pharmacy, medical, dental, and other health-professional schools.

- c. 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.

We predict ~84 new B.S. Biochemistry majors during the first year of the program, where ~50% of our current B.A. Chemistry majors may switch majors, yet still be within the Chemistry Department. In addition, we expect the double majors to switch completely to the B.S. Biochemistry program. We predict ~5 students graduating in the new program during the first year. The chart below indicates the estimated 3<sup>rd</sup> and 5<sup>th</sup> year enrollments in the program.

We predict a modest increase in new majors at the freshman level and overall number of total majors (B.S. Biochemistry, B.A. Chemistry, B.S. Chemistry) in our Chemistry Department remaining modest but with some growth over the next five years.

Class Year	Current chem major	# of students (% per class yr) 2012	# of double majors w/B.S. Chem & Biology	Estimated initial year		Estimated 3 <sup>rd</sup> year		Estimated 5 <sup>th</sup> year	
				# B.S. Biochem majors	# B.S. Biochem graduates	# B.S. Biochem majors	# B.S. Biochem graduates	# B.S. Biochem majors	# B.S. Biochem graduates
Fresh.	B.A.	60(61%)	0	40		50		60	
	B.S.	39(39%)	0						
Soph.	B.A.	32(68%)	1	16		25		30	
	B.S.	15(32%)	2						
Junior	B.A.	46(63%)	0	23		35		32	
	B.S.	27(37%)	2						
Senior	B.A.	41(53%)	4	5		23		35	
	B.S.	36(47%)	5						
	Total #	296 179 ~60% B.A. 117 ~40% B.S.		84	5	133	23	157	35

### 7. 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.

*Please see attached letter from Chair, Department of Chemistry, Dr. Saeed Attar.*

- a. 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.

The following faculty will teach in the proposed B.S. biochemistry program (alphabetical order):

- Saeed Attar, Professor, tenured, Ph.D., 1995, Chemistry (University of Nevada, Reno).
- Qiao-Hong Chen, Assistant Professor, tenure-track, Ph.D., 2001, Medicinal Chemistry (Sichuan University, China).
- Jai-Pil Choi, Associate Professor, tenured, Ph.D., 2003, Chemistry (University of Texas, Austin).

- Cory Brooks, Assistant Professor, tenure-track, Ph.D., 2009, Biochemistry and Microbiology (University of Victoria).
- Laurent Dejean, Assistant Professor, tenure-track, Ph.D., 2000, Biochemistry and Cell Biology (University of Bordeaux 2).
- David L. Frank, Professor, tenured, Ph.D., 1970, Organic Chemistry (University of Rochester).
- Joseph R. Gandler, Professor, tenured, Ph.D., 1978, Organic Chemistry (UC Santa Cruz).
- Melissa L. Golden, Associate Professor, tenured, Ph.D., 2004, Chemistry (Texas A&M).
- Joy J. Goto, Associate Professor, tenured, Ph.D., 1999, Chemistry and Biochemistry (UCLA).
- Andrea Gray, Lecturer, part-time, Ph.D., 2003, Biochemistry (Virginia Commonwealth University).
- Alam Hasson, Professor, tenured, Ph.D., 1998, Chemistry (Oxford University, UK).
- Viswanathan V. Krishnan, Professor, tenured, Ph.D., 1991, Physics (Indian Institute of Science, Bangalore).
- Santanu Maitra, Assistant Professor, tenure-track, Ph.D., 2000, Chemistry (University of Nevada, Reno).
- Barbara J. Mayer, Professor, tenured, Ph.D., 1981, Physical Organic Chemistry (Dartmouth College).
- Kin Ng, Professor, tenured, Ph.D., 1983, Chemistry (University of Cincinnati).
- Eric Person, Associate Professor, tenured, Ph.D., 2001, Biophysics (UCSF).
- Taha Rezai, Lecturer, part-time, Ph.D., 2007, Chemistry and Biochemistry (UC Santa Cruz)

We have the following staffing available: Tenured = 11 faculty; Tenure-track = 4 faculty; Full-time=15 tenured/tenure-track faculty; Part-time = 16 lecturers; Staff = 5

- Note: For all proposed graduate degree programs, there must be a minimum of five full-time faculty. *Not applicable.*
- Describe facilities that would be used in support of the proposed program. Existing classrooms on the University campus will be used to support the proposed program. Specific laboratory classrooms (e.g. Science I, room 351) will be used to teach the specialized biochemistry laboratory course (e.g. CHEM 156). Research laboratory space is located on campus and housed in the Science I building. All tenure-track and tenured chemistry faculty have research laboratory space.
- Provide evidence that the institution provides adequate access to both electronic and physical library and learning resources.

*Please see the attached letter of support from Carol Doyle, Sciences Librarian, Henry Madden Library, California State University, Fresno.*



- c. Describe available academic technology, equipment, and other specialized materials.

The following are all instruments located in the Department of Chemistry.

**Nuclear Magnetic Resonance:** NMRS 400MHz (Agilent-Varian) with Oxford magnet: Solution-state, VT with pre-cooling FTS, one-NMR multinuclear probe with PFG and broadband detection.

**Infrared Spectroscopy**

Nicolet Avatar FTIR with ATR Attachment

Nicolet Nexus 470 FTIR

**UV-Vis Spectroscopy & Fluorescence**

Perkin-Elmer LS50 spectrofluorimeter

Shimadzu UV-1800 Spectrometer

HP Diode Array Cary 50

**Gas Chromatography**

Agilent 7890/5975 Gas Chromatograph – Mass Spectrometer

Agilent 6890/5973 Gas Chromatograph – Mass Spectrometer

Varian 3800/Saturn 2100T Gas Chromatograph – Mass Spectrometer

Agilent 6890 Gas Chromatograph – Flame Ionization Detector

Agilent 6850 Gas Chromatograph – Flame Ionization Detector

**Liquid Chromatography**

Applied Biosystems API 2000 LC/MS/MS

Shimadzu LC10/RF-10 HPLC system with fluorescence detector

Agilent 1180 System

HP 1040/1050 Sytem

**Synthetic Equipment**

Rudolph Autopol III Polarimeter

Solvent Purifier

CEM (Discovery) Microwave Reactor

ISCO Autopurifier

Labconco Lyophilizer

Dry Boxes

**Atomic Spectroscopy**

PE Optima 2000DV ICP Atomic Emission Spectrometer

Buck Accusys 24

Atomic Absorption Spectrometer GBC 902

Atomic Absorption Spectrometer Pananalytical XRD and PERT

Magix Pro X-Ray Fluorescence

*Instruments available in the Department of Chemistry (continued)***Capillary Electrophoresis**

Two Applied Biosystems 310 Genetic Analyzers

Beckman Coulter P/ACE MDQ Capillary Electrophoresis Unit

**Biochemistry Equipment**

Tissue Culture Facility

Sorvall RC6 Centrifuge

**Electrochemical Equipment**

CHI660C and 440A potentiostats and spectroelectrochemical systems

Pine RRDE voltammetric system

**Other Major Equipment**

Infrared Analysis Smog Chamber (142 L long path cell with Hanst optics)

Tisch Environmental Hi-Vol PM2.5 and PUF samplers

Thermoelectron Model 42C NOx Analyzer and Model 49C Ozone Analyzer

Olympus BX45 microscope with CCD and Mideo Caseworks 2 Software

Olympus SZX7 stereo microscopes

**Computational Facility**

Two AMD Athlon 4 processor Linux computers

13 Node Linux Redhat high performance computing cluster (part of RIMI)

Gaussian03 (Ab initio quantum chemistry software), Amber 9.0 (Molecular dynamics software), Mestrelab Research (offline NMR data processing), CYANA (NMR structure calculations) and several other open source software for molecular dynamics and statistical applications.

Several Windows desktop computers for data analysis

## 7. 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.

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

The only budget impact during the first year of the program is the back-fill rate (\$5,000) for one lecturer to teach the course normally taught by the CHEM 112 instructor. Other resources are sufficient and available for the first year. As the program moves through its first cohort we can only estimate that an increase in new student enrollment into the program may result in an increase in the number of sections of upper-division biochemistry program courses (e.g. CHEM 110A, 112, 155A, 155B, 156), since all of these courses listed are only taught one semester of the academic year.

- b. 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.

Access to one lecture classroom will be required to accommodate the CHEM112 course. The use of this classroom will come from the availability of current lecture rooms available on campus. No new lecture classrooms are required for the program.

- c. 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.

*Please see the attached letter of support from Carol Doyle, Sciences Librarian, Henry Madden Library, California State University, Fresno.*

- d. 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. **Not applicable.**
- e. For self-support programs, please provide information on the per-unit cost to students and the total cost to complete the program. **Not applicable.**

The Chemistry Department is requesting approval of the BS Biochemistry as a new degree program. Several BizFlow processes are related to this request:

Principal Changes		
Process	Name	Description
4342	BS Biochemistry (new program proposal)	This process contains the primary justification, proposed catalog copy, documents for the chancellor's office, new program SOAP, and student advising information
4343	CHEM 112 (new course proposal)	The BS Biochemistry will use primarily existing course with this single new course required. Is it an adaptation of what is taught in CHEM 110B to better serve biochemistry students.
Minor Changes		
Process	Name	Description
4344	CHEM 110A (course change proposal)	A change in prerequisites to allow Physics 2AB in addition to Physics 4ABC and updating description to be accurate in listing separately from 110B.
4345	CHEM 155 (course change proposal)	Course number change from 155 to 155A to emphasize sequence of biochemistry courses.
4346	CHEM 153 (course change proposal)	Course number change from 153 to 155B to emphasize sequence of biochemistry courses.
4348	BA Chemistry (program change request)	Update listing of requirements including using new CHEM 155A and 155B course numbers.
4350	CHEM 110B (course change proposal)	Updating description to be accurate in listing separately from 110B.
Resulting Numbering Changes – See memo on process 4345		
	BS Chemistry	Update requirements and electives to new CHEM 155A and 155B course numbers.
	Chemistry Minor	Update electives to new CHEM 155A and 155B course numbers.
	BS Biology	Update additional requirements and advising notes from CHEM 155 to CHEM 155A.
	CHEM 156	A change in prerequisites from CHEM 155 to CHEM 155A
	CHEM 241A	A change in prerequisites from CHEM 155 to CHEM 155A
	CHEM 241B	A change in prerequisites from CHEM 155 to CHEM 155A
	CHEM 242	A change in prerequisites from CHEM 155 to CHEM 155A
	CHEM 245	A change in prerequisites from CHEM 155 to CHEM 155A
	BIOL 103	A change in prerequisites from CHEM 155 to CHEM 155A
	BIOL 150	A change in prerequisites from CHEM 155 to CHEM 155A
	BIOL 151	A change in prerequisites from CHEM 155 to CHEM 155A
	BIOL 157	A change in prerequisites from CHEM 155 to CHEM 155A
	BIOL 241A	A change in prerequisites from CHEM 155 to CHEM 155A
	BIOL 241B	A change in prerequisites from CHEM 155 to CHEM 155A
	BIOL 242	A change in prerequisites from CHEM 155 to CHEM 155A
	BIOL 245	A change in prerequisites from CHEM 155 to CHEM 155A

**Proposed Catalog Description:**

**Bachelor of Science in Biochemistry Degree Requirements**

The Bachelor of Science in Biochemistry is intended for students who plan to pursue a career in biochemical research, chemistry research, and suitable for student pursuing health professions (medical, pharmaceutical, dental, and other clinical and health professions). The B.S. program is a comprehensive, multi-disciplinary program to prepare students for graduate study in pursuit of a Master of Science (M.S.) or Doctor of Philosophy (Ph.D.) in areas related to biochemistry.

**Note:** Biochemistry majors may not take courses listed in category A or B for CR/NC grades.

**A. The B.S. Biochemistry Major requirements (50-54 units)**

*Core Program*

CHEM 1A, 1B, 102, 110A, 112, 128A, 128B, 129A, 129B, 155A, 155B, 156

Select two additional upper-division CHEM courses (4-7 units): CHEM 106, 106S, 111, 123, 124, or 190 or other approved courses.

Select two additional upper-division BIOL courses (6-7 units): BIOL 102, 103, 104, 120, or other approved courses.

**B. Additional requirements (25-28 units)**

BIOL 1A, 1B, 1BL

MATH 75, 76

PHYS 2A, 2B (or PHYS 4A, 4AL, 4B, 4BL, 4C strongly recommended)

**C. Remaining General Education requirements\* (42 units)**

**D. Free Elective Units (0-3 units)**

**Total (minimum 120 units)**

\*Of the 51 required General Education units, 9 units will be satisfied by the following courses in the major and additional requirements:

3 units of CHEM 1A or PHYS 2A or (PHYS 4A and 4AL) in G.E. Breadth B1;

3 units of BIOL 1A in G.E. Breadth B2;

3 units of MATH 75 in G.E. Foundation B4.

The following is an example of a four-year program for the B.S. in Biochemistry.

<b>First Semester – Fall</b>	<i>Units</i>
CHEM 1A	5
MATH 75	4
ENGL 5B or 10	3
<u>General Education</u>	<u>3</u>

15

<b>Second Semester – Spring</b>	<i>Units</i>
CHEM 1B	5
MATH 76	4
PHYS 2A	4
<u>General Education</u>	<u>3</u>
	16

<b>Third Semester – Fall</b>	<i>Units</i>
CHEM 128A	3
PHYS 2B	4
BIOL 1A	4
<u>General Education</u>	<u>3</u>
	14

<b>Fourth Semester – Spring</b>	<i>Units</i>
CHEM 128B	3
CHEM 129A	2
BIOL 1B, 1BL	5
<u>Electives or General Education</u>	<u>6</u>
	16

<b>Fifth Semester* – Fall</b>	<i>Units</i>
**CHEM 155A	3
CHEM 129B	2
CHEM 102	5
**CHEM 110A	3
<u>Electives or General Education</u>	<u>6</u>
	16

<b>Sixth Semester* – Spring</b>	<i>Units</i>
***CHEM 155B	3
***CHEM 156	3
***CHEM 112	3
<u>Electives or General Education</u>	<u>6</u>
	15

<b>Seventh Semester – Fall</b>	<i>Units</i>
<u>Electives or General Education</u>	<u>14</u>
	14

<b>Eighth Semester – Spring</b>	<i>Units</i>
<u>Electives or General Education</u>	<u>14</u>
	14

\*=It is important to fulfill the upper-division writing skills requirement by exam or W class during the junior year. \*\*=Offered fall semester only. \*\*\*=Offered spring semester only.

**Budget Analysis for proposed new Bachelor of Science in  
Biochemistry  
Department of  
Chemistry**

It is the charge of the University Budget Committee to provide an analysis of budgetary impact to the Academic Senate of those proposals submitted for Senate for approval. The University Budget Committee expects the initiating department/program to provide a reasoned estimate of those changes that will result from implementation of their proposal. The estimate is to be provided in the form of quantitative and narrative descriptions, so as to permit University Budget Committee analysis. The University Budget Committee also requires evidence that the proposal has received fiscal review at the College/School level. The University Budget Committee therefore requests that departments/programs use the following guidelines in providing the information required.

**1. Projected changes in enrollment  
(FTEs)**

- a) What is the recent enrollment history of the program and what effect will the proposed changes have on enrollment?

*Table of Department of Chemistry, Annual FTEs from Academic Years Fall 2005-Spring 2012*

Academic Year	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Annual FTEs	744	837	852	858	739	807	902

The proposed program will shift FTEs where most new B.S. Biochemistry majors will come from within our current program (B.A. Chemistry and B.S. Chemistry) students. The new FTEs generated will come from the only new course (CHEM112) in the program, however, this also means students will take one less other upper-division chemistry course, therefore resulting in a net zero change in FTEs during the initial year of the program.

There will be an increase in student enrollment during the 2<sup>nd</sup>-5<sup>th</sup> years of the new program, but our prediction is the student numbers will not dramatically increase and will match with the overall increase seen in FTEs within our existing program growth, which we have already seen over the last five years.

- b) If FTEs is expected to increase, what proportion represents new FTEs and what proportion represents shifts from existing programs?

The FTE for Chem 108 is 7.20, based on the fall 2012 semester enrollment. We estimate the change in FTEs for the new program during its first year, to be 7.20 shift based on the addition of only one new course (Chem 112). The rationale being students that are currently B.A. Chemistry majors taking Chem 108, may take CHEM 112 in spring 2015 to switch to the B.S. Biochemistry program. Therefore, the change in total program



FTEs is estimated as  $\{(902+7.20)/902\} \times 100 = 101\%$  or an increase of 1% in the total FTEs. In years two and on, the FTEs (estimated 7.20) would represent a shift where students normally taking CHEM 108, taking CHEM 110A instead, and then progressing to CHEM 112.

However, the new FTEs will also be counteracted by a shift of FTEs, where current students taking other classes within their major will now take the required CHEM112 as a part of their B.S. Biochemistry program. Therefore, the new FTEs are actually a shift in proportion to keep within the 120 units of our given majors. The year one FTEs will be a net zero change, with subsequent years following a modest increase with an increase in new majors.

c) How did you estimate your expected changes in enrollment?

Our expected changes in enrollment were estimated from student interest level informal surveys (see section 6D. Student Demand: Expected number of majors and graduates). Our total B.A. and B.S. Chemistry major enrollments have been steadily growing since 2005.

(2005=210 majors; 2006=260 majors; 2007=253 majors; 2008=248 majors; 2009=256 majors; 2010=270 majors; 2011=289 majors). This data was from the Fresno State Office of Institutional Research, Planning, and Assessment.

Our current 2012 enrollment of all classes (freshman, sophomore, junior and senior) is 296 majors (179 students ~60% B.A. Chemistry; 117 students ~40% B.S. Chemistry). We estimate an enrollment of ~84 new B.S. Biochemistry majors in the first year of the new degree offering. Our estimate is based on informal student interest surveys conducted between 2008-2013. We estimate ~50% of all students from our B.A. chemistry majors (see section 6D. Student Demand: Expected number of majors and graduates) will shift and change majors to B.S. Biochemistry once the new program is approved. We do not expect the first year of the new program to have a significant increase in enrollment, but represents a shift in our current B.A./B.S. Chemistry program undergraduates.

We also predict a shift in enrollment between students in the B.S. Biology, and especially the ~10-15 students who are currently double majors (B.A. or B.S. Chemistry and B.S. Biology). An advantage to the new B.S. Biochemistry major is a total reduction of units required for those students currently enrolled as double majors. This will also increase the rate at which these double majors are able to graduate, where they can now be strictly B.S. Biochemistry majors without the extra years in the programs and the excess units.

Overall, we predict a modest 10% growth in student enrollment, drawing from current students in the program, and the potential for freshmen to choose to stay in the Central Valley to earn a B.S. Biochemistry degree; we will be the only 4-year university in the Central Valley to offer this degree program. We will expect an influx of new freshman and transfer majors during the 2<sup>nd</sup>-5<sup>th</sup> years of the new program. We expect to draw most of our new students from the local region.

## 2. Projected changes in existing curriculum

- a) Will there be changes in the cost of delivering the curriculum? What will those costs be and what is their basis?

The cost of a new course in the program is \$5,000 assuming back-fill or lecturer rates to cover the instruction of the lower-division course, the instructor for CHEM112 normally would have taught. This is the estimated cost for a 3 WTU course taught once a year. The only new course proposed is Chem 112 (Biophysical Chemistry) and the qualified and needed faculty are already available within our Department (Tenured = 11 faculty; Tenure-track = 4 faculty; Full-time=15 tenured/tenure-track faculty; Part-time = 16 lecturers; Staff = 5)

- b) For new courses, what is the estimated class size, frequency, and level/classification ("S" or "C" classification) of course delivery? Please be specific.

We plan to offer Chem 112 (C04 classification) during the spring semester, beginning spring 2015, since it is the second semester, required physical chemistry course in the two-semester physical chemistry requirement for the for B.S. Biochemistry degree. Chem 108 (Introductory Physical Chemistry; 4 units is offered fall-semester only) is the pre-requisite course for Chem 112. Chem 110A (Physical Chemistry) for B.S. Chemistry majors will also be accepted in lieu of Chem 108 as a pre-requisite for those students transferring from the B.S. Chemistry to B.S. Biochemistry degree.

Estimate class size = 20 students during the first offering in spring 2015. This estimate was made from the average class sizes of the CHEM 108 and CHEM 110A courses.

- c) For courses currently being offered, will there be changes in class size, frequency, level or classification of course delivery?

There are no current plans to change the class size, frequency, level, or classification of courses. The Chemistry Department may decide to revisit the frequency of class offerings depending on the demand of the B.S. Biochemistry degree and the number of students interested in the major. We will closely follow the enrollment of students into the program and the demands on the major required courses to determine if the frequency and number of course sections need to be adjusted.

- d) Will courses be dropped from the existing curriculum? Please list specific courses.

There are no plans to drop any existing courses from the current curriculum.

### 3. Projected changes in faculty

- a) Will there be a shift in faculty assignments? If so, what will be the difference between current and proposed assignments?

The only change in faculty assignment will come from offering the new Chem 112 course as a major requirement for the B.S. Biochemistry. Dr. Krish Krishnan, tenured Professor will teach the first offering of Chem 112 in the spring 2015 semester. Other full-time tenured and tenure-track faculty in physical chemistry (Dr. Hasson) or biochemistry (Drs. Brooks, Dejean, and Goto) may opt to teach or co-teach this course after spring 2015, depending on course-loads and assigned time.

- b) Will there be shifts in faculty numbers or distribution (T/TT vs FT/PT)? If so, what will they be?

There will be no shift in faculty number or distributions to initiate the program.

- c) Will new positions be added/required and what resources will be used to acquire them?

New positions are not required at this time. With 15 full-time tenured or tenure-track faculty and 16 part-time lecturers we have the staffing to fully support all courses and teaching required for the new program.

### 4. Projected changes in budget

- a) What is your current operating budget? \$95,000
- b) What are your current positions (T, TT, FT, PT, staff)?  
Tenured = 11 faculty; Tenure-track = 4 faculty; Full-time=15 tenured/tenure-track faculty;  
Part-time = 16 lecturers; Staff = 5

### 5. Budgetary impact over time

- a) What are the projections for 1, 3 and 4 above as the program moves through its first cohort and sufficient courses and resources are brought online to satisfy the graduating cohort and all new cohorts at that time?

The only budget impact during the first year of the program is the back-fill rate (\$5,000) for one lecturer to teach the course normally taught by the CHEM 112 instructor. Other resources are sufficient and available for the first year. As the program moves through its first cohort we can only estimate that an increase in new student enrollment into the program may result in an increase in the number of sections of upper-division biochemistry program courses (e.g. CHEM 110A, 112, 155A, 155B, 156), since all of these courses listed are only taught one semester of the academic year.

- b) What are the plans for a systematic budgetary review of the program at the end of the transitional period (toward full implementation when all cohorts are in place)?

Budget review will occur after each year after program implementation. If the number of students increases throughout the full implementation, class sizes will increase, and the number of sections and frequency of those sections will be evaluated each year.

### 6. Do you anticipate outside revenue to support your program (state funds, grants/contracts, endowments, etc.)?

- a) Will budget requirements change and what will those changes be (e.g. in operating budget, facilities, equipment, technical support, staff, etc.)? Please specify.

There are no new budget requirements for implementation of the new program.

- b) Will there be any increase in administrative roles/responsibilities that require buy-back or release time? None at this time.
- c) How will the expected changes in budget requirements be met? n/a
- d) Has the budgetary impact of the proposal been reviewed by the College/School Budget Committee and Office of the Dean?

*In the process of review by the Office of the Dean.*

**7. Effect on Support Services and programs in other Colleges/Schools**

- Are support services (e.g. Academic Innovation Center) required for program implementation and function?

No, there are no supplementary support services required for the program implementation or function.

- Are library services impacted? (e.g., the requirement for new publication subscriptions, databases? or other services essential for program viability or accreditation?) Has the budgetary impact of the proposal been reviewed and accepted by the Dean of the Library?

There are no major impacts on library services.

A memo from the Dean Peter McDonald of the Library is being prepared.  
Please see attached memo from Carol Doyle, Sciences Librarian.

- Are programs in other Colleges/Schools directly affected by the proposal and in what way?

The new program should not have an effect on other programs. The new program has been discussed with the Department of Biology, Chair (Dr. Alejandro Calderon) to make him and the department aware of the curriculum for the B.S. Biochemistry program. The new biochemistry program may draw B.S. Biology to switch majors and surely draw the double majors (biology and chemistry) to choose the B.S. Biochemistry program in the Chemistry Department.

- Who are the representatives in the affected service areas and/or Schools/Colleges that have been contacted?

Dr. Alejandro Calderon-Urrea (Professor, Chair, Department of Biology) has been contacted and informed of the curriculum of the proposed B.S. Biochemistry program. He will include a letter of support and confirmation the proposed new program has been discussed and introduced to the faculty in the Biology Department.

# FRESNO STATE

College of Science and Mathematics

September 4, 2013

To Whom It May Concern:

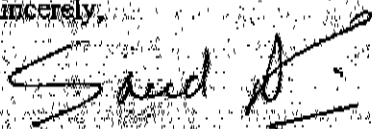
This is to certify that my colleague, Dr. Joy Goto, and I had a meeting today to discuss the needs and requirements of the proposed B.S. Biochemistry degree in terms of faculty, facilities, library support, and available technology and instrumentation. I fully support this new degree proposal since it is built upon a very successful Bachelor of Arts (B.A.) Chemistry degree that has been in existence in our department for the past 20 years. As such, this new degree proposal does not require new or additional resources for it to start. The main advantages of this new degree are as follows:

(a) conversion of a B.A. to a B.S. degree, viewed as more valuable to the majority of our students who wish to continue their education beyond the bachelor's degree.

(b) the possibility of obtaining the certification of the American Chemical Society (ACS) for the new degree, making the degree more visible and valuable from the perspective of potential employers of our graduates.

In conclusion, I fully support this new degree program and am excited to contribute to its success along with my colleagues in this department. Please do not hesitate to contact me if I can be of any further assistance in this regard.

Sincerely,



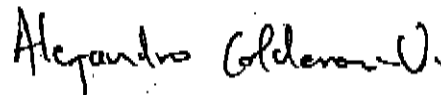
Saeed Attar, Ph.D.  
Professor & Chair  
Department of Chemistry  
Direct phone: (559) 278-5239  
Email: saattar@csufresno.edu

October 1, 2013

**MEMORANDUM**

**TO:** To Whom It May Concern

**FROM:** Dr. Alejandro Calderón-Urrea  
Chair, Department of Biology



**SUBJECT:** Bachelor of Science in Biochemistry proposal

After review of the Bachelor of Science in Biochemistry proposal by me and the Curriculum committee of the Department of Biology, submitted to us by Dr. Joy Goto from the Department of Chemistry on September 19, 2013, we have concluded that the impact to our B.S. in Biology program may be minimal. We also have the following observation.

The proposal indicates on page 4: "The Bachelor of Science in Biochemistry is intended for students who plan to pursue a career in biochemical research, chemistry research, and suitable for student pursuing health professions (medical, pharmaceutical, dental, and other clinical and health professions)". We understand that "suitable" means that it is not primarily designed for student pursuing health professions but if interested they can take this program. In the case of pre-med students, although strictly speaking they only need one year of biology, they are recommended to take genetics and cell biology (which the program recommends as electives). We feel that it is very beneficial to students when a Biochemistry degree requires or recommends taking genetics and cell biology.

Overall, we support the implementation of the new program as it will add further to the cross-disciplinary connection we share in our teaching and research with the faculty and students in both the Department of Biology and our colleagues in the Department of Chemistry.

September 5, 2013

To: Dr. Joy Goto  
Department of Chemistry

From: Carol Doyle   
Sciences Librarian

Subject: Library Support for a Bachelor of Science in Biochemistry

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). *The library should provide a report on the resources currently available to support the program. This might include counts and holdings of hard copies of books and periodicals and also a listing of the appropriate data bases and online resources that are held by the library to support the program.*

The Madden Library has a collections budget around 1.5 million dollars and holds over a million titles in print or electronic formats. The Library's collections and services currently support the existing undergraduate degree program in chemistry as well as the Master's of Science programs in chemistry, biology, biotechnology, and in the agricultural and health sciences. The same resources would support the curricular needs of a Bachelors of Science in Biochemistry.

#### Key Databases

The Library provides online access to Scifinder, the major chemistry literature and substance database, as well as to other supporting indexing databases such as

Web of Science

Medline and

Biological Abstracts.

It also provides a connection to the PubMed database which inserts the FindIt@FresnoState icon into PubMed search results, connecting our users back into our subscription resources.

#### Journals

The Madden Library also makes available the American Chemical Society's online journal collection, including their legacy collection.

Other online journal packages supporting chemistry/biochemistry include:

ScienceDirect (Elsevier)

SpringerLink Online, and

Wiley Interscience

Specific journal titles available in the Madden Library collections or online through Madden Library or CSU licenses can be found at <http://sfx.calstate.edu:9003/fresno/az>

The Category Search of journal titles on that page identifies:

1817 chemistry-related journal titles, including

575 in the biochemistry subcategory

#### Library Catalog

We ran a count from the library catalog of books and journals, both tangible and online, in selected Library of Congress (LC) classification number ranges most likely to be of interest to the program. Please note that the library has additional resources of potential use that are classified in more general or in related subject areas.

<u>LC Classification Range</u>	<u>Volumes</u>
Chemistry (QD1-999)	16,270
Other Chemistry (S583-587, RS400-432)	384
<u>Other Biochemistry (QH345; OK861-899; QP501-801)</u>	<u>5,492</u>
TOTAL VOLUMES	22,146

We are increasingly selecting material for which we can provide online access. These ebooks and our online journal subscriptions are accessible off-campus via proxy authentication and can be accessed both through our library catalog and the database list. We acquire or license ebooks individually or in packages. One such ebook package is the *Ebrary Academic Complete* ebook collection which currently has 616 titles classed in the QDs (Chemistry).

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.

No major gap in resources required to support a BS in Biochemistry has been identified. While we continue to purchase books and other resources (such as ChemDraw), new journal subscriptions usually fall outside of our budgetary means. However, to expand the resources available to the campus, the library participates in a variety of resource sharing initiatives including our Interlibrary Loan services. The Fresno State librarians are committed to working with Chemistry faculty and students to identify and make accessible resources and services to support their curricular and research needs via our own purchases or in partnership with other libraries.



## Student Outcomes Assessment Plan (SOAP)

## I. Mission Statement

The mission of the Department of Chemistry is to provide students with the appropriate level of modern and comprehensive chemical education required for life and work in our technologically advanced society. To accomplish this the department offers courses for students planning to be professional chemists, for students planning careers in the medical professions and careers in teaching, for students requiring a basic chemical science background for other majors, and for students fulfilling their general education science requirements.

The Bachelor of Science in Biochemistry is intended for students who plan to pursue a career in biochemical or chemical research, graduate study in biochemistry, or professional education in clinical health professions (e.g. medical, pharmaceutical, or dental).

## II. Goals and Student Learning Outcomes

The Department of Chemistry's expectations for student learning are based on the accreditation standards outlined for undergraduate programs in chemistry by the American Chemical Society (ACS) and their curriculum requirements. Each outcome is listed below with details of how they fit into curriculum and the types of activities that may show evidence of student progress in these areas. The goals of the program in Biochemistry are to prepare undergraduate students with the relevant and applicable **knowledge** in the core chemistry and biochemistry areas (i.e. general, analytical, biochemistry, organic, and physical); the **critical thinking skills** and the **technical laboratory skills** in preparation to **contribute to society** and work in the health professions (e.g. medical, pharmaceutical, dental, osteopathy, ophthalmology, and other health-related professions), as skilled biochemists and science researchers, or for entry into graduate degree programs (M.S. or Ph.D.).

- SLO1 Students will apply their understanding of chemical and biochemical terminology, concepts, theories, and skills to solve problems and evaluate the significance of data.
- SLO2 Students will apply their understanding of chemical and biochemical terminology, concepts, theories, and skills to conduct experimental laboratory work of high quality.
- SLO3 Students will identify, find, and use chemical and biochemical information from reference materials and the peer-reviewed literature.
- SLO4 Students will clearly, effectively, and professionally communicate their scientific opinions, understanding and results in common written and oral formats.
- SLO5 Students will function effectively in collaborative and group work environments in lecture, study, and laboratory settings. This often includes the ability to work on a component of a larger project and connect their work with the results and work of other students and reports in the peer-reviewed literature.

### III: Curriculum Map (Matrix of Courses X Learning Outcomes)

#### BS Biochemistry Program Curriculum Map

This table provides information regarding how the outlined student learning outcomes are introduced (I), developed (D), and mastered (M) as students progress through the curriculum.

SLO	IAIec	IAIab	IBIec	IBIab	128A	128B	129A	129B	102	110A	112	155A	155B	156
1	I	I	D	D	D	D	D	D	D	D	D	D	M	M
2		I		D			D	D	D					M
3	I	I	I	I	I	I	I	D	D	D	M	D	M	M
4				I			I	D	D					M
5		I		I			D	D	D			D	M	M

### IV: Assessment Methods

#### Direct Measures

The majority of assessment measures for the BS Biochemistry program take place during the CHEM 156 Biochemical Laboratory Techniques. This course and its independent research project serves as a capstone experience for students in this program.

- A. Biochemistry Exam (SLO1) – This exam will consist of validated multiple choice questions taken from biochemistry test banks. It will be administered to students in CHEM 155B near the end of the course. It is expected that students passing the course will score above 50% correct responses on the exam.
- B. Laboratory Work, Notebook, and Data Review (SLO2, SLO5)- Students will be scored on writing a protocol for describing the steps, reagents, conditions and use of instrumentation for a procedure conducted during CHEM 156 laboratory. A rubric will be used to score the work. It is expected that students passing the course will score above 70% on the assignment. The rubric is calibrated by all biochemistry faculty evaluating ~3-5 works on the protocol assignment, comparing the scores anytime the assignment or rubrics are updated.

- C. Final Group Written Report Rubric (SLO1, SLO3, SLO4) – Students will write a group report on a culminating independent experiment conducted during CHEM156. Student reports will be scored on the ability to accurately report data as compared to notebook data, including a thorough materials and methods section, and including content, integration and critical analysis of their own work in the context of other groups' results. A rubric will be used to score the work. It is expected that students passing the course will score above 70% on the assignment. The rubric is calibrated by all biochemistry faculty evaluating ~3-5 works on the protocol assignment, comparing the scores anytime the assignment or rubrics are updated.
- D. Oral Presentation Rubric (SLO1, SLO3, SLO4) – A 15 minute oral presentation is given at the end of CHEM 156. The student's presentation will be scored using the attached oral presentation rubric. The rubric is calibrated by all biochemistry faculty evaluating 3-5 presentations and comparing scores any time instructional faculty, the assignment, or the rubric are updated. It is expected that 70% of students passing the class will have scores of 21 or above.

#### Indirect Measures

- E. Alumni and Employer Feedback – At least once every five years the department will conduct surveys or focus groups with alumni and their employers using either surveys or focus groups. These mechanisms will allow the department to reevaluate the target student outcomes to match changing needs in the chemistry community.
- F. Graduating Students Feedback – The department will ask for feedback from graduating students using surveys or focus groups to evaluate their perception of whether the degree has adequately prepared them for their chosen career. This may include job placement and graduate/professional school admission rates.
- G. Existing Student Feedback – At least once every five years, the department will hold a focus group with existing biochemistry majors. This will provide an opportunity to identify emerging problems quickly before they show up in tracked data.
- H. Faculty Feedback – The department will periodically collect feedback from permanent and temporary faculty and instructors on their perceptions of student strengths and weaknesses.

#### V. Student Learning Outcomes X Assessment Methods Matrix

This table provides information regarding how the outlined student learning outcomes will be assessed.

	Direct Measures	Indirect Measures
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	A – Biochemistry Exam	B – Laboratory Work	C – Written Report	D – Oral Presentation	E – Alumni and Employer	F – Graduating Students	G – Current Students	H – Faculty
1	X		X		X	X	X	X
2		X			X	X	X	X
3			X		X	X	X	X
4			X	X	X	X	X	X
5		X	X		X	X	X	X

## **VI. Timeline for Implementation of Assessment Methods and Summary Evaluations**

The assessment timeline is based on the department's external program review cycle, repeating each five to seven years beginning with the year following the completion of the department's self-study.

Data for all direct measures will be collected on an annual basis and stored for future review by the assessment committee. Surveys or focus groups with graduating students will be conducted annually and the data will be stored for future review by the assessment committee. The following timeline outlines the schedule for review of that data by the department assessment committee.

### **First Year (AY 2015-2016)**

- Review of SLO1 – Problem Solving & Data Interpretation using data from methods A,C,F
- Faculty Discussion of Student Outcomes (Method H)

### **Second Year (AY 2016-2017)**

- Review of SLO2 – Laboratory Work using data from methods B,F
- Current Student Survey / Focus Group (Method G)
- Faculty Discussion of Student Outcomes (Method H)

### **Third Year (AY 2017-2018)**

- Review of SLO3 – Literature Skills using data from methods C,F
- Alumni & Employer Survey / Focus Groups (Method E)
- Faculty Discussion of Student Outcomes (Method H)

### **Fourth Year (AY 2018-2019)**

- Review of SLO4 – Communication Skills using data from methods C,D,F
- Current Student Survey / Focus Groups (Method G)
- Faculty Discussion of Student Outcomes (Method H)

### **Fifth Year (AY 2019-2020)**

- Review of SLO5 – Group Work using data from methods B,C,F
- Faculty Discussion of Student Outcomes (Method H)

#### VII. Process for Closing the Loop

The Chemistry Department Assessment Committee will be responsible for collecting and summarizing assessment data each semester. Assessment results will be reported at regular department meetings. Near the end of each spring semester, a department meeting will be dedicated to reviewing assessment results, determining what changes, if any, the results suggest, and adjusting the next year's assessment activities as needed. The minutes of this meeting will provide the basis for the department chair's annual report on assessment activities.

#### VIII. Appendix and Supporting Documents

- A – Exam Evaluation Rubric
- B – Laboratory Work Evaluation Rubric
- C – Written Report Rubric
- D – Presentation Rubric (Sample included)
- E – Alumni and Employer Questions
- F – Gradating Student Questions
- G – Current Student Questions

## Oral Presentation Rubric (sample)

### Scoring:

**0-7: Does not meet expectatons**

**8-21: Meets the expectations**

**22-35: Exceeds expectations**

**Student Presenter's Name:** \_\_\_\_\_ **Date:** \_\_\_\_\_ **Time Started:** \_\_\_\_\_ **Ended:** \_\_\_\_\_

### 1. Content

#### 1A. Introduction

*Excellent (5 pt.):* The opening captivates the audience with interest and/or intrigue. It lays the foundation for the audience to understand the significance and purpose of what follows.

*Good (4 pt.):* Interesting opening; engages audience.

*Average (3 pt.):* Opening is minimally engaging.

*Poor (1 pt.):* Opening is not engaging at all.

**Student Score:** \_\_\_\_\_

Written Comments by Evaluator: \_\_\_\_\_

#### 1B. Statement of Purpose

*Excellent (5 pt.):* The purpose of presentation is clear. Supporting ideas maintain exceptional focus on the topic.

*Good (4 pt.):* Topic of the presentation is clear. Content consistently supports the purpose.

*Average (3 pt.):* Presentation lacks clear direction.

*Poor (1 pt.):* No clear focus.

**Student Score:** \_\_\_\_\_

Written Comments by Evaluator: \_\_\_\_\_

#### 1C. Organization of Material

*Excellent (5 pt.):* Information/ideas are presented in a consistently logical sequence. Transition/connections are eloquent. A strong sense of wholeness is conveyed. The "Conclusions" section leaves the audience with a strong sense of closure.

*Good (4 pt.):* Important ideas and information are identified for the audience. Information/ideas are presented in a logical sequence with few lapses. Transitions and connections are made. Closing effectively summarizes the presentation.

*Average (3 pt.):* Irrelevant, unnecessary information detracts. Big ideas are not specifically identified. There are significant lapses in the order of ideas. Transitions are inconsistent and weak or missing. Closing demonstrates an attempt to summarize.

*Poor (1 pt.):* No clear organization. Ideas do not connect with one another. There are no clear transitions. No closing is evident.

**Student Score:** \_\_\_\_\_

Written Comments by Evaluator: \_\_\_\_\_

#### 1D. Literature Review & Citation

*Excellent (5 pt.):* Literature review is from appropriate scientific journals, covers the topic in depth, and demonstrates the ability to extract the salient features of the articles.

*Good (4 pt.):* Literature review is from appropriate scientific journals but gives a shallow survey of the literature.

*Average (3 pt.):* Literature review is from appropriate scientific journals but very few articles are presented.

*Poor (1 pt.):* No scientific journals have been surveyed, only an internet search of popular magazines and sites.

Student Score: \_\_\_\_\_

Written Comments by Evaluator: \_\_\_\_\_

## 2. Oral Presentation

### 2A. Speaking Ability

- Excellent (5 pt.):* Commands audience politely using eye contact, making sure audience is ready. Can be heard by all members of audience without assistance. Uses visual aid as guide or outline for speaking. Consistently maintains eye contact. Notes are either not used or used at a minimum. An appropriate pace (not too fast and not too slow) is kept throughout the presentation.
- Good (4 pt.):* Makes sure audience is ready before starting. May need reminders from audience to speak up; generally consistent, maintains eye contact, minimizes reliance on notes.
- Average (3 pt.):* Makes occasional eye contact, makes few attempts to command audience; may start speaking before audience is ready. Needs reminders from audience to speak up. Mostly reads from notes (or PowerPoint slides).
- Poor (1 pt.):* Audience hears with great difficulty. Reads from notes (or PowerPoint slides) and seldom establishes eye contact.

Student Score: \_\_\_\_\_

Written Comments by Evaluator: \_\_\_\_\_

### 2B. Visual Aids

- Excellent (5 pt.):* Visual aids are readable and attractive from all parts of the room. Graphic is clear and professional looking, enhancing the message. Citation are clearly given for the material taken out of scientific literature.
- Good (4 pt.):* Visual aid readable from all parts of the room. Graphic is neat. Appropriate graphics are chosen to depict the message.
- Average (3 pt.):* Visual aid is not completely accessible to all audience members. Graphic may be messy. Visual may not be most appropriate to support presentation.
- Poor (1 pt.):* Visual aid undecipherable. Graphic detracts from message. Messy or inappropriate visuals.

Student Score: \_\_\_\_\_

Written Comments by Evaluator: \_\_\_\_\_

### 2C. Question & Answer Session

- Excellent (5 pt.):* Speaker understands the specific question asked and responds to it concisely. Expands upon previous statements. Cites additional examples to answer a question. Conveys a thorough knowledge of subject.
- Good (4 pt.):* Thoughtful, concise response. Conveys reasonable knowledge of subject.
- Average (3 pt.):* Response not clear or did not add to comprehension of the listener.
- Poor (1 pt.):* Could not answer questions or answers are irrelevant.

Student Score: \_\_\_\_\_

Written Comments by Evaluating Faculty: \_\_\_\_\_