PROPOSAL FOR A

BACHELOR OF ARTS DEGREE IN BIOCHEMISTRY

AND

BACHELOR OF SCIENCE DEGREE IN BIOCHEMISTRY

IN THE

DEPARTMENT OF CHEMISTRY
COLLEGE OF NATURAL SCIENCES
UNIVERSITY OF HAWAI'I AT MANOA

Locus (Unit School/College):	College of Natural Sciences
Chair/Conveners of Planning Committee:	Kristin Kumashiro and Joseph Jarrett
Program Category:	New
Department Unit/Program:	Chemistry
Level of Program:	Undergraduate
Degree and Certificates Proposed:	Bachelor of Arts in Biochemistry Bachelor of Science in Biochemistry
Proposed Date of Implementation:	Academic Year 2012 – 2013

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1. Program Objectives and Learning Outcomes

A. Program Objectives.

The objective of the proposed program in Biochemistry is to prepare students for future careers in the various fields in which a core understanding of the chemistry of biological processes is important. Examples include scientific disciplines such as biochemistry and chemistry, medicinal chemistry, biomedical sciences, biotechnology, and environmental sciences, as well as the various health disciplines such as medicine, dentistry, pharmacy, and veterinary medicine. The Biochemistry Program will serve the State of Hawaii by adding to the highly skilled scientific workforce, particularly for the nascent biotechnology and biomedical research sectors, as well as for laboratory research programs at the John A. Burns School of Medicine and the Cancer Center of Hawaii. The Biochemistry Program will also serve as a source of highly qualified applicants for the UHM School of Medicine, the UHH School of Pharmacy, and the various UH graduate programs in biology, biotechnology, and the biomedical sciences.

B. Learning Objectives.

The educational objective of the Biochemistry Program is to impart an understanding of how to apply fundamental chemical principles to the study of biological systems. The objectives can be divided into a set of desirable cognitive outcomes and a set of important experimental skills.

i. Cognitive Learning Objectives

1. Students will become well grounded in laws and theories of chemistry, including how to use quantitative measurements and spectroscopy to analyze molecular structure.
2. Students will demonstrate an understanding of the fundamental principles of biochemistry, including structural and mechanistic understanding of the major pathways of metabolism, biosynthesis, replication, transcription, and translation.
3. Students will demonstrate a qualitative and quantitative understanding of biomolecular structure and reactivity, and the manner by which enzymes can catalyze chemical reactions that transform biomolecules.
4. Students will develop the ability to use the scientific method to ask meaningful questions, to design experiments to address these questions, to acquire and critically analyze the data, to draw appropriate conclusions, and to communicate the results and conclusions in both written and oral format.
5. Students will learn how to use the biochemical literature and databases to obtain relevant published information.

ii. Skills-Based Learning Objectives

1. Students will be able to prepare solutions, buffers, and standards, to use appropriate instrumentation to make accurate measurements, and to statistically analyze the data.
2. Students will be able to use modern instrumentation and computational tools to record data pertaining to the structure of molecules, to interpret the data using

appropriate mathematical models and statistical analysis, and to propose structures consistent with the data.

3. Students will be able to grow microorganisms in order to purify, characterize, and manipulate small biomolecules, proteins, and DNA.
4. Students will be able to use modern instrumentation to monitor biochemical reactions catalyzed by enzymes and to analyze the resulting data to extract meaningful thermodynamic and kinetic information.

2. Appropriateness of the Program for the College, University, and State

A. Relationship to State, University and Campus mission and development plans.

The State of Hawai'i has placed considerable recent emphasis on developing an infrastructure that can support high technology industries. In 2007, then Governor Lingle began the Hawai'i Innovation Initiative, which has a stated goal of "...providing Hawai'i students with world-class analytical and problem-solving skills developed through science, technology, engineering and math (STEM) education." The Abercrombie administration has reiterated the importance of "... a conscious effort by government ... to establish digital media, information technology, nanotechnology, ocean sciences, biotechnology, aerospace, astronomy, and other innovation fields. These industries bring dollars into Hawai'i, often have minimal impacts on our environment, enhance the quality of education, lead our drive toward self-sufficiency, and create high paying jobs for our local families." The establishment of an undergraduate Biochemistry Program will help to support these goals by providing a young, motivated, and highly educated workforce for the growing STEM-based economy.

The University of Hawai'i at Manoa is the flagship campus of the University of Hawai'i system and is ranked by the Carnegie Foundation as the only top-tier research university in the State of Hawai'i. One of the stated goals of the current UH Manoa Chancellor is to establish Manoa as "a leading, global research university that meets society's needs around the world." The 2010 UH Manoa strategic plan defines as strategic goals that we should "expand and create transdisciplinary opportunities and programs" and "increase student appreciation for research and all types of scholarly activities, and emphasize that they are an integral part of teaching and learning." The proposed Biochemistry Program will be hosted within the Department of Chemistry at UH Manoa, but will provide a "transdisciplinary" education through both required and elective upper-level courses that will include educational contributions from the Departments of Biology, Microbiology, and Molecular Biosciences and Bioengineering. Students pursuing a B.S. in Biochemistry degree will be encouraged to integrate research and education through a required Advanced Biochemistry Laboratory course that will teach modern techniques used in biochemical research, and will also be encouraged to participate in faculty-directed laboratory research projects through enrollment in Undergraduate Directed Research (CHEM 399), or through an equivalent course in another department.

B. Uniqueness of a Biochemistry Program within the UH System

An undergraduate degree in biochemistry has never been offered within the UH system.

The Department of Anatomy, Biochemistry, and Physiology within the John A. Burns School of Medicine was created by a merger involving a previous free standing Department of Biochemistry. Faculty in the current combined department participate in the Interdisciplinary Program in Cell and Molecular Biology and offer only graduate degrees: M.S. and Ph.D. in Cell and Molecular Biology. The former Department of Biochemistry has never offered an undergraduate degree.

Departments that offer instruction and degree programs in various aspects of biology exist both at UH Manoa and at UH Hilo, including Biology, Microbiology, Botany, and Molecular Biosciences and Bioengineering. Each of these programs has a unique focus and emphasis that differs significantly from the proposed biochemistry program. None of these departments has ever offered or even proposed to offer a degree in biochemistry. The Chairs of several of these departments have offered their support and have confirmed that there is little overlap in educational objectives.

C. Survey of Programs at Peer and Benchmark Institutions

We conducted a brief email survey of schools that UH Manoa cites as "Peer Institutions" and "Benchmark Institutions" in Spring 2008.

Among Benchmark Institutions, all 18 schools offer an undergraduate degree in Biochemistry, and that degree is administered through the Chemistry Department at 5 of 18 schools, while 12 of 18 schools had separate Biochemistry or Biochemistry & Molecular Biology Departments.

Among Peer Institutions, 23 out of 27 schools offer an undergraduate degree in Biochemistry, and that degree is administered through the Chemistry Department at 5 of 27 schools. Again, 17 of 27 schools had separate Biochemistry or Biochemistry & Molecular Biology Departments.

A recent survey of all United States PhD-granting research universities conducted by the American Chemical Society found that 65% of Chemistry Departments have a Biochemistry division within the department. Within most chemistry departments, divisions often exist for purposes of fairly distributing faculty teaching loads and graduate student admissions across several subdisciplines. At the undergraduate level, these departments are approximately evenly split between those that offer a "Bachelors Degree in Biochemistry" and those that offer a "Bachelors Degree in Chemistry with emphasis in Biochemistry."

D. Justification for Administering through the Department of Chemistry

Biochemistry, as a field distinct from other areas of Biology, relies on the application of chemical principles to the understanding of biological processes. The knowledge base for a well-trained biochemist is fundamentally the same as for a chemist. We have therefore developed a preliminary curriculum proposal that is modified from the existing curriculum for the Chemistry degree. Administration through the Department of Chemistry would allow our department to more easily track the progress of these students and to assess the effectiveness of the program in training students and placing them in careers or in graduate or medical school.

The introduction of an undergraduate degree in Biochemistry is part of the long-term strategic plan of the Department of Chemistry. The Chemistry faculty have collectively developed a long-term plan of hiring additional faculty that would form a Biochemistry Division within the department. The department would eventually be renamed as the Department of Chemistry and Biochemistry. Faculty in the Biochemistry Division would teach upper-level classes associated with the new degree program, and would run research laboratories that educate undergraduate and graduate students in the techniques of biochemical research.

E. Student Interest

To gauge student interest in the new degree program, we undertook a brief survey of students in General Chemistry II (CHEM 162, mostly Freshmen) and Organic Chemistry II (CHEM 273, mostly Sophomores) in the Spring 2008 semester during the last week of class.

Students were asked the following:

1. *If a BS in Biochemistry degree had been available when you started at UH Manoa, would that be your undergraduate major?*
2. *What is your current or projected undergraduate major?*

Students in CHEM 273 are generally either preparing for a health-related discipline (*i.e.* pre-Medicine or pre-Pharmacy), or are Chemistry or Biology majors interested in scientific careers. Among 99 respondents, **39 students (39 %)** agreed that they would have chosen Biochemistry as their undergraduate degree. These interested students are partly drawn from current Chemistry (9) and Biology (18) majors.

Students in CHEM 162 include all students interested in science, engineering, or health-related careers. Among 118 total respondents, **28 students (23 %)** agreed that they would have chosen Biochemistry as their undergraduate degree. Some of these interested students are drawn from current Biology, Botany, or Zoology majors (16), although others describe themselves as undecided (6). Those students that describe their majors as engineering, mathematics, or physics showed little interest in the Biochemistry degree.

These surveys fail to account for students who choose to attend mainland colleges and universities when they find that UH does not offer a biochemistry degree. The number of these students is difficult to estimate. However, anecdotal evidence has been obtained through discussions with a few students who have returned to UH in the summer to participate in research in the Department of Chemistry. Ms. Elaine Ngo of Honolulu transferred from UH Manoa to the University of Notre Dame in 2007, after her Freshman year, when she discovered that there was no biochemistry degree available at UH. She graduated from Notre Dame in 2010 and has since been admitted to a PhD program in Chemistry and Biochemistry. Ms. Lindsey Ross of Kailua enrolled at Williamette University in Oregon in 2008 despite being accepted at UH Manoa, in part due to the lack of a Biochemistry Program at UHM. Presumably there are several talented students each year that make similar choices.

3. Organization of the Program

A. Program Course Requirements

Students must fulfill all UH Manoa General Education requirements and all College of Arts & Sciences requirements. Specific requirements for the B.A. and B.S. degrees include foundational basic science requirements, Biochemistry core requirements, and Biochemistry elective requirements. Proposed 4 year graduation plans are included in the Appendix (p. 19-20). In developing the new curriculum, we have started with the existing Chemistry curriculum, and have added Biology courses while reducing the number of upper-level Chemistry courses.

There are no national accreditation standards for undergraduate programs in biochemistry, and no specific recommendations regarding curriculum content. The American Society for Biochemistry and Molecular Biology is considering establishing minimal standards and providing accreditation in the future, but as of now we can only use other established programs for guidance. We have modeled the basic framework of the curriculum after programs at one peer and one benchmark institution: Utah State University (USU Biochemistry) and the University of Michigan – Ann Arbor (UM Biochemistry).

i. Required for both BA and BS in Biochemistry

Foundational basic science requirements:		credits
1. CHEM 161/161L	General Chemistry I	4
2. CHEM 162/162L	General Chemistry II	4
3. BIOL 171/171L	Biology I	4
4. BIOL 172/172L	Biology II	4
5. BIOL 275/275L	Cell & Molecular Biology	4
6. PHYS 170/170L	General Physics I	5
7. PHYS 272/272L	General Physics II	4
8. MATH 215 or 241 or 251A	Calculus I	4
9. MATH 242 or 252A	Calculus II	4
subtotal		37

ii. Required for BS in Biochemistry

Biochemistry core course requirements:		credits
1. CHEM 272/272L	Organic Chemistry I	5
2. CHEM 273/273L	Organic Chemistry II	4
3. CHEM 372	Bioorganic Chemistry	3
4. CHEM 274/274L	Analytical Chemistry	5
5. CHEM 361 (*new*)	Physical Biochemistry	3
or CHEM 351 & 352	Phys. Chem. I & II	(6)
6. CHEM 380	Professional Ethics	1
7. BIOL 402	Principles of Biochemistry	4

8.	CHEM 462 (*new*)	Advanced Biochemistry	3
9.	CHEM 463 (*new*)	Advanced Biochemistry Lab	2
	subtotal		30-33

Biochemistry elective requirements.
At least 14 credits including 2 laboratory courses. At least 1 course must be from the Chemistry group and 2 courses must be from the Biology group.

Chemistry (at least 1 course from the following)

CHEM 352L	Physico-Chemical Measurements[†]
CHEM 422	Intermediate Inorganic
CHEM 425/425L	Synthesis: Inorganic (Lab)
CHEM 445/445L	Synthesis: Organic (Lab)
CHEM 399	Research

[†]This course requires MATH 243 & CHEM 351 as prerequisites and CHEM 352 as a pre- or corequisite.

Biology (at least 2 courses from the following)

MICR 351/351L	Biology of Microorganisms
BIOL 375/375L	Genetics
BIOL/MBBE 401	Molecular Biotechnology
BIOL/MBBE 406	Cellular Biology
BIOL 407	Molecular Biology
BIOL/MBBE 483	Bioinformatics
MBBE 412	Environmental Biochemistry
MBBE 480	Integrative Genomics & Biotechnology
MICR 431/431L	Microbial Physiology[*]
MICR 461/461L	Immunology
MICR 463/463L	Microbiology of Pathogens[*]
MICR 475/475L	Bacterial Genetics
MICR 490/490L	Virology
ZOOL 430/430L	Animal Physiology
ZOOL 442	Introduction to Neuroscience

*These courses require MICR 351/351L as a prerequisite.

Total Credits of Required Non-Foundational Courses: 44-47

iii. Required for BA in Biochemistry

Biochemistry core course requirements:		credits
1. CHEM 272/272L	Organic Chemistry I	5
2. CHEM 273/273L	Organic Chemistry II	4
3. CHEM 372	Bioorganic Chemistry	3
4. CHEM 274/274L	Analytical Chemistry	5

5.	CHEM 361 (*new*)	Physical Biochemistry	3
	or CHEM 351 & 352	Phys Chem I & II	(6)
6.	CHEM 380	Professional Ethics	1
7.	BIOL 402	Principles of Biochemistry	4
	subtotal		25-28

Biochemistry elective requirements.
At least 10 credits including 1 laboratory course.

Chemistry

CHEM 352L	Phys Chem Measurements†
CHEM 422	Intermediate Inorganic
CHEM 425/425L	Synthesis: Inorganic (Lab)
CHEM 445/445L	Synthesis: Organic (Lab)
CHEM 462	Advanced Biochemistry

†This course requires MATH 243 & CHEM 351 as prerequisites and CHEM 352 as a pre- or corequisite.

Biology

MICR 351/351L	Biology of Microorganisms
BIOL 375/375L	Genetics
BIOL/MBBE 401	Molecular Biotechnology
BIOL/MBBE 406	Cellular Biology
BIOL 407	Molecular Biology
BIOL/MBBE 483	Bioinformatics
MBBE 412	Environmental Biochemistry
MBBE 480	Integrative Genomics & Biotechnology
MICR 431/431L	Microbial Physiology*
MICR 461/461L	Immunology
MICR 463/463L	Microbiology of Pathogens*
MICR 475/475L	Bacterial Genetics
MICR 490/490L	Virology
ZOOL 430/430L	Animal Physiology
ZOOL 442	Introduction to Neuroscience

*These courses require MICR 351/351L as a prerequisite.

Total Credits of Required Non-Foundational Courses:	35-38

We envision that eventually CHEM 462: Advanced Biochemistry and CHEM 463: Advanced Biochemistry Laboratory would be taken together in the spring semester of the final year, and would jointly serve as capstone courses for the BS degree program. However, since CHEM 463 will initially be sharing teaching lab space with CHEM 274L, currently a spring semester course, we will initially be offering CHEM 463 only in the fall semester. After additional teaching lab space is renovated, as discussed in the Resources section below, then CHEM 463 will be shifted to the spring semester and the Capstone Course concept will be further developed.

B. Program Admission

Students will be admitted into the Biochemistry Program who have successfully completed CHEM 162/162L, BIOL 171/171L, and MATH 241 or 251A with a C (not C–) or better grade in each course, or that have received equivalent transfer or AP credit. MATH 215 may be substituted for MATH 241 provided the student has passed with a B (not B–) or better grade. In general, these course requirements can only be met by students that have at least sophomore standing (25 or more credits). Students that declare as Biochemistry majors in their sophomore year will be advised on specific course requirements, in particular the requirement that they take CHEM 272/272L and CHEM 273/273L, and the suggestion that they take BIOL 275/275L, during their sophomore year.

Due to current space limitations for CHEM 463: Advanced Biochemistry Lab, enrollment in the BS Biochemistry degree program will be capped at 48 students per year for the first 6-year cycle.

Due to current space limitations for CHEM 274L: Analytical Chemistry Lab, total combined enrollment in the BA Chemistry, BS Chemistry, BA Biochemistry, and BS Biochemistry degrees will be capped at 96 students per year.

More stringent admissions policies based upon GPA and prerequisite grades will be implemented if necessary. An application form for admission to the Biochemistry Program will be developed requiring submission of a prior year transcript, and applicants will be ranked and reviewed late in the fall semester of the Sophomore year (25 – 50 credits earned). Precise details regarding GPA and grade criteria will depend on the number and quality of applicants.

C. Advising and Counseling

Advising for all declared majors will be handled by faculty within the Department of Chemistry. Upon declaring as a Biochemistry major, students will be assigned to a faculty member who will serve as their advisor through graduation. Faculty currently advise students in the BA and BS in Chemistry tracks, and the new degrees in Biochemistry will be handled in a similar manner. Additional Chemistry faculty will be recruited and trained for advising as needed.

If the combined number of Chemistry and Biochemistry majors exceeds *ca.* 100 students per year, then additional administrative support staff may be needed, who could be trained to handle administrative counseling issues such as course requirements and enrollment.

4. Enrollment in the Program

All undergraduate students at UH Manoa will eligible for enrollment in the program, provided that they meet prerequisite requirements. We anticipate that enrollment will include students broadly interested in either scientific careers or health-related careers. The UH Manoa College of Natural Sciences has nearly 1800 students in various declared majors (Fall 2010 data), including ~1000 Biology majors and ~130 Chemistry majors. We anticipate that a portion of these students will choose to switch to the Biochemistry Program.

We have attempted to gauge the anticipated number of Biochemistry majors in two ways. First, as described above, we have surveyed students in Freshman and Sophomore Chemistry courses regarding the likelihood that they would choose to become Biochemistry majors. Based on the response rate (~50%) and the number of students that either Strongly

Agreed or Agreed that they would have declared as Biochemistry majors (~40 in each year), we would anticipate that the maximum number of interested students would be 70-80 per year. However, we have instituted course requirements in math and physics that we anticipate will reduce this number to <50 students per year.

We have also examined enrollment in Biochemistry Programs administered through Chemistry Departments at other universities. Based upon data available through the American Chemical Society for medium-sized universities (8,000 – 20,000 total students), Chemistry Departments graduated 5 – 80 undergraduate Biochemistry majors each year. A major factor in the total number of majors appears to be the requirements for math-based courses including Calculus and Physical Chemistry. Those departments with stringent requirements have relatively few students, while those with lenient requirements have more students. Our curriculum is intermediate between these extremes.

Due to existing space limitations for the Advanced Biochemistry Laboratory course (up to 2 sections of 24 students), we will cap the enrollment in the BS degree at 48 students per year. Due to projected space limitations for the Analytical Chemistry Laboratory course (up to 4 sections of 24 students), we will cap the enrollment in all Chemistry department degree programs at 96 students per year. If demand exceeds these limits, majors will be selected based upon highest overall GPA and highest grades in prerequisite courses. Additional expansion of the Chemistry and Biochemistry degree programs would require renovation and expansion of upper division teaching lab space.

5. Resources

A. Faculty

- Most courses required for the Biochemistry Program are existing UHM courses, and will not require additional instructional faculty.
- Current Chemistry faculty that will contribute to new course instruction are:
  - Dr. Joseph T. Jarrett – Chem 372: Bioorganic Chemistry
  - Dr. Tijana Talisman – Chem 361: Physical Biochemistry
  - Dr. Ho Leung Ng – Chem 463: Advanced Biochemistry Laboratory

  Each of these faculty members will commit one semester to upper-division Biochemistry instruction as indicated, and will also contribute one semester to lower-division Chemistry instruction. In addition, faculty will contribute to instruction in graduate courses and serve as graduate advisors.
- At least one additional tenure-track faculty member will be hired within the Department of Chemistry to teach Chem 462: Advanced Biochemistry and an elective course such as Protein Chemistry, Medicinal Chemistry, or Chemical Biology, and to also contribute to lower-division Chemistry instruction.

B. Space resources

- All new lecture courses can be accommodated within existing facilities.
- Chem 463: Advanced Biochemistry Laboratory. Bilger Hall, Room 201, houses an existing undergraduate teaching lab that is currently used for CHEM 274L: Analytical Chemistry Lab during the Spring semester. This room is available for teaching biochemistry labs during the Fall semester. Bilger 201 has seating and lab bench

workspace for up to 24 students, and by offering the course on MW and TTh afternoons, we could safely accommodate 48 total students. An adjoining instrument room (Bilger 201B) of ~600 sq. ft. has received a power upgrade to allow the installation of all essential large equipment.

- Eventually we envision renovation of Bilger 337/341, a 2,000 sq. ft. space that is essentially unimproved since Bilger Hall was built in the 1950s. The timing of this renovation will depend on the growth of the program and our ability to raise funds. At an estimated cost >$700/sq. ft., the renovation budget may reach $1.5M + 10% design cost.
- Research space will be required for new faculty. Although space is available within Bilger Hall and Bilger Addition, renovations and infrastructure improvements will be needed to house modern biochemistry research laboratories.

C. Equipment and supply resources

- Chem 463: Advanced Biochemistry Laboratory course will require the purchase of equipment estimated at ~$150,000 over 3 years. Major equipment will include freezers, refrigerators, incubators, and centrifuges, as well as several lab stations equipped with chromatography and electrophoresis equipment.
- The laboratory course will require microbiological and chemical supplies estimated at ~$5000 per year.

D. Other resources

- Chem 463: Advanced Biochemistry Laboratory course would require two new Teaching Assistantships for Fall semester only – 2 x 0.25 FTE, 9 month TA appointment.
- Existing Chemistry Department administrative and support staff will be sufficient as long as the total number of Biochemistry majors is similar to the existing Chemistry program (~100 total majors). If the program becomes highly enrolled (>100 majors), additional staff may be required.

E. Sources of funds

- At least one new faculty hire will come from a new unfilled position in Chemistry.
- New TA positions will be funded by the College of Natural Sciences.
- Funds to renovate Bilger 201 and to purchase equipment for the Advanced Biochemistry Laboratory will initially come from the Chemistry Department share of summer tuition revenue. We will also apply for an NSF Chemistry Instrumentation grant in Fall 2012.
- Annual lab supplies will be funded in part through lab fees (~$100 per student), supplemented by departmental operating funds.

6. Efficiency

To estimate the annual costs and revenues for the Biochemistry Program, we have assumed an intermediate-sized program with 20 students per year in the B.S. degree program (about half of our enrollment cap) and an additional 30 students per year in the BA

degree program, or approximately 200 total students. Total Chemistry Department faculty salaries committed to the program were then calculated based upon the proportional enrollment of these students in existing and new Chemistry courses, relative to the total enrollment in these courses. For example, Chem 272 has an annual enrollment of *ca.* 500 students, of which 50 students per year could be attributed to the Biochemistry Program, and so 10% of the faculty salary is attributable to teaching Biochemistry students. We have assumed an estimated average annual salary of $85,000 per year. Carrying this type of calculation through each required and elective Chemistry course suggests an annual faculty salary cost of ~$300,000 – 350,000 attributable to instruction of Biochemistry students in Chemistry courses. For an estimated 200 total students, the total student semester hours of instruction will be 1900 SSH for Chemistry courses.

The following table provides an estimated of the costs and revenues attributable to the program. Costs have been inflated at 3% per annum. "Other expenses" includes TA stipends inflated at 3% per annum. Tuition increases have been estimated at 7% per annum.

Projected Cost and Revenue During the First Program Cycle (6 years).

YEAR	FY12/13	FY13/14	FY14/15	FY15/16	FY16/17	FY17/18
PROGRAM COSTS						
Faculty w/o fringe	$102,271	302,550	311,626	320,975	330,605	340,523
Equipment/Supplies	$50,000	55,000	55,150	5,300	5,460	5,625
Other (TA stipends)	$0	17,500	18,000	18,500	19,000	19,570
TOTAL Expenses	$152,271	375,050	384,776	344,775	355,065	365,718
Expenses per SSH	**$113**	**210**	**203**	**181**	**187**	**192**
REVENUES						
Projected Enrollment	150	190	200	200	200	200
No. of Courses	12	16	16	16	16	16
No. of Credits	28	39	39	39	39	39
SSH	1350	1790	1900	1900	1900	1900
Tuition Rate/Credit	$350	375	400	428	458	490
Revenue from Tuition	$472,500	671,250	760,000	813,200	870,200	931,000
Other Sources of Income	$50,000	51,000	52,060	2,122	2,185	2,251
TOTAL Revenue	$522,500	722,250	812,060	815,322	872,385	933,251
Revenue per SSH	**$387**	**403**	**427**	**429**	**459**	**491**

The estimated size of the program, ~200 total students, is compared to other department-based degree programs in the College of Natural Sciences. The number and size of upper division courses is also compared. We have not included lower division courses, as these are service courses that include a high percentage of students from other majors and colleges. Data is taken from the UHM 2011 Course Registration Report available from the UH Institutional Research Office (http://www.hawaii.edu/iro).

Projected Enrollment in Upper Division Courses.

	No. of Courses	No. of Classes	Avg. Class Size	Semester Hours	No. of Students	SSH
PROGRAM						
Biochemistry (*estimated*)	8	9	38	22	200	880
Botany	7	6	26	18	163	506
Chemistry	6	7	13	17	95	246
ICS	12	17	17	52	297	910
Mathematics	19	17	16	49	264	775
Microbiology	10	11	22	24	254	613
Physics	9	8	7	21	60	165
Zoology	13	12	30	26	370	930
Averages for existing Nat Sci programs	**11**	**11**	**19**	**30**	**214**	**592**

As shown in the tables above, the projected size of the Biochemistry Program is comparable to other department-based degree programs in the College of Natural Sciences. The expenses of the program are largely due to the faculty salaries, as apportioned to the number of Biochemistry students in each Chemistry course. However, these costs are well below the estimated revenues based on total SSH and per-credit-hour tuition.

Further efficiency is realized due to the combination of the Biochemistry Program within the existing Chemistry Department, which already offers BA and BS degrees in Chemistry. Since most of the courses for the new program use existing Chemistry courses taught by existing faculty, these salaries have already been budgeted for lower-division service teaching and upper-division Chemistry instruction. The Biochemistry Program is projected to at least double the total number of majors served by the Chemistry Department, and thus the total faculty salary cost per SSH should decrease significantly.

7. Demonstration of Effectiveness

The program is projected to serve two significant groups of students: students who desire science-related careers and those interested in health-related professions. Students in the first group are likely to seek entry-level positions in scientific research or entrance to graduate school for additional training. Students in the second group are likely to seek admission to medical, dental, pharmacy, or veterinary schools. The success of our program will be largely determined by the success of our graduates in obtaining desirable positions in industry or professional education, as well as by the student's preparation for their future positions.

We will use a two-pronged approach to assess the effectiveness of the program. Both of these will require feedback from departing students and recent graduates. We will maintain an accurate address database and conduct a longitudinal study to obtain data for up to 6 years. We will also track course evaluations and current student feedback to improve course delivery.

A. Student preparation

We will examine student performance in Chem 462: Advanced Biochemistry as an indicator of student preparation and knowledge in cognitive learning objectives. A "standardized exam" will be developed that mimics sections of the Biochemistry GRE® exam, and will be administered near the end of the semester. This exam can be adapted from widely available practice exams. We will try to align selected exam sections and project goals with the program learning objectives. Average student performance will be used to evaluate our success in imparting biochemical concepts.

We will also track student satisfaction with the training they obtained. Students will be sent questionnaires at 1 year and 3 years after graduation and will be asked to assess their training in the key areas described within the Biochemistry Program SLOs. Detailed feedback will be obtained where areas of deficiency are noted, and this will be used to improve future course design.

B. Student placement success

We will track the success of students in obtaining a job at a science-related company or obtaining a position in graduate or professional school. In the same questionnaire students will be asked to provide the following types of information:

- Are they in school, working, or unemployed?
- What type of position do they have? Is this position on track towards your ultimate career goals?
- How many applications or interviews did they complete to get the position, and was the position they took one of their top choices?
- Do they feel that their training at UH was an important factor in obtaining this position?

C. Course and instructor evaluation

The Chemistry Department uses written course evaluations to solicit student feedback in all courses. Numeric evaluations are useful in course improvements, particularly with respect to textbook selection, homework and exam design, and lecture presentation. Anonymous student suggestions for course improvements will also be solicited. These evaluations and comments will be continuously compiled to provide a longitudinal analysis of course improvement.

8. Appendices

H. Suggested catalog listing

I. Sample 4-year graduation plans

J. Curriculum map

K. Condensed syllabi for new proposed courses:
   1. Chem 361: Physical Biochemistry
   2. Biol 402: Biochemistry
   3. Chem 462: Advanced Biochemistry
   4. Chem 463: Advanced Biochemistry Lab

L. Preliminary UHM-1 Forms and Supplementary Information:
   1. Chem 462: Advanced Biochemistry
   2. Chem 463: Advanced Biochemistry Lab

M. Condensed CVs for primary instructional faculty
   1. Dr. Joseph T. Jarrett, Associate Professor
   2. Dr. Ho Leung Ng, Assistant Professor
   3. Dr. Tijana Talisman, Assistant Professor

N. Letters of support

A. Suggested catalog listing

We suggest adding the degree descriptions to the section describing the current BA and BS in Chemistry, to be listed after the Chemistry degrees but before the Minor concentration, as follows:

BA in Chemistry Degree

Requirements

- 27 credit hours in CHEM courses numbered 200 and above, including CHEM 272/272L, 273/273L, 274/274L, 351, 352/352L, and either 425/425L or 445/445L
- MATH 243 (Calculus III) or 253A
- PHYS 170/170L and 272/272L
- Recommended languages: German, French, Russian, or Japanese

BS in Chemistry Degree

Requirements

- 41 credit hours in CHEM courses numbered 200 and above, including CHEM 272/272L, 273/273L, 274/274L, 351, 352/352L, 372 or BIOL 402, or BIOC 441, 422, 425/425L, and 445/445L
- A minimum of three credits from CHEM 399, 601, 602, 622, 641, 642, 643, 651, 653, or 657
- MATH 243 (Calculus III) or 253A
- PHYS 170/170L and 272/272L
- Recommended electives: MATH 244 and PHYS 274
- Recommended languages: German or French

BA in Biochemistry Degree

Requirements

- 24 credit hours or more in CHEM courses numbered 200 and above, including CHEM 272/272L, 273/273L, 274/274L, 361 or 351/352, 372, and 380.
- BIOL 171/171L, 172/172L, 275/275L, and 402.
- Three elective lecture courses and one accompanying laboratory course selected from CHEM, BIOL, MBBE, or MICR courses numbered 300 or higher.
- MATH 215 or 241 or 251A and 242 or 252A.
- PHYS 170/170L and 272/272L.
- Recommended languages: German, French, or Japanese.

Upon approval of a Chemistry Department Advisor and the Chair, the elective requirements may be modified to accommodate a special emphasis or interdisciplinary program that is appropriate for a major in Biochemistry.

BS in Biochemistry Degree

Requirements

- 30 credit hours or more in CHEM courses numbered 200 and above, including CHEM 272/272L, 273/273L, 274/274L, 361 or 351/352, 372, 380, 462, 463 and at least one additional CHEM course numbered 300 or higher.
- BIOL 171/171L, 172/172L, 275/275L, and 402, and at least one additional BIOL, MBBE, MICR, or ZOOL courses numbered 300 or higher.
- Two elective lecture courses and accompanying laboratory courses selected from CHEM, BIOL, MBBE, or MICR courses numbered 300 or higher.
- MATH 215 or 241 or 251A and 242 or 252A.
- PHYS 170/170L and 272/272L.
- Recommended languages: German, French, or Japanese.

Upon approval of a Chemistry Department Advisor and the Chair, the elective requirements may be modified to accommodate a special emphasis or interdisciplinary program that is appropriate for a major in Biochemistry.

Minor in Chemistry

Requirements

- 17 credit hours in CHEM courses numbered 200 and above, including CHEM 272/272L, 273/273L, 274/274L, and 351

In addition, the following blanket statement should be added at the beginning of the list of Chemistry courses in the catalog:

Credit towards the BA or BS in Biochemistry allowed for either CHEM 361 or CHEM 351 and 352. Students who pass CHEM 361 may not count CHEM 351 and/or 352 as electives. Students who pass CHEM 351 and/or CHEM 352 may not count CHEM 361 as an elective.

B. Sample 4-year graduation plans

Proposed BA Biochemistry Undergrad Major

4 year plan

Fall 1		Cr
CHEM 161/161L	General Chem I	4
BIOL 171/171L	Biology I	4
FG		3
FW		3
		14

Spring 1		Cr
CHEM 162/162L	General Chem II	4
BIOL 172/172L	Biology II	4
MATH 215-241-251A	Calculus I	4
FG		3
		15

Fall 2		
CHEM 272/272L	Organic Chem I	5
MATH 242-252A	Calculus II	4
H/SL		3
DS		3
		15

Spring 2		
CHEM 273/273L	Organic Chem II	4
BIOL 275/275L	Cell & Mol Biology	4
H/SL		3
DA/DH/DL		3
		14

Fall 3		
CHEM 372	Bioorganic Chemistry	3
PHYS 170/170L	Gen Physics I	5
DS		3
H/SL		3
elective		3
		17

Spring 3		
CHEM 274/274L	Analytical Chemistry	5
CHEM 380	Professional Ethics	1
PHYS 272/272L	Gen Physics II	4
H/SL		3
elective		3
		16

Fall 4		
CHEM 361	Physical Biochemistry	4
Chem/Bio elective w/ Lab		5
Chem/Bio elective		3
elective		3
		15

Spring 4		
BIOL 402	Biochemistry I	4
Chem/Bio elective		3
DA/DH/DL		3
elective		3
elective		3
		16

Total credits: 122

Suggested Electives (10 credits including at least 1 lab course):

CHEM 351	Phys Chem I[1]	CHEM 422	Intermed Inorganic
CHEM 352	Phys Chem II[1]	CHEM 425/425L	Synthesis: Inorganic (Lab)
CHEM 352L	Phys Chem Measurements[1]	CHEM 445/445L	Synthesis: Organic (Lab)
CHEM 399	Research	CHEM 462	Adv. Biochemistry
BIOL 375/375L	Genetics	MICR 351/351L	Biology of Microorganisms
BIOL 401	Molecular Biotechnology	MICR 431/431L	Microbial Physiology[2]
BIOL 406	Cellular Biology	MICR 461/461L	Immunology
BIOL 407	Molecular Biology	MICR 463/463L	Microbiology of Pathogens[2]
BIOL 483	Bioinformatics	MICR 475/475L	Bacterial Genetics
MBBE 412	Environ. Biochemistry	MICR 490/490L	Virology
MBBE 480	Integr. Genetics & Biotech.	ZOOL 430/430L	Animal Physiology
		ZOOL 442	Introduction to Neuroscience

[1]prereq is Math 243 & Phys 272

[2]prereq is MICR 351

Proposed BS Biochemistry Undergrad Major

4 year plan

Fall 1		Cr
CHEM 161/161L	General Chem I	4
BIOL 171/171L	Biology I	4
MATH 215-241-251A	Calculus I	4
FW		3
		15

Spring 1		Cr
CHEM 162/162L	General Chem II	4
BIOL 172/172L	Biology II	4
MATH 242-252A	Calculus II	4
FG		3
		15

Fall 2		
CHEM 272/272L	Organic Chem I	5
PHYS 170/170L	Gen Physics I	5
FG		3
DA/DH/DL		3
		16

Spring 2		
CHEM 273/273L	Organic Chem II	4
BIOL 275/275L	Cell & Mol Biology	4
PHYS 272/272L	Gen Physics II	4
H/SL		3
		15

Fall 3		
CHEM 372	Bioorganic Chemistry	3
CHEM 361	Physical Biochemistry	3
DA/DH/DL		3
DS		3
H/SL		3
		15

Spring 3		
CHEM 274/274L	Analytical Chemistry	5
CHEM 380	Professional Ethics	1
Chem/Bio elective w/ Lab		5
DS		3
H/SL		3
		17

Fall 4		
BIOL 402	Biochemistry I	4
CHEM 463	Adv. Biochem. Lab	2
Chem/Bio elective		3
H/SL		3
elective		3
		15

Spring 4		
CHEM 462	Advanced Biochemistry	3
Chem/Bio elective w/ Lab		5
Chem/Bio elective		3
elective		3
elective		3
		17

Total credits: 125

Suggested Electives (14 credits including at least 2 lab courses):

Chemistry (at least 1 course)

CHEM 352L	Phys Chem Measurements[1]	CHEM 422	Intermed Inorganic
CHEM 399	Research	CHEM 425/425L	Synthesis: Inorganic (Lab)
		CHEM 445/445L	Synthesis: Organic (Lab)

[1]prereq is CHEM 351, coreq is CHEM 352

Biology (at least 2 courses)

BIOL 375/375L	Genetics	MICR 431/431L	Microbial Physiology[2]
BIOL 401	Molecular Biotechnology	MICR 461/461L	Immunology
BIOL 406	Cellular Biology	MICR 463/463L	Microbiology of Pathogens[2]
BIOL 407	Molecular Biology	MICR 475/475L	Bacterial Genetics
BIOL 483	Bioinformatics	MICR 490/490L	Virology
MBBE 412	Environ. Biochemistry	ZOOL 430/430L	Animal Physiology
MBBE 480	Integr. Genetics & Biotech.	ZOOL 442	Introduction to Neuroscience
MICR 351/351L	Biology of Microorganisms		

[2]prereq is MICR 351

C. Curriculum map

	CHEM 161	CHEM 161L	CHEM 162	CHEM 162L	BIOL 171	BIOL 171L	BIOL 172	BIOL 172L	CHEM 272	CHEM 272L	CHEM 273	CHEM 273L	BIOL 275	BIOL 275L	CHEM 372	CHEM 361	CHEM 274	CHEM 274L	CHEM 380	BIOL 402	CHEM 462	CHEM 463
Chem Laws & Theories	I		I						D		D				D	A						
Quant. Measurements	I		I														D A					A
Fundamental Biochemistry					I		I						D							A	A	A
Structure & Reactivity									I		D				D	D					A	A
Scientific Method & Communication		I		I		I		I		D		D		D				D	D			A
Literature & Databases														I	I	D			D		A	A
Make Measurements & Analyze Data		I		I		I		I		D		D		D				A				A
Modern Structure Analysis										I		I				D					D	A
Purify & Characterize Biomolecules						I		I		I		D		D								A
Kinetic & Therm. Analysis				I										D			D	D				A
Instrumental Methods				I						D		D		D				D				A

D. Condensed syllabi for core courses:

CHEM 372: Bioorganic Chemistry *(existing course already optional for the BS Chem major)*

Professor: Joseph T. Jarrett
jtj@hawaii.edu
956-6721

Text: *The Organic Chemistry of Biological Pathways*, McMurry and Begley – Required

Prerequisites: CHEM 272

Student Learning Objectives:

1. Students can describe fundamental chemical mechanisms for the major types of chemical reactions observed in biochemistry, including specific examples for each.
2. Students can describe the basic elements of amino acid, peptide, and protein structure.
3. Students can explain the common features of enzyme catalysts, and some of the basic methods used in studying enzyme function.
4. Students can outline the basic metabolic pathways for carbohydrate metabolism, amino acid biosynthesis and breakdown, fatty acid/lipid production and breakdown, and nucleotide biosynthesis and degradation.
5. Students can use research databases, journal articles, and reviews to learn more about modern topics in bioorganic chemistry.

Grading: In class pop quizzes 10%
Homework 10%
4 Exams, each 20%

Week 1: Alkyl transfer reactions, biological methylation (S_N2), turpene reactions (S_N1)
Week 2: Alcohols, aldehydes, ketones, aldol reactions
Week 3: Carboxylic acid derivatives, acyl group substitution Homework set 1
Week 4: Amines and nitrogenous heterocycles, acid-base chemistry in biology, Exam 1
Week 5: Amino acid structures and properties
Week 6: Peptides and proteins, enzymes Homework set 2
Week 7: Amino acid catabolism, mechanisms of pyridoxal phosphate enzymes
Week 8: Amino acid biosynthesis, Exam 2
Week 9: Intro to bioenergetics, glycolysis enzymes
Week 10: The TCA cycle, mechanisms of thiamine enzymes, Homework set 3
Week 11: Fatty acid β oxidation
Week 12: Fatty acid, lipid, turpene, and cholesterol biosynthesis, Exam 3
Week 13: Nucleic acid biosynthesis, one-carbon metabolism and folic acid
Week 14: Nucleic acid degradation, medical problems related to nucleotides, Homework set 4
Week 15: Drugs based on nucleic acids, a look inside the pharmaceutical industry
Final Exam Week: Final exam

CHEM 361: Physical Biochemistry

Professor:
Tijana Talisman
Bilger 245b
talisman@hawaii.edu
956-3207

Text: *Physical Chemistry for the Life Sciences*, 2nd ed., P. Atkins and J. de Paula
Prerequisites: CHEM 273 and MATH 242 or 252A

Student Learning Objectives:

- This course will focus on the basic principles of physical chemistry applied to bio-systems and emphasize the interdisciplinary nature of physical biochemistry.
- Students will learn about the relevance of theoretical concepts for experimental analysis and gain a basic understanding of how thermodynamics, kinetics, and spectroscopy can be applied in biosciences.
- Students will gain awareness of current physical and biochemical issues and applications.
- Students will learn about literature search processes, selection of relevant articles, and use of scientific databases in order to gain knowledge of new advances in physical biochemistry.
- Students will learn about benefits of collaboration by working on problem sets in groups.

Grading: Class participation 10%
Homework 20%
2 midterm exams, each 20%
Final exam 30% (cumulative)

Week 1: Work and Heat, Internal energy and enthalpy
Week 2: Entropy, The Gibbs energy, Homework set 1
Week 3: Phase equilibria: phase transitions, mixtures, colligative properties
Week 4: Chemical equilibrium, Homework set 2
Week 5: Thermodynamics of ion and electron transport, Exam 1
Week 6: The rates of reactions
Week 7: Rate laws, Homework set 3
Week 8: Enzyme kinetics
Week 9: Principles and applications of quantum theory
Week 10: Hydrogenic atoms, The structures of many electron atoms, Homework set 4
Week 11: The chemical bond, Exam 2
Week 12: Macromolecules and self-assembly
Week 13: General features of spectroscopy, UV and Vis spectra, vibrational spectra
Week 14: Fluorescence and phosphorescence, Homework set 5
Week 15: Nuclear Magnetic Resonance
Final Exam Week: Final exam

BIOL/MBBE 402: Biochemistry

Course Supervisor: Dr. Jon-Paul Bingham, BSc. BSc. (Hons) PhD.
E-mail: jbingham@hawaii.edu

Biochemistry :

Overview: This course will provide a foundational core of Biochemistry, with a medical orientation. This course is designed to specifically enhance student understanding in the related courses. Students will be required to demonstrate comprehension of materials and well as illustrate their application in solving biochemical related questions and problems.

Format: Students will be provided with a weekly course outline, providing clear indication to the topics covered, the concepts required to be mastered. The course will utilize materials provided by Lehninger 'Principles of Biochemistry, 4th Edition', as too the teaching and learning resources associated with this text. Students will be guided to questions/problems and will be provided homework throughout the course.

Areas that will be covered range from:

- Basic concepts in understanding Biochemistry;
- Properties of Amino acids, Peptides and Proteins;
- Protein structure and function;
- 3D Dimensional structure of proteins;
- Enzyme kinetics;
- Carbohydrate and Glycobiology;
- Carbohydrate Pathologies;
- Nucleotide and Nucleic acids;
- Lipids and Lipid diseases;
- Biochemistry of membranes and Biosignaling, and;
- Bioenergetics;
- Glycolysis
- Metabolic regulation
- The Citric Acid Cycle
- Fatty Acid Catabolism
- Urea Cycle
- Oxidative Phosphorylation
- Photophosphorylation
- Carbohydrate Biosynthesis
- Biosynthesis of Amino Acids, Nucleotides
- Hormonal Regulation and Integration of Metabolisms
- Protein Metabolism

Students will be expected to:

- Know and apply scientific terminology;
- Know applications of certain biochemical technologies and their limitations;
- Undertake problems from textbook/provided in class and from internet resources, and;
- Participate in problem classes/tutorials

Course Grading Breakdown: Grades are a reflection of what students know and how students apply that knowledge, a bell curve is not. Therefore I will NOT undertake the practice of curving marks.

Grading components:

No.	Type	Points allotted
2*	60 min. Examinations @ 100 marks	200
1	2hr. Final Examination 165 marks	165
15	Graded Homework @ 5 marks	75
15	Graded Web-based Quiz @ 3.5 marks	52.5
	Attendance/participation	7.5
TOTAL		**500**

Lecture Schedule

Lecture	Lehninger Principles of Biochemistry Ed. 4	Notes
1	Introduction Chapter 1	
2	Chapter 1 and 2	
3	Chapter 2	Homework 1 Chapts. 1 and 2
4	Chapter 3	
5	Chapter 3	
6	Chapter 4	Homework 2 Chapts. 3 and 4
7	Chapter 5	
8	Chapter 5	Homework 3 Chapt. 5
9	Chapter 6	

10	Chapter 6	
11	Chapter 7	Homework 4 Chapt. 6
12	Chapter 7	
13	Chapter 8	
14	Chapter 9	Homework 5 Chapts. 7, 8 and 9
	Examination	**Chapters 1-9**
15	Chapter 10	
16	Chapter 10	Homework 6 Chapt. 10
17	Chapter 11	
18	Chapter 11	
19	Chapter 12	Homework 7 Chapts. 11
20	Chapter 12	
21	Chapter 13	
22	Chapter 14	Homework 8 Chapt. 12 and 13
23	Chapter 14	
24	Chapter 15	
25	Chapter 15	Homework 9 Chapt. 14 and 15
26	Chapter 16	
27	Chapter 16	
28	Chapter 17	Homework 10 Chapt. 16 and 17
	Examination	**Chapter 10-17**
29	Chapter 18	
30	Chapter 18	Homework 11 Chapt. 18

31	Chapter 19	
32	Chapter 19	
33	Chapter 20	Homework 12 Chapt 19
34	Chapter 20	
35	Chapter 21	Homework 13 Chapt 20 and 21
36	Chapter 22	
37	Chapter 22	Homework 14 Chapt 22
38	Chapter 23	
39	Chapter 23	
40	Chapter 27	Homework 15 Chapt. 23
41	Chapter 27	
	Examination	**Chapters 18-23**
	Accumulative Final	**Chapters 1-23**

CHEM 462: Advanced Biochemistry

Professor:
New Faculty Hire (Fall 2013)

Text: *Lehninger: Principles of Biochemistry*, 5th ed., D. L. Nelson and M. M. Cox
Prerequisites: CHEM 361, BIOL 402

Student Learning Objectives:

- Students will understand the chemical principles that underlie DNA replication and transcription, and RNA translation and protein synthesis.
- Students will understand the interplay between methods for regulating networks of biochemical reactions, including genetic regulation, hormones and signal transduction, protein activation and inhibition, and
- Students will understand how biochemical reactions can be described at an atomic level, including how enzyme catalysts and cofactors can accelerate difficult reactions.
- Students will be able to apply basic thermodynamic principles to biochemical reactions.
- Students will use literature search processes to gain knowledge of recent advances in biochemistry and will write a magazine article communicating one topic to their peers.

Grading: 3 exams, each 20%
Weekly homework, 20%
Written report, 20 %

Week 1: Introduction: The organization and control of metabolism and biosynthesis
Week 2: Nucleotide biosynthesis, DNA replication
Week 3: DNA transcription, gene regulation mechanisms
Week 4: RNA translation: mRNA, tRNA, ribosomes, and protein synthesis
Week 5: Genetic causes of cancer, Exam 1
Week 6: A re-examination of enzyme structure and mechanism
Week 7: Bioinorganic chemistry: catalytic and structural roles for metal ions in enzymes
Week 8: Advanced mechanisms: enzymes of amino acid metabolism
Week 9: Methods for probing chemical mechanism – transient kinetics and isotope effects
Week 10: Proteomics and mass spectrometry, Exam 2
Week 11: Bioenergetics and thermodynamics
Week 12: Energy harvesting steps in glycolysis, TCA cycle, and fatty acid catabolism
Week 13: Oxidative phosphorylation, membrane potentials, and ATP synthesis
GRE Practice Test
Week 14: Hormonal control of energy metabolism in mammals
Week 15: Alternative metabolic strategies in microorganisms, bioenergetics and biofuel production
Final Exam Week: Exam 3

CHEM 463: Advanced Biochemistry Laboratory

Professor:
Dr. Ho Leung Ng
Bilger 208B
holeung.ng@hawaii.edu
956-2014

Text: *Modern Experimental Biochemistry*, R. Boyer. Prentice Hall, 2000.
Prerequisites: Chem 273L, BIOL 275L, and BIOL 402 (or concurrent)

Course overview:
The course objective is to introduce biochemistry students to the major skills and methods used to study biochemical systems. The class will include lectures but will primarily involve hands on experimental work. Analysis and communication are heavily emphasized. This is a Writing Intensive (WI) class. Emphasis is placed on laboratory notebook keeping, lab reports, and oral presentations.

Student Learning Objectives:

- laboratory safety
- applications of molecular biology to biochemistry research
- protein expression, purification and chromatography
- gel electrophoresis
- enzyme kinetics
- protein structure
- written and oral communication skills

Assignments
Students will be assessed by 1) thoroughness and quality of lab notebooks, 2) laboratory reports, 3) oral presentations, 4) final examination.
Oral pre-lab presentations will be assigned to lab teams. 15 min presentations will be made at the beginning of each lab to introduce the lab to the entire class.

Grading

Prelab quizzes	10%
Laboratory notebooks	15%
Laboratory reports	25%
Oral presentations	20%
Midterm exam	15%
Final exam	15%

Course Schedule

Week 1	Lab safety, lab notebooks and reports. Protein expression of GFP.
Week 2	Protein expression, gel electrophoresis, spectrophotometry, protein purification
Week 3	Protein purification, affinity chromatography, ion exchange chromatography
Week 4	Protein purification, size exclusion chromatography, determining molecular mass, determining protein concentration
Week 5	Determining protein concentration, GFP fluorescence, Western blot
Week 6	Western blot, mass spectrometry
Week 7	Computer lab: molecular modeling, Midterm exam
Week 8	Enzyme kinetics (trypsin)
Week 9	Enzyme inhibitors, effects of buffers on enzyme activity
Week 10	Protein-ligand binding (albumin + phenol red)
Week 11	Measuring sugar concentration
Week 12	Measuring cholesterol
Week 13	DNA electrophoresis, DNA ligation
Week 14	DNA ligation, restriction enzymes
Week 15	Oral research paper presentations
Week 16	Oral research paper presentations
	Final exam

E. Preliminary UHM-1 Forms and Supplementary Information:

UNIVERSITY OF HAWAI'I AT MĀNOA
UHM-1 FORM (ADD A COURSE)

See *Guidelines* for instructions and deadlines. For undergraduate courses, submit an original and 4 copies; graduate courses, submit an original and 6 copies. If cross-listed, include extra copies for cross-listed department(s) & college(s). List one course per form. Attach additional sheets as needed.

1. Course Subject	2. Course Number	3. Effective Term *(semester & year)*	4. Frequency *(check all that apply)*
CHEM	462	Spring 2014	☐ Fall semester ☐ Alternate years ☒ Spring semester ☐ Other: _____ ☐ Summer semester

5. Offering Status *(check one)*
- ☒ Regular
- ☐ Experimental
- ☐ Single-term

6a. Full Course Title *(Alpha courses: attach separate sheet & specify title for each alpha)*
Advanced Biochemistry

6b. BANNER Course Title *(30 characters max, including spaces/punctuation. Alpha courses: attach separate sheet & specify title for each alpha)*
Advanced Biochemistry

7. Grade Option *(check all that apply)*
- ☒ Letter Grade
- ☐ Credit/No Credit
- ☐ Audit
- ☐ Satisfactory/Unsatisfactory (500, 700, 700F, 800, 800C only)
- ☐ Honors (Medicine only)

8. Gen Ed Core or Hawaiian/Second Language Requirement Designation *(check one)*
- ☒ Do not consider for Core or Hawaiian/Second Language designation.
- ☐ Request approval of _____ Diversification (DA, DH, DL, DB, DP, DY, DS), Foundations (FW, FS, FG), or Hawaiian/Second Language (HSL) designation (For Foundations, also submit a proposal to General Education Office.)

GEC Use: ☐ Approve ☐ Deny _____ GEC Initials

9. Contact Hours *(meeting hours per week – if variable, specify range)*	10. # of credits *(if variable, give range)*	11. Repeat Limit	12. Credit Limit
3	3	0	3

13. Schedule Type *(check all that apply)*
- ☒ Lecture (LEC)
- ☐ Laboratory (LAB)
- ☐ Discussion (DIS)
- ☐ Seminar (SEM)
- ☐ Lecture/Discussion combined (LED)
- ☐ Lecture/Laboratory combined (LEL)
- ☐ Thesis/Dissertation (THE)
- ☐ Hybrid Technology Intensive (HTI)
- ☐ Directed Reading or Research (DRR)
- ☐ Field Experience/ Internship/Practicum (PRA)

14. Co-requisite Course(s)	15a. Major Restriction *(as it should appear in Catalog)*	15b. Banner codes of acceptable majors	16. Class Standing Restriction
none	none		none

17a. Prerequisite Course(s) *(Use "ands", "ors" and punctuation to indicate relationships between prerequisites. "Or consent" is implied for ALL prerequisites. "Consent" requirements can be implemented through your class schedules each semester.)*
CHEM 361 and BIOL 402

17b. Minimum required grade for prerequisites	17c. Blanket requirements listed in Catalog *(if none, write "none")*	17d. Non-introductory (NI) Course? *(Numbered between 300 & 499, or 200-level with college-level course as a prerequisite)*
C	none	☒ Yes ☐ No

18. Catalog Description *(Limit 35 words; 85 words for alpha courses)*
Advanced topics in biochemistry including nucleic acid replication, transcription, and translation; genetic and epigenetic regulation; bioenergetics and control of metabolism; alternative metabolic strategies; and enzyme structure and mechanism.

19. Justification *Attach separate sheets and indicate the rationale for the request, expected course enrollment, and a course syllabus.*

20. Cross-listed or Honors Course(s)

Course Subject & Number	Chair/Director	Signature	Date

21. Requested By

Department/Unit	Chair/Director	Signature	Date

Approved By

1st College or School	Dean	Signature	Date
2nd College or School	Dean	Signature	Date

General Education *(Undergraduate courses)*

Director	Signature	Date

Graduate Division *(600 level and above)*

Dean	Signature	Date

Mānoa Chancellor's Office

Vice Chancellor for Academic Affairs	Signature	Date

Rev. 06/10

Rationale for request:
The Advanced Biochemistry course will be a core course for the proposed undergraduate biochemistry degree program (see attached *proposed* course outline for this major). This course will serve two purposes: it will be a continuation of BIOL 402 and will cover the remaining material in the text Lehninger: Principles of Biochemistry, and it will cover advanced topics that relate to the chemical and physical underpinnings of the B.S. Biochemistry degree track. The primary purpose of the course is to impart a more sophisticated understanding of selected aspects of biochemistry, to expose students to a small selection of primary literature through handouts, and to prepare students for graduate-level courses in biochemistry that they might be taking in the future should they choose to attend graduate school.

Overlap with existing courses:
The proposed course uses the same textbook as BIOL/MBBE 402 and is intended as a continuation of that course. However, we will also re-cover a few topics such as bioenergetics, hormonal regulation, and enzyme structure and function, so that we can delve more deeply into the topics and begin to explore how researchers come to understand detailed aspects of biochemistry. For example, in BIOL 402 only one lecture is devoted to bioenergetics. In CHEM 462, we will re-examine bioenergetics from the perspective of the chemical field of thermodynamics: which steps in metabolism are designed to capture energy; how is the energy stored; how is the energy ultimately utilized; how efficient are these processes?

Course Syllabus: Attached.

Expected course enrollment: 20 – 40

Additional Resources Needed: None

Academic units for which this course will be a degree requirement:
B.S. Biochemistry (major is pending approval)

This course will also be an optional elective for undergraduate and graduate students in the Department of Chemistry.

CHEM 462: Advanced Biochemistry

Instructor: Prof. Joseph Jarrett
Bilger 245
jtj@hawaii.edu
956-6721

Summary:
CHEM 462: Advanced Biochemistry is intended as a continuation of BIOL 402: Principles of Biochemistry for students in the B.S. in Biochemistry degree track. BIOL 402 covers approximately the first 20 chapters of Lehninger: Biochemistry, dealing predominantly with carbohydrate, fatty acid, and amino acid metabolism. In CHEM 462, we will start with chapter 24 in Lehninger, covering the various aspects of nucleic acid biochemistry, replication, transcription, and translation. We'll spend considerable time developing the complexities of metabolic regulation, including gene regulation, epigenetic control of gene expression, enzyme inhibition and activation, and the various ways in which hormones can exert these effects. Finally, we'll go back and re-examine some earlier topics such as bioenergetics and enzyme structure and function, but at a depth typically found in graduate school courses, with some selected reading from the primary scientific literature. We will also cover some of the modern instrumental methods used to probe biochemical structure and mechanism.

Student Learning Objectives:

- Students will understand the chemical principles that underlie DNA replication and transcription, and RNA translation and protein synthesis.
- Students will understand the interplay between methods for regulating networks of biochemical reactions, including genetic regulation, hormones and signal transduction, and protein activation and inhibition.
- Students will understand how biochemical reactions can be described at an atomic level, including how enzyme catalysts and cofactors can accelerate difficult reactions.
- Students will be able to apply basic thermodynamic principles to biochemical reactions.
- Students will use literature search processes to gain knowledge of recent advances in biochemistry and will write a magazine article communicating one topic to their peers.

Text:

Required: *Lehninger: Principles of Biochemistry*, 5th ed., D. L. Nelson and M. M. Cox, W. H. Freeman & Co., 2009. This text is already used by BIOL 402, and covers human biochemistry in a format that most health-related professional schools are looking for. Since most students already have this textbook, we will use this as a starting point for the topics and lectures.

Optional: *Voet & Voet: Biochemistry*, 4th ed., D. Voet and J. G. Voet, Wiley & Sons, Inc., 2011. This text is written with considerable chemical detail and is used by many graduate-level biochemistry courses. Protein and nucleotide structures and enzyme mechanisms are both woven throughout the text. I will reference this text frequently in my lectures. I strongly recommend that students interested in graduate school purchase this text; however, a copy will be placed on reserve at Sinclair Library.

Prerequisites: CHEM 361, BIOL 402

Written report:
The ability to read primary scientific literature and to critically analyze and summarize the data and conclusions is an important skill in every scientific field. Written summaries and critiques have become common features in mainstream scientific journals as a way to convey the important aspects of a scholarly work to a lay scientific audience. The journal ***Science*** has a section titled "Perspectives" in which the most important contributions of the week are summarized and given a broader context; ***Nature*** has a similar sections titled "News & Views." You will be asked to find a paper on a biochemical or biomedical topic from the last 12 months of ***Science*** or ***Nature*** and thoroughly read and understand the scientific work. You will then track down 2-3 related review articles to help establish a broader context for the work. You will then write a 3-5 page (*ca.* 1000 words) article similar to a "Perspectives" or "News & Views" article. Your paper must be your own independent work and must not resemble any existing publication.

Grading: Three exams, each 20%
Practice GRE Exam, 20 %
Weekly homework, 10%
Written report, 10 %

Schedule:

	Topic	Reading
Week 1:	Introduction: organization and control of catabolism and biosynthesis	Ch. 15, 23
Week 2:	Nucleotide biosynthesis, DNA replication	Ch. 24, 25
Week 3:	DNA transcription, gene regulation mechanisms	Ch. 26
Week 4:	RNA translation: mRNA, tRNA, ribosomes, and protein synthesis	Ch. 27
Week 5:	Genetic causes of cancer, DNA repair mechanisms	Ch. 25
	Exam 1	
Week 6:	An in Depth Reexamination of Bioenergetics and Thermodynamics	Ch. 13, handouts
Week 7:	Energy harvesting steps in glycolysis, TCA cycle, and fatty acid catabolism	Ch. 14, 16, handouts
Week 8:	Oxidative phosphorylation, membrane potentials, mechanical energy, and ATP synthesis	Ch. 19, handouts
Week 9:	Enzyme inhibition and activation; hormonal control of energy metabolism in mammals	Ch. 6, 15, 23
	Exam 2	
Week 10:	A reexamination of enzyme structure and mechanism	Handouts
Week 11:	Bioinorganic chemistry: catalytic and structural roles for metal ions in enzymes	Handouts
Week 12:	Advanced mechanisms: enzymes of aromatic amino acid metabolism	Ch. 18, 22, handouts
	Exam 3 - GRE Practice Test	

Week 13:	Methods for probing chemical mechanism – transient kinetics and isotope effects	Handouts
Week 14:	Proteomics and mass spectrometry	Handouts
Week 15:	Alternative metabolic strategies in microorganisms, bioenergetics and biofuel production	Ch. 19, 20, handouts
Final Exam Week	Exam 4	

UNIVERSITY OF HAWAI'I AT MĀNOA
UHM-1 FORM (ADD A COURSE)

See *Guidelines* for instructions and deadlines. For undergraduate courses, submit an original and 4 copies; graduate courses, submit an original and 6 copies. If cross-listed, include extra copies for cross-listed department(s) & college(s). List one course per form. Attach additional sheets as needed.

1. Course Subject	2. Course Number	3. Effective Term *(semester & year)*	4. Frequency *(check all that apply)*
CHEM	463	Fall 2013	☒ Fall semester ☐ Spring semester ☐ Summer semester — Alternate years — Other: _____

5. Offering Status *(check one)*: ☒ Regular ☐ Experimental ☐ Single-term

6a. Full Course Title *(Alpha courses: attach separate sheet & specify title for each alpha)*: Advanced Biochemistry Lab

6b. BANNER Course Title *(30 characters max, including spaces/punctuation. Alpha courses: attach separate sheet & specify title for each alpha)*: Advanced Biochemistry Lab

7. Grade Option *(check all that apply)*: ☒ Letter Grade ☐ Credit/No Credit ☐ Audit ☐ Satisfactory/Unsatisfactory (500, 700, 700F, 800, 800C only) ☐ Honors (Medicine only)

8. Gen Ed Core or Hawaiian/Second Language Requirement Designation *(check one)*: ☒ Do not consider for Core or Hawaiian/Second Language designation. ☐ Request approval of _____ Diversification (DA, DH, DL, DB, DP, DY, DS), Foundations (FW, FS, FG), or Hawaiian/Second Language (HSL) designation (For Foundations, also submit a proposal to General Education Office.)

GEC Use: ☐ Approve ☐ Deny _____ GEC Initials

9. Contact Hours *(meeting hours per week – if variable, specify range)*	10. # of credits *(if variable, give range)*	11. Repeat Limit	12. Credit Limit
10	2	0	2

13. Schedule Type *(check all that apply)*: ☐ Lecture (LEC) ☒ Laboratory (LAB) ☐ Discussion (DIS) ☐ Seminar (SEM) ☐ Lecture/Discussion combined (LED) ☐ Lecture/Laboratory combined (LEL) ☐ Thesis/Dissertation (THE) ☐ Hybrid Technology Intensive (HTI) ☐ Directed Reading or Research (DRR) ☐ Field Experience/ Internship/Practicum (PRA)

14. Co-requisite Course(s)	15a. Major Restriction *(as it should appear in Catalog)*	15b. Banner codes of acceptable majors	16. Class Standing Restriction
none	none		none

17a. Prerequisite Course(s) *(Use "ands", "ors" and punctuation to indicate relationships between prerequisites. "Or consent" is implied for ALL prerequisites. "Consent" requirements can be implemented through your class schedules each semester.)*

CHEM 273L, and BIOL 275L, and BIOL 402 (or concurrent)

17b. Minimum required grade for prerequisites	17c. Blanket requirements listed in Catalog *(if none, write "none")*	17d. Non-introductory (NI) Course? *(Numbered between 300 & 499, or 200-level with college-level course as a prerequisite)*
C	none	☒ Yes ☐ No

18. Catalog Description *(Limit 35 words; 85 words for alpha courses)*

Advanced biochemistry lab techniques: protein purification and characterization, enzyme kinetics, ligand binding, nucleic acid structure, protein structure, fluorescence

19. Justification *Attach separate sheets and indicate the rationale for the request, expected course enrollment, and a course syllabus.*

20. Cross-listed or Honors Course(s)

Course Subject & Number	Chair/Director	Signature	Date
Course Subject & Number	Chair/Director	Signature	Date

21. Requested By

Department/Unit	Chair/Director	Signature	Date

Approved By

1st College or School	Dean	Signature	Date
2nd College or School	Dean	Signature	Date

General Education *(Undergraduate courses)*

Director	Signature	Date

Graduate Division *(600 level and above)*

Dean	Signature	Date

Mānoa Chancellor's Office

Vice Chancellor for Academic Affairs	Signature	Date

Rationale for request:

The Advanced Biochemistry Lab course will be a capstone course for the proposed undergraduate biochemistry major program (see attached *suggested* course outline for this major). This course will teach modern, experimental approaches involving protein structure and folding, protein purification, protein biochemical and biophysical characterization, nucleic acid structure, enzyme kinetic, ligand binding, fluorescence, and molecular modeling. The course will present a 1-semester exposure to experimental biochemistry intended primarily for biochemistry majors, but that might also be suitable for Biology, Marine Biology, Molecular Cell Biology, Microbiology, Zoology, Botany, and MBBE majors. In addition to scientific topics covered, Chem 463 will also emphasize developing writing and oral presentation skills. This is a Writing Intensive (WI) course, and students will be challenged with regular lab reports. The class will also introduce students to reading and presenting primary research literature. Students will give oral presentations on laboratory experiments and research literature.

Overlap with existing courses:
The proposed course has similar content to Biol 275L (Cell and Molecular Biology Lab) and MBBE 402L (Principles of Biochemistry Lab). This class builds on the topics introduced in Biol 275L and includes it as a formal prerequisite. MBBE 402L differs in its emphasis on plant biology. The individual experiments covered in this class have been carefully chosen to avoid overlap with those taught in Biol 275L and MBBE 402L. This class differs from more biologically oriented course offerings in its focus on chemical properties of biological molecules.

Course Syllabus: Attached.

Expected course enrollment: 20-40

Additional Resources Needed: None

Academic units for which this course will be a degree requirement: B.S. Biochemistry, B.A. Biochemistry (both majors are pending approval)

CHEM 463

ADVANCED BIOCHEMISTRY LABORATORY
GENERAL COURSE INFORMATION

INSTRUCTOR

Prof. Ho Leung Ng
Department of Chemistry
Office: Bilger 208B, 956-2014
hng@hawaii.edu

TEACHING ASSISTANTS

TBA

TEXTBOOKS

Handouts will be given out prior to each lab. You are expected to read them thoroughly before lab.

The following books are not required, but helpful for reference. They will be placed on reserve at Hamilton Library.

1. Modern experimental biochemistry, R. Boyer. Benjamin Cummings 2000.
2. Biochemistry laboratory, R. Boyer. Prentice Hall 2012
3. Fundamental laboratory approaches for biochemistry and biotechnology, A.J. Ninfa et al. Wiley 2010

PREREQUISITES

Biol 275L, Chem 273L,Biol 402 (can be taken concurrently)

COURSE OVERVIEW

The course objective is to introduce biochemistry students to the major skills and methods used to study biochemical systems. The class will include lectures but will primarily involve hands on experimental work. Analysis and communication are heavily emphasized. This is a Writing Intensive (WI) class. Emphasis is placed on laboratory notebook keeping, lab reports, and oral presentations.

STUDENT LEARNING OBJECTIVES

1. Maintain an accurate laboratory notebook for biochemistry research.
2. Expression and purification of recombinant proteins by chromatography.
3. Protein characterization by biophysical methods such as mass spectrometry, fluorescence spectrometry, size exclusion chromatography.
4. Quantitative facility with enzyme kinetics and protein ligand binding.
5. Apply chemical principles to developing assays for small molecules
6. Read the biochemical research literature critically.
7. Develop the written and oral communication skills necessary to be a successful scientist.

ATTENDANCE AND PARTICIPATION

Attendance at all class sessions is expected. Each unexcused absence will lower your final grade one letter grade.

Collaboration with your lab partners on lab reports and presentations is expected. However, you are expected to write your own lab report, not copy someone else's verbatim!

ASSIGNMENTS

Students will be assessed by 1) thoroughness and quality of lab notebooks, 2) laboratory reports, 3) oral presentations, and 4) pre-lab quizzes.

Oral pre-lab presentations will be assigned to lab teams. 15 minute presentations will be made at the beginning of each lab to introduce the lab to the entire class.

PERFORMANCE EVALUATON

Pre-lab quizzes	20%
Laboratory notebooks	30%
Laboratory reports	30%
Oral presentations	20%

Pre-lab quizzes

Before each lab, there will be a short, simple quiz to make sure you are prepared for the experiments.

Academic Misconduct

Cheating during an exam and altering an exam prior to submission for regarding are examples of academic misconduct. Violations of acceptable academic conduct will elicit penalties commensurate with the offense. Penalties can include assignment of a failing grade for an examination or a failing grade for the entire course, depending upon the nature and severity of the infraction. Although collaboration during examinations is strictly forbidden, students may work together on problem sets.

The grade in a course is intended to be a reflection of what you have learned in the course. Any instances of plagiarism (presenting someone else's work as your own) will be dealt with through university procedures for academic dishonesty.

Special accommodations

Students with disabilities that might hinder their ability to participate in the full range of class activities should contact the instructor as soon as possible.

SAFETY

Lab safety is of PARAMOUNT importance! Learning lab safety procedures protects you and your classmates. We will go over lab safety in our first session.

Rules to follow:

1. Never pipette by mouth.
2. Dispose of material properly.
3. Tell your TAs if glass is broken.
4. No open toed shoes in the lab (sandals, slippers).
5. No eating or drinking in the lab.
6. If you are not sure what to do, ASK!
7. Wear gloves when working with bacteria or chemicals.

Course Schedule

Week 1	Lab safety, lab notebooks and reports, protein expression of GFP
Week 2	Protein expression, gel electrophoresis, spectrophotometry, protein purification
Week 3	Protein purification, affinity chromatography, ion exchange chromatography
Week 4	Protein purification, size exclusion chromatography, determining molecular mass, determining protein concentration
Week 5	Determining protein concentration, GFP fluorescence, Western blot
Week 6	Western blot, Mass spectrometry
Week 7	Computer lab: molecular modeling
Week 8	Enzyme kinetics (trypsin)
Week 9	Enzyme inhibitors, effects of buffers on enzyme activity
Week 10	Protein-ligand binding (albumin + phenol red)
Week 11	Measuring sugar concentration
Week 12	Measuring cholesterol
Week 13	DNA melting temperature
Week 14	Protein folding
Week 15	Research paper presentations
Week 16	Research paper presentations

E. Condensed CVs for primary instructional faculty

1. Dr. Joseph T. Jarrett, Associate Professor
2. Dr. Ho Leung Ng, Assistant Professor
3. Dr. Tijana Talisman, Assistant Professor

CURRICULUM VITAE

JOSEPH T. JARRETT

Department of Chemistry
University of Hawai'i at Manoa
Bilger 245
2545 McCarthy Mall
Honolulu, HI 96822-2275

email: jtj@hawaii.edu
Office: (808) 956-6721
Cell: (808) 214-3687
Fax: (808) 956-5908

Faculty Appointments:

2006-present	Associate Professor (tenured July 2010) Department of Chemistry University of Hawai'i at Manoa
2003-2005	Associate Professor (tenured July 2003) Department of Biochemistry and Biophysics University of Pennsylvania School of Medicine
1997-2003	Assistant Professor Department of Biochemistry and Biophysics University of Pennsylvania School of Medicine

Postgraduate Training:

1993-1997	Postdoctoral Fellow Biophysics Research Division and Department of Biological Chemistry University of Michigan, Ann Arbor, MI Advisor: Rowena G. Matthews

Education:

1988-1993	Ph.D. in Biochemistry Department of Chemistry Massachusetts Institute of Technology, Cambridge, MA Doctoral Thesis: *Amyloid Fibril Formation in Alzheimer's Disease* Advisor: Peter T. Lansbury, Jr.
1984-1988	B.S. in Chemistry, Magna Cum Laude Department of Chemistry University of Michigan, Ann Arbor, MI Honors Thesis: *Radiolysis of Molten Salts* Advisor: Adon A. Gordus (Chemistry).

Awards, Honors and Membership in Honorary Societies:

2000-2005	Fellowship in Science and Engineering, David and Lucille Packard Foundation
1995-1997	NIH Ruth L. Kirschstein National Research Service Award Postdoctoral Fellowship
1989-1993	NIH Predoctoral Fellowship (Biophysics)
1987	Phi Lambda Upsilon
1986	Phi Beta Kappa

Memberships in Professional and Scientific Societies:

1998-	American Association for the Advancement of Science
1994-	American Chemical Society, Division of Biological Chemistry

1997-	American Society for Biochemistry and Molecular Biology
2001-	Society for Biological Inorganic Chemistry

Teaching:

2010-present	Chem 162. General Chemistry II. 3 credits, 300+ students
2009-present	Chem 372. Bioorganic Chemistry. 3 credits, 15-20 students.
2008	Chem 161. General Chemistry I. 3 credits, 310 students.
2008	Chem 741. Special Topics in Organic Chemistry: Bioorganic Chemistry.
2007	Chem 272. Organic Chemistry I. 3 credits, 135 students.
2006-2007	Chem 181A. Honors General Chemistry. 4 credits, *ca.* 50 students.
2006	Chem 741. Special Topics in Organic Chemistry: Mechanisms of Enzyme Catalysis.

Academic Committees:

2011-	Chair, General Education Committee
2011-	University Council on Articulation
2010-	Senator, University of Hawaii at Manoa Faculty Senate
2008-	Chair, Biochemistry Degree Program Planning Committee
2007-	Chemistry Department Graduate Education Committee
2010-2011	Vice Chair, General Education Committee
2010-2011	Physical Chemistry Faculty Search Committee
2007-2011	College of Natural Sciences Curriculum Committee, Chair 2009-2011
2007-2008	Organic Faculty Search Committee
2006-2007	Chair, Inorganic Faculty Search Committee
2006-2007	Chemistry Department Chair Search Committee

Thesis and Exam Committees:

Thesis Committees:

Ongoing	Zhibin Liang	Williams	Chemistry
Ongoing	Kahoano Wong	Tius	Chemistry
Ongoing	Sedef Malloy	Cooney	Chemistry/HNEI
Ongoing	Derek Birkmire	Jensen	Chemistry
Ongoing	Kristen McReynolds	Vicic	Chemistry
Ongoing	Gary Lum	Head	Chemistry
Ongoing	Chester Dabalos	Kumashiro	Chemistry
Oct 2011	Prabhakara rao Burma	Vicic	Chemistry
Oct 2010	Domonkos Feher	Hemscheidt	Chemistry
Apr 2010	Analia Sorribas	Williams	Chemistry
May 2009	Christopher Bennett	Kaiser	Chemistry
May 2009	Benjamin Philmus	Hemscheidt	Chemistry
Apr 2008	April Banaag	Tius	Chemistry

Oral Examination Committees:

Dec 2007	Francis Dhoro	Tius	Chemistry

Service Activities:

Jun 2012	Chair, Protein-Derived Radicals, Cofactors, and Quinones Gordon Research Conference
Jan 2010	Vice Chair, Protein-Derived Radicals, Cofactors, and Quinones Gordon Research Conference
Oct 2005	Ad Hoc Reviewer, Synthetic and Biological Chemistry B Study Section, CSR, NIH
Oct 2004	Ad Hoc Reviewer, Physical Biochemistry Study Section, CSR, NIH.
Oct 2003	Ad Hoc Reviewer, Physical Biochemistry Study Section, CSR, NIH.

Ongoing Reviewer for Nature, Science, J. Am. Chem. Soc., PNAS, Biochemistry, J. Biol. Chem., Arch. Biochem. Biophys., Biochemical J., FEBS Letters, J. Biol. Inorg. Chem., J. Inorg. Biochem., Inorg. Chem.

Bibliography (selected from *ca.* 50 total publications)

Research publications, peer reviewed:

1. Taylor, AM., Stoll, S., Britt, RD., and **Jarrett, JT.**: Reduction of the [2Fe-2S] Cluster Accompanies Formation of 9-Mercaptodethiobiotin in *Escherichia coli* Biotin Synthase. *manuscript in preparation.*
2. Farrar, CE., Siu, KKW., Howell, PL., and **Jarrett, JT.**: Biotin Synthase Catalyzes Multiple Turnovers of Biotin Formation in the Absence of Inhibition by Products and Product-Related Biomolecules. Biochemistry, Vol. 49:9985-9996 (2010).
3. Reyda MR., Fugate, CE., and **Jarrett JT.**: A Complex Between Biotin Synthase and the Iron-Sulfur Cluster Assembly Chaperone HscA That Enhances In Vivo Cluster Assembly. Biochemistry, Vol. 48:10782-10792 (2009).
4. Farrar CE and **Jarrett JT.**: Protein Residues That Control the Reaction Trajectory in *S*-Adenosylmethionine Radical Enzymes: Mutagenesis of Asparagine 153 and Aspartate 155 in *Escherichia coli* Biotin Synthase. Biochemistry, Vol. 48: 2448-2458, 2009.
5. Taylor AM., Farrar, CE., and **Jarrett JT.**: 9-Mercaptodethiobiotin is Formed as a Competent Catalytic Intermediate by *Escherichia coli* Biotin Synthase. Biochemistry, Vol. 47: 9309-9317, 2008.
6. Reyda MR., Dippold R., Dotson ME., and **Jarrett JT.**: Loss of Iron-Sulfur Clusters from Biotin Synthase as a Result of Catalysis Promotes Unfolding and Degradation. Archives of Biochemistry and Biophysics Vol. 471: 32-41, 2008.
7. Broach RB. and **Jarrett JT.**: Role of the $[2Fe\text{-}2S]^{2+}$ Cluster in Biotin Synthase: Mutagenesis of the Atypical Metal Ligand Arginine 260. Biochemistry Vol. 45: 14166-74, 2006.
8. Berkovitch F., Nicolet Y., Wan JT., **Jarrett JT.**, Drennan CL.: Crystal structure of biotin synthase, an *S*-adenosylmethionine-dependent radical enzyme. Science Vol. 303:76-79, 2004.
9. Ugulava NB., Frederick KK., **Jarrett JT.**: Control of Adenosylmethionine-Dependent Radical Generation in Biotin Synthase: A Kinetic and Thermodynamic Analysis of Substrate Binding to Active and Inactive Forms of BioB. Biochemistry Vol. 42: 2708-2719, 2003.
10. **Jarrett JT.**, Wan JT.: Thermal inactivation of reduced ferredoxin flavodoxin):$NADP^+$ oxidoreductase from *Escherichia coli*. FEBS Letters Vol. 529: 237-242, 2002.
11. Wan JT., **Jarrett JT.**: Electron acceptor specificity of ferredoxin (flavodoxin):$NADP^+$ oxidoreductase from *Escherichia coli*. Archives of Biochemistry and Biophysics Vol. 406: 116-126, 2002.
12. Ugulava NB., Surerus, KK., **Jarrett JT.**: Evidence from Mössbauer Spectroscopy for Distinct $[2Fe\text{-}2S]^{2+}$ and $[4Fe\text{-}4S]^{2+}$ Cluster Binding Sites in Biotin Synthase from *Escherichia coli*. Journal of the American Chemical Society Vol. 124: 9050-9051, 2002.
13. Ugulava NB., Sacanell CJ., **Jarrett JT.**: Spectroscopic changes during a single turnover of biotin synthase: destruction of a [2Fe-2S] cluster accompanies sulfur insertion. Biochemistry Vol. 40: 8352-8358, 2001.
14. Ugulava NB., Gibney BR., **Jarrett JT.**: Biotin synthase contains two distinct iron-sulfur cluster binding sites: chemical and spectroelectrochemical analysis of iron-sulfur cluster interconversions. Biochemistry Vol. 40: 8343-8351, 2001.
15. Ugulava NB., Gibney BR., **Jarrett JT.**: Iron-sulfur cluster interconversions in biotin synthase: dissociation and reassociation of iron during conversion of [2Fe-2S] to [4Fe-4S] clusters. Biochemistry,Vol. 39: 5206-5214, 2000.

Reviews and Book Chapters:

16. **Jarrett JT.**: Iron Sulfur Clusters. In: Encyclopedia of Biophysics. Springer: New York, 2012.
17. Drennan, CL. and **Jarrett JT.**: From single molecules to whole organisms: the evolving field of mechanistic enzymology. Curr. Op. Chem. Biol., Vol. 13: 433-435, 2009.
18. **Jarrett JT.**: News and Views: Radicals by Reduction. Nature, Vol. 452: 163-164, 2008.
19. Farrar CE. and **Jarrett JT.**: Radical S-adenosylmethionine (SAM) Superfamily. In: ENCYCLOPEDIA OF LIFE SCIENCES. John Wiley & Sons, Ltd: Chichester, 2007. http://www.els.net/ %5Bdoi: 10.1002/9780470015902.a0020547%5D
20. **Jarrett JT.**: Biotin Synthase: Enzyme or Reactant. Chemistry & Biology, Vol. 12: 409-410, 2005.
21. **Jarrett JT**.: The novel structure and chemistry of iron-sulfur clusters in the adenosylmethionine-dependent radical enzyme biotin synthase. Archives of Biochemistry and Biophysics Vol. 433: 312-321, 2005.
22. **Jarrett JT**.: The generation of 5'-deoxyadenosyl radicals by adenosylmethionine-dependent radical enzymes. Current Opinion in Chemical Biology Vol. 7: 174-182, 2003.

Alternative Media:

1. Rebecca C. Rawls: Biochemistry's Secret Agents. Chemical and Engineering News Vol. 79(34): 48-49, August 2001. Notes: Science & Technology review of two papers (Ugulava, et al., Biochemistry, 2001) that proposed novel biochemical roles for iron-sulfur clusters in biotin biosynthesis.

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Honolulu, HI 96822-2275

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hng@hawaii.edu

EDUCATION

Institution	Major	Degree, Year
Harvard University	Biochemical Sciences	A.B., 1994
University of California, Los Angeles	Molecular Biology	Ph.D., 2001
University of California, Berkeley	Structural Biology	Postdoc, 2001-2007

APPOINTMENTS

2011 – present	Assistant Professor, Dept. Chemistry, Univ. Hawaii at Manoa
2009-2011	Senior Scientist, ConfometRx, Inc.
2007-2009	Associate Specialist, UC Berkeley

SELECTED PUBLICATIONS

Tosha T*, **Ng HL***, Bhattasali O, Alber T, Theil EC. (2010). Moving metal ions through ferritin protein nanocages: the journey from three-fold pores to catalytic sites. *J. Am. Chem. Soc.* 132, 14562. (***Co-lead authors**).

Lang PT*, **Ng HL***, Fraser JS, Corn J, Echols N, Sales M, Holton J, Alber T. (2010). Observation of protein conformational polymorphism in crystallographic electron density maps. *Protein Science*. 19, 1420. (***Co-lead authors**).

Lin MZ, McKeown MR, **Ng HL**, Aguilera T, Shaner NC, Adams SR, Ma W, Alber T, Tsien RY. (2009). Autofluorescent proteins with excitation in the optical window for intravital imaging in mammals. *Chemistry & Biology*. 16, 1169.

Bertin A, McMurray MA, Grob P, Park SS, Garcia G, Patanwala I, **Ng HL**, Alber T, Thorner J, Nogales E. (2008). *Saccharomyces cerevisiae* Septins: Supramolecular Organization of Hetero-oligomers and the Mechanism of Filament Assembly. *Proc. Natl. Acad. Sci. USA*. 105, 8274.

Gay LM, **Ng HL**, Alber T. (2006). A conserved dimer and global conformational changes in the structure of apo-PknE Ser/Thr protein kinase from *Mycobacterium tuberculosis*. *J. Mol. Biol.* 360, 409.

Grundner C, **Ng HL**, Alber T. (2005). Mycobacterium tuberculosis protein tyrosine phosphatase PtpB structure reveals a diverged fold and a buried active site. *Structure* 13, 1625.

Pullen KE, **Ng HL**, Sung PY, Good MC, Smith SM, Alber T. (2004). An alternate conformation and a third metal in PstP/Ppp, the M. tuberculosis PP2C-Family Ser/Thr protein phosphatase. *Structure* 12, 1947.

Ng HL, Dickerson RE. (2002). The mediation of the A↔B DNA transition by guanine tracts.

Nucleic Acids Res. 30, 4061.

Ng HL, Dickerson RE. (2001). Mildly eccentric 'E-DNA'. *Nature Struct. Biol.* **8**, 107.

Dickerson RE, **Ng HL**. (2001). DNA structure from A to B. *Proc. Natl. Acad. Sci. USA* 98, 6986.

Ng HL, Kopka ML, Dickerson RE. (2000). The structure of a stable intermediate in the A↔B DNA transition. *Proc. Natl. Acad. Sci. USA* 97, 2035.

Marcotte E, Pellegrini M, **Ng HL**, Rice DW, Yeates T, Eisenberg D. (1999). Detecting protein function and protein-protein interactions from genome sequences. *Science* 285, 751.

SYNERGISTIC ACTIVITIES

1. Mentored 8 women and minority PhD students and postdoctoral fellows, MentorNet, 2009-present
2. Recipient of NIH Postdoctoral Fellowship and Medical Scientist Training Program Fellowship
3. Co-developing curriculum for new Biochemistry B.A/B.S. programs at Univ. Hawaii
4. Developed curriculum for new Scientific Ethics course at Univ. Hawaii
5. Invited speaker for TEDx Honolulu 2011, a forum for top thinkers and speakers to share their ideas with community leaders

GRADUATE AND POSTDOCTORAL ADVISORS

Tom Alber (UC Berkeley), David Eisenberg (HHMI/UCLA), Richard Dickerson (UCLA)

COLLABORATORS (Past 48 months)

Roger Tsien (HHMI/UCSD), Michael Lin (Stanford), Brian Kobilka (Stanford), Elizabeth Theil (Childrens Hospital Oakland Research Institute), Takehiko Toshi (SPring-8, Japan), James Holton (Lawrence Berkeley National Laboratory), James Fraser (UCSF), Eva Nogales (HHMI/UC Berkeley), Jeremy Thorner (UC Berkeley)

CURRENT TRAINEES (UH MANOA)

Matthew Bronstad (M.S.)

FORMER TRAINEES (UC BERKELEY) AND CURRENT POSITIONS

Wendy Ma (B.A.), Medical Student, UCSF
Camilla Guitarte (B.A.), Medical Student, SUNY Downstate
Onita Bhattasali (B.A.), Medical Student, Tulane
Brett McBrayer (B.A.), Research Associate, Novozymes

Tijana Talisman, Ph.D.

University of Hawai'i at Mānoa
2545 McCarthy Mall
Honolulu, HI 96822
808-956-3207; talisman@hawaii.edu

Education

2005 **Ph.D.** in Chemistry **with distinction**, Columbia University, New York, NY
Ph.D. Thesis: "Substrate binding to cytochrome P450 BM-3: temperature and redox dependence"

2004 **M.Phil.** in Chemistry, Columbia University, New York, NY

2001 **M.A.** in Chemistry, Columbia University, New York, NY

2000 **B.Sc.** in Physical Chemistry, University of Belgrade, School of Physical Chemistry, Serbia
B.Sc. Thesis: "Obtaining and characterizing neelaredoxin"

Research Experience

University of Hawai'i at Mānoa, Department of Chemistry, Honolulu, HI
Assistant Professor (8/2011-present)

NIH, NICHD, Bethesda, MD Advisor: **J. Lippincott-Schwartz**
Postdoctoral Intramural Research Training Award Fellow (6/2009-7/2011)
Utilized different microscopy approaches including super resolution fluorescence technique PALM to investigate the dynamic distribution of the plasma membrane proteins.

Rockefeller University, New York, NY Advisor: **B. T. Chait**
Postdoctoral Research Associate (10/2005-6/2009)
Investigated nuclear pore complexes (NPCs) and subsequently engineered/characterized artificial nanopores that mimic the transport selectivity of the NPC.
Identified protein complexes using crosslinking approaches and mass spectrometric readout.

Columbia University, Chemistry Department, New York, NY Advisor: **A. E. McDermott**
Postdoctoral Research Scientist (2/2005-10/2005) & **Doctoral Research** (9/2000-2/2005)
Developed and implemented spectroscopic methods (solid state NMR, EPR, and UV-Vis spectroscopy) to locate the position of the substrates during the initial steps of the catalytic cycle of cytochrome P450 isozymes.
Investigated relaxation properties of well-established and novel MRI agents to aid in drug discovery.

Mayo Clinic, Hematology Department, Rochester, MN Advisor: **F. Rusnak**
Special Project Associate (6/1999-4/2000)
Obtained and characterized novel paramagnetic protein, neelaredoxin from *Treponema pallidum*, to determine its function.

University of Belgrade, Belgrade, Serbia Advisor: **B. Adnadjevic**
Undergraduate research (1999)
Used different agents that control the size, shape, and fusion of particles to synthesize amorphous $CaCO_3$.

Mentoring and Teaching Experience

Co-supervised 2 postdocs, 2 graduate students; **supervised** 2 technicians, 1 undergraduate student
Instructor, General Chemistry Lectures, Columbia University (2003, 2004)
Assisted Prof. Ann McDermott in preparing and proctoring the exams; tutored small groups of students.
Teaching Assistant, General Chemistry, Columbia University (2000-2001)

Fellowships and Awards

- **Jack Miller Award**, excellence in teaching by a graduate student, Columbia University, 2002
- **Columbia-Upjohn Fellowship**, Columbia University, 2001-2002
- **Faculty Fellowship,** Department of Chemistry, Columbia University, 2001-2002, 2002-2005
- **Serbian Chemical Society Special Award**, outstanding achievements during undergraduate studies, Serbia, 2001
- ***"Sestre Bulajic"* Fund Award**, best bachelor's thesis in the field of physical chemistry in 2000, University of Belgrade, Serbia, 2001
- ***"Pavle Savic"* Award**, most successful graduate in physical chemistry in 2000, Physicochemical Society of Serbia, Serbia, 2000
- **Republic of Serbia National Fellowship**, Serbia, 1996, 1998, 1999

Service and Leadership

- Co-organizer of the 2nd Nuclear Pore Complex Workshop, Albuquerque, NM, July 2010; involved in procuring grants, logistics, abstract/speaker selection, and chairing the session
- Invited reviewer for Proc. Natl. Acad. Sci. U. S. A. and J. Cell Sci.
- 2009 Selection Committee Member, The Rockefeller University high school summer science outreach program
- Co-organizer and volunteer teaching instructor for "Girl's Science Day" and "Take a Girl to College Day", Columbia University, New York, NY, 2004, 2005
- Involved in starting Women in science at Columbia and organizing member activities, 2004, 2005

Professional Affiliations

- American Chemical Society, 2004-present
- American Society for Cell Biology, 2008-present
- Biophysical Society, 2009-present
- US MENSA, 2009-present

Selected Publications

- Sengupta P*., **Jovanovic-Talisman T***., Skoko D., Veatch S., Lippincott-Schwartz J. "Probing protein heterogeneity in the plasma membrane using PALM and pair correlation analysis" *Nature Methods,* 2011 doi: 10.1038/nmeth.1704, In Press
- **Jovanovic-Talisman T.**, Zilman A., "Building a basic nanomachine" *Nature Nanotechnology*, 2011, 6, 397-398
- Zilman A., Di Talia S., **Jovanovic-Talisman T.**, Chait B.T., Rout M.P., Magnasco M.O. "Enhancement of transport selectivity through nano-channels by non-specific competition" *PLoS Comput. Biol.*, 2010, 6, e100084
- **Jovanovic-Talisman T.**, Tetenbaum-Novatt J., McKenney A.S., Zilman A., Peters R., Rout M.P., Chait B.T. "Artificial nanopores that mimic the transport selectivity of the nuclear pore complex" *Nature*, 2009, 457, 1023-1027
- **Jovanovic T.**, Farid R., Friesner R. A., McDermott A. E. "Thermal equilibrium of high- and low-spin forms of cytochrome P450-BM3: repositioning of the substrate?" *J. Am. Chem. Soc.*, 2005, 127, 13548-13552
- **Jovanovic T.**, McDermott A. E. "Observation of ligand binding to cytochrome P450 BM-3 by means of solid state NMR spectroscopy" *J. Am. Chem. Soc.*, 2005, 127, 13816-13821
- **Jovanovic T.**, Ascenso C., Hazlett K. R. O., Sikkink R., Krebs C., Litwiller R., Benson L. M., Moura I., Moura J. J. G., Radolf J. D., Huynh B. H., Naylor S., and Rusnak F. "Neelaredoxin, an iron-binding protein from the syphilis spirochete, *Treponema pallidum*, is a superoxide reductase" *J. Biol. Chem.*, 2000, 275, 28439-28448

* Both authors contributed equally

F. Letters of Support

1. Dr. Jerris Hedges, Dean, John A. Burns School of Medicine, UH Manoa.
   Dr. Scott Lozaroff, Chair, Department of Anatomy, Biochemistry, and Physiology, JABSOM, UH Manoa.

2. Dr. John M. Pezzuto, Dean, College of Pharmacy, UH Hilo.

3. Dr. Paul Patek, Chair, Department of Microbiology, UH Manoa.

4. Dr. Steven Robinow, Professor, Department of Biology, UH Manoa.

5. Dr. Tom Ranker, Chair, Department of Botany, UH Manoa.

6. Dr. Harry Ako, Professor and former Chair, Department of Molecular Biosciences and Bioengineering, UH Manoa.

John A. Burns School of Medicine
Office of the Dean

UNIVERSITY of HAWAI'I® MĀNOA

November 10, 2011

Joseph T. Jarrett, PhD
Associate Professor
Department of Chemistry
University of Hawaii at Manoa
Bilger Hall 245
2425 McCarthy Mall
Honolulu, HI 96822

Dear Dr. Jarrett:

This letter of support is provided to accompany your proposal to initiate a new program at UH Mānoa leading to a baccalaureate BS or BA degree in Biochemistry. As you are aware, discussions were undertaken with Dr. Ho Leung in this regard and we support your proposal. Indeed, a Biochemistry Program has long been absent from our campus and your proposal will solve this deficiency. It appears that sufficient resources and faculty are available to initiate the program. The plan that Dr. Leung described was clear and well focused.

As we expressed in an earlier communication, the John A. Burns School of Medicine (JABSOM) has maintained a series of undergraduate Biochemistry courses with BIOC441 as the primary offering. This course was developed many years ago with the intention of providing UH undergraduates with a biochemistry course that emphasized medical concepts. The rationale for this course is that our Problem Based Learning (PBL) curriculum at JABSOM requires a firm understanding of medical biochemistry concepts. The PBL approach emphasizes diagnostic reasoning requiring student-based independent learning from the very first day of matriculation. Medical biochemistry concepts are central to the process of differential diagnosis. It is our understanding from Dr. Leung that the program you propose is oriented toward biophysical concepts. Our medically oriented biochemistry course will not compete with your proposed program. We will continue to offer BIOC441 and we understand that it is possible that you will provide your students with the option of taking BIOC441 for credit in your program.

Sincerely,

Jerris Hedges, MD, MS, MMM
Dean and Professor of Medicine,
Barry & Virginia Weinman – Endowed Chair

Scott Lozanoff, PhD
Professor and Chair
Department of Anatomy, Biochemistry & Physiology

UNIVERSITY
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HILO

October 10, 2011

Joseph T. Jarrett
Associate Professor
Department of Chemistry
University of Hawaii
Bilger 245
2545 McCarthy Mall
Honolulu, HI 96822

Dear Dr. Jarrett,

On behalf of the UH Hilo College of Pharmacy, I am writing in support of your proposal for a Bachelor's Degree in Biochemistry to be offered through the Department of Chemistry at UH Manoa. This degree program would add to the number of students trained in the core biological and physical sciences, i.e., the STEM disciplines, which is clearly a high priority for the State and Pacific Region. Once they graduate, we would welcome their application to our PhD in Pharmaceutical Science program.

In addition, I would recommend close scrutiny of pre-requisites for entry into our PharmD program. As you probably know, a Bachelor's degree is not a requirement for entry, but approximately 70% of our students have obtained this degree. It appears to me your proposed curriculum will form a solid core of an independent pre-pharmacy experience, provided electives include courses such as Human Anatomy & Physiology. You are welcome to consult with our student services team for specific details. Clearly, however, students meeting the pre-requisites would be competitive for the 90 positions we offer each year in pharmacy.

Best wishes with your proposal.

Sincerely yours,

John M. Pezzuto
Professor and Dean

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University of Hawaii at Manoa

Department of Microbiology

Snyder Hall 207 • 2538 The Mall • Honolulu, Hawaii 96822
Telephone: (808) 956-7025 • Facsimile: (808) 956-5339 • patek@hawaii.edu

October 11, 2011

Joseph T. Jarrett
Associate Professor
Department of Chemistry
University of Hawaii
Honolulu, HI 96822

Joe,

An undergraduate program in biochemistry is long overdue at the University of Hawaii. The Bachelor of Science Degree in Biochemistry you have outlined seem quite appropriate and will prepare students for careers in science and education, and will serve as a stepping stone for more advanced degrees. Additionally, your proposed degree expands the range of STEM offerings at UHM, and should complement both the Microbiology and Molecular Cell Biology degrees offered through our department.

We see no significant overlap or redundancy between the proposed Biochemistry curriculum and the Microbiology and Molecular Cell Biology curricula. Your proposed curriculum requires significantly more Chemistry/Math/Physics courses and less Biology/Microbiology courses than our programs, and should attract students whose interests and abilities align with this physical sciences emphasis.

Future biochemistry students are welcome in Microbiology courses, provided that they have fulfilled the necessary prerequisites. There is currently sufficient space in these courses for the additional 5-10 students per year from your program that you project might take any given course.

Good luck with your proposal.
Sincerely,

Paul Patek, Ph.D
Professor and Chair

Re: Support for a proposed BS Biochemistry degree

1 message

Steven Robinow <robinow@hawaii.edu> **Tue, Sep 27, 2011 at 7:44 AM**
To: JosephT Jarrett <jtj@hawaii.edu>
Cc: Chris Womersley <womersle@hawaii.edu>

Joe,

I am generally in support of your proposal. I am a strong proponent of evolutionary biology and would like to see these students exposed at least to some aspects of evolution. And ecological principles are also important - particularly systems ecology that gets down to issues of the cycling of elements - which of course involves lots of chemistry. But I realize that you can't pack it full of everything.

Maybe you could add a few upper division courses as choices for electives:

Zool 442: Principles of Neurobiology

our upper division ecology and evolution courses require Biol 265. so adding these might be more problematic, but I think they would add interesting scope.

We will make room for all students that have the pre-reqs for Biology 275 (Biology 171, Chem 272 and labs) independent of major.

-Steve

****
Department of Zoology
2538 McCarthy Mall
University of Hawaii
Honolulu, HI 96822
phone: 808-956-8088
FAX: 808-956-9812
****

Support for proposed BS Biochemistry major

Tom Ranker <ranker@hawaii.edu> **Mon, Sep 26, 2011 at 11:15 AM**
To: JosephT Jarrett <jtj@hawaii.edu>

Hi Joe,

I am incomplete support of your proposal to implement a BS degree in Biochemistry and see no conflicts with the Department of Botany.

Best wishes,
Tom

Tom A. Ranker, Professor and Chair
Department of Botany
UHM
[Quoted text hidden]

comment on your biochemistry proposal

1 message

Harry Ako <hako@hawaii.edu> **Wed, Feb 9, 2011 at 12:19 PM**
To: Joseph T Jarrett <jtj@hawaii.edu>

Faculty most interested in undergraduate instruction in molecular biosciences in the Department of Molecular Biosciences and Bioengineering (MBBE) support your creation of a biochemistry major within the Department of Chemistry at the University of Hawaii at Manoa. In this major, our MBBE/BIOL 402 biochemistry course is envisioned to be Biochemistry I of your senior year Biochemistry I and Biochemistry II series. This would ratify MBBE's many years of work in developing the 402 course and would be contrary to developing another, small redundant biochemistry course which in our opinion would be inefficient.

In our meeting with you, we pointed out that we offer 402 in the Spring as well and this could be used by majors who are out of sync in their coursework timing.

Our students who have especially liked our 402 biochemistry have been asking for additional biochemistry coursework for years. Your program will offer them additional undergraduate biochemistry training.

I see your efforts as an attempt to work to enhance Hawaii students' STEM skills. Your major would be a departmentally administered program which would take advantage of another discipline and we would be pleased to offer our help.

Reviewed by:

Department Chair:

Kristin K. Kumashiro [signature] 2/8/2012

Print Name | Signature | Date

College/School Dean(s):

William L. Ditto [signature] 2/15/2012

Print Name | Signature | Date

Vice Chancellor for Academic Affairs:
Comments and Recommendations:

Reed Dasenbrock

Print Name | Signature | Date

Council of Chief Academic Officers (Systemwide Consultation):
Comments/Recommendations:

Linda K. Johnsrud

Print Name | Signature | Date

Chancellor: ___ ***Approved*** ___ ***Disapproved***

Virginia S. Hinshaw

Print Name | Signature | Date