

AUTHORIZATION TO PLAN AN ACADEMIC PROGRAM AT MANOA

1. Locus (Unit, School/College)

College of Natural Sciences

2. Chair/Convener of Planning Committee

Paul Patek and Sean Callahan

3. Program Category:

New

4. Department/Unit/Program

Department of Microbiology

5. Level of Program or Major (Graduate, Undergraduate, etc.)

Undergraduate

6. Degree or Certificate Proposed

Molecular Cell Biology

7. Proposed Planning Period

November 15, 2007 to November 14, 2008

8. Proposed Date of Implementation

Fall Semester, 2008

9. Program Description (Objectives and Relationship to Mission)

Molecular and cellular biology are the driving forces behind the majority of biological research studies today and form the basis of the biotechnology and nanotechnology industries. Currently, there is no undergraduate degree in molecular and cellular biology offered at the University of Hawaii. Although a degree in Microbiology has a cell and molecular biology focus by virtue of the unicellular nature of most microorganisms and the emphasis on molecular studies concerning viruses and the immune system, a corresponding degree in eukaryotic molecular biology is lacking. The Department of Microbiology seeks permission to plan the creation of a comprehensive undergraduate

degree program in Molecular Cell Biology that focuses on eukaryotic systems at the molecular and cellular levels.

10. Program Justification (Needs and Rationale)

Importance of a Molecular and Cellular Biology Degree. It is hard to overstate the importance of having a robust undergraduate program in Molecular Cell Biology (MCB). The field has had profound impacts on society, politics, and most directly, healthcare. Undergraduates, especially those planning a career in the health professions, and graduate students will be attracted to the College of Natural Sciences and the university by the program, and the state of Hawaii will benefit from the creation of a well-trained pool of applicants for positions in biotechnology companies and medical schools. Of the 18 benchmark universities compiled by the UH Office of Planning and Policy, universities that UH is striving to emulate, 12 offer undergraduate degrees in cell and molecular biology or related field, and almost all have a department of similar name (Please see section A of Supporting Material).

Advantages of administering the program in the Microbiology Department. Administration of the MCB degree from the Department of Microbiology is both appropriate and has several advantages. Existing faculty research programs all have components that will complement and be complemented by an instructional program in the molecular biology of prokaryotes and eukaryotes. Such programs include those focused on the human immune system (Patek), animal-bacteria pathogenic interactions (Hoang and Douglas), animal-virus interactions (Li), yeast and fungi (Robert and Donachie), bioinformatics of eukaryotic genomes (Alam), and developmental biology (Callahan). All members of the department have research programs incorporating studies at the molecular level, making the department unique within the College of Natural Sciences.

There is tremendous pent-up demand for a MCB undergraduate degree program as evidenced by student enrollment in upper-level courses in the biological sciences. Currently, it is the Department of Microbiology that is partially fulfilling this demand. In the '06-'07 school year, the Department of Microbiology, with 64 majors, teaches the equivalent of 92% of the upper-division SSH taught by the Biology program, which has 560 majors (Please see section B of Supporting Material). Furthermore, one Biology course with a molecular focus, Concepts of Genetics (BIOL 375) accounts for 28% of all upper division student semester hours in the Biology Program. In the Microbiology Department we would like to think that it is our superior teaching that attracts students from other departments to take our courses as electives, but the reality is that Microbiology courses are molecular in nature, and the perceived value of molecular and cell biology courses is high among undergraduates. While BIOL 375 is a required course for the 560 Biology majors, non-Microbiology majors are electing to take Microbiology courses.

As examples MICR 351 (Biology of Microorganisms), 461 (Immunology), 431 (Bacterial Physiology) and 475 (Bacterial Genetics) historically have all had substantially more non-majors than Microbiology majors enrolled. In the fall 2006 semester 76% of students in these courses were non-majors, and 45% were Biology majors taking these courses as electives.

It could be argued that the Department of Microbiology is already teaching the upper division cell and molecular courses to undergraduates in the life sciences at UH. However, with the exception of the immunology course, Microbiology focuses on the study of prokaryotic and lower eukaryotic organisms. What is lacking is a degree program focused on the molecular and cellular biology of higher eukaryotic organisms. The establishment of an undergraduate MCB degree with the resource backing of the Department of Microbiology would remedy this deficiency at UH.

11. Activities to be undertaken during the planning phase

During the planning phase the degree requirements will be finalized, stakeholders will be consulted on the design and implementation of the program.

12. Description of resources required and status or sources

A. Faculty

No new faculty are required to initiate the program. All of the courses included in the degree program currently exist. Although no new faculty are required, it would be advisable to hire two full time faculty to teach the Genetics (BIOL375) and Cell Biology (BIOL406) courses to stabilize the program. Both courses are currently taught by faculty outside of the College of Natural Sciences, and in particular, there has been some difficulty finding an instructor for the Genetics course.

B. Library resources (including an evaluation of current resources and an estimate of the cost of additional resources required)

Existing resources are adequate.

C. Physical resources (space, equipment, etc.)

Existing resources are adequate.

D. Additional resources required (staff, graduate assistantships, etc.)

If enrollment in the lab courses increases significantly, then TAs will be required for those courses. If an increase in enrollment comes from additional students enrolling in the life sciences then more TAs will need to

be hired. However, if an increase in enrollment comes from existing life science students changing their majors to MCB then TAs can be shifted from courses with decreased enrollment. Because all of the courses for the major are being taught already, there will be no costs associated with new instructional plans. However, increased enrollment in the Cellular Biology Laboratory (BIOL406L) and Molecular Biology Laboratory (BIOL407L) courses is anticipated to require approximately \$30,000 per year. In addition, a student support staff position for advising will be required once enrollment exceeds 100. Below 100 majors, Microbiology faculty can advise students as they now do for Microbiology majors.

E Estimate of additional position counts and budget implementation for first five years of the program

As stated, no new faculty are required, but to stabilize the program positions are requested for existing Genetics and Cell Biology courses. Upon enrollment of 50 majors in the program, anticipated in year two, the Genetics position should be filled. Salary for years 3, 4 and 5 will be required. At enrollment of 100 students, anticipated in year three, the Cell Biology position should be filled. Salary for years 4 and 5 will be required. In addition, funding for 2 additional TA positions to cover increased enrollment in existing Cell Biology and Molecular Biology laboratory courses will be required.

F. Additional resources should enrollment fall short of estimates

Below enrollment of 50 majors, no new personnel resources would be required. New faculty and TA positions are contingent upon reaching enrollment benchmarks, therefore if enrollment falls below estimates, no new faculty or TA positions are required; existing faculty and TA positions will suffice if enrollment is below 50 majors.

13. Five-Year Business Plan. Please provide a five-year projected budget for the program that includes: 1) projected enrollment and estimated tuition revenue, 2) additional sources of revenue, and 3) costs associated with the resources noted above.

A. Enrollment and tuition revenue. We expect enrollment in the undergraduate MCB degree program to be robust from the start and continue to climb each successive year after its introduction for several years. Conservative estimates for majors by year are: 1st year – 25; 2nd year – 50; 3rd year – 100; 4th year – 150; 5th year - 200. Estimates are based on the proportion of students in the life sciences at other universities enrolled in undergraduate molecular and cellular biology programs. For instance, at UC Davis, a UH peer institution, 1650 of 4765 students (35%) with declared majors in the College of Biological Sciences

are majoring in Biochemistry and Molecular Biology, Cell Biology or Genetics. At the University of Washington, a UH benchmark institution, 407 of 1128 (36%) life science majors are enrolled in the Molecular, Cellular and Development program (please see section E of Supporting Material). 36% of the non-Marine Biology life science majors in the College of Natural Sciences at UH represents 274 majors. MCB majors will consist primarily of students that would have otherwise been Microbiology or Biology majors and students that were attracted to UH because it offers the MCB Program. Tuition from MCB majors would be expected to account for \$2M per year by year 5.

B. Additional sources of revenue.

If the degree program is approved, we will apply for a NSF Course, Curriculum, and Laboratory Improvement (CCLI) grant. These pay up to \$150,000. No matching funds are required. Initiation of new programs is an opportune time for requesting funding of this sort from NSF. However, this proposed program is unique since no new courses are being proposed at the outset. Therefore, while NSF funding would facilitate creation a world-class MCB program, it is not necessary for its inception or continuation.

C. Associated costs.

Apart from those listed under “Additional resources required”, none are anticipated.

14. Does the current or proposed budget include funds or a request for funds for the proposed program? Please provide details.

None

15. Given a “flat budget” situation, how will the proposed program be funded?

A flat budget situation will not affect the program significantly when enrollment is under 50 majors. For more than 50 majors, additional resources as indicated will be required, necessitating limitation of enrollment in a flat budget situation.

16. Impact on current courses or programs.

Enrollments in BIOL406/L and BIOL407 are expected to increase when these courses are required for an MCB degree. Many of the MCB majors will be students who would otherwise have been Microbiology or Biology majors. Both of these programs are expected to have reduced enrollment.

17. If this program is multidisciplinary, provide evidence of commitment for support from the colleges, departments, programs, and/or individuals expected to participate

18. Authorization to Plan Approved

Department Chair(s)/Program Director(s):

PAUL PATEK  10/26/07
Print Name Signature Date

College/School Dean(s):

Thomas Craven  10/26/07
Print Name Signature Date

Print Name Signature Date

Graduate Division Dean (graduate programs only):

Comments and Recommendations:

Print Name Signature Date

Vice Chancellor for Academic Affairs:

Comments and Recommendations:

Print Name Signature Date

Chancellor: *Approved* *Disapproved* *Deferred*

Comments and Recommendations:

Print Name Signature Date

c: Manoa Faculty Senate
Manoa Budget Office

Supporting Material

A. Undergraduate Molecular and Cellular Biology degrees offered by Benchmark Universities (Universities we strive to be like).

Benchmark University

Undergraduate Cell and Molecular Degrees

Indiana University at Bloomington	None
Michigan State University	Micro and Mol Gen; Bioch & Mol Bio
SUNY Buffalo	None
University of Arizona	None
University of California – Berkeley	Mol and Cell Biology
University of California – Davis	Cell Bio; Genetics
University of California – Los Angeles	Mol, Cell and Dev Bio
University of Colorado at Boulder	Mol, Cell and Dev Bio
University of Florida	Micro and Cell Sci
University of Illinois at Urbana Champaign	Mol and Cell Bio
University of Iowa	Cell and Dev Bio; Genetics
University of Maryland, College Park	None
University of Michigan, Ann Arbor	Cell and Molecular Bio
University of Minnesota, Twin Cities	Genetics, Cell Bio and Dev
University of Missouri, Columbia	None
University of Oregon	None
University of Washington, Seattle	Mol, Cell, and Dev Bio
University of Wisconsin, Madison	Genetics

B. Undergraduate Student Semester hours for School Year 06-07

	lower division SSH	upper division SSH	Total SSH	number of majors*
Biology	7743	2120	9863	529
Botany	749	944	1657	30
Microbiology	1389	1947	3369	64
Zoology	764	927	1691	87

Fall '06 data from Star Correspondent on 9/28/2006
 Spring '07 data from Star Correspondent on 1/12/07
 All 399 and 499 data is excluded (the numbers are small)
 *From Star Correspondent 2/6/07

Undergraduate SSH relative to Microbiology

	lower division SSH	upper division SSH	Total SSH
Biology	5.6	1.1	2.9
Botany	0.5	0.5	0.5
Microbiology	1.0	1.0	1.0
Zoology	0.6	0.5	0.5

C. Enrollment in Microbiology courses by major.

MICR 351 (taught fall & spring; only fall data shown)	Enrollment:	65	MICR 461	Enrollment:	127
	Micro majors:	13		Micro majors:	28
	Biology majors:	32		Biology majors:	53
	Other majors:	20		Other majors:	46
MICR 431	Enrollment:	51	MICR 475	Enrollment:	51
	Micro majors:	9		Micro majors:	23
	Biology majors:	34		Biology majors:	13
	Other majors:	9		Other majors:	15

D. Existing courses at UH that could serve as the basis for an undergraduate MCB degree.

Requirements:

Genetics	BIOL375	3	1 (Lecture / Lab credits)
Biochemistry	BIOL405/441	4	-
Cell Biology	BIOL406	3	1
Molecular Biology	BIOL407	3	1
Immunology	MICR461	3	2
Molecular Biology Lab	MCMB4XX	-	3

Electives

Developmental Biology	ZOOL420	3	2
Molecular Biotechnology	BIOL401	3	-
Microbial Biotechnology	MBBE405	3	-
Integrative Gen and Biotech	MBBE480	3	3
Research Ethics	MICR314	1	-
Biology of Microorganisms	MICR351	3	2
Marine Microbiology	MICR401	3	1
Microbial Physiology	MICR431	3	2
Microbiology of Pathogens	MICR463	3	2
Microbial Pathogenesis	MICR470	3	-
Bacterial Genetics	MICR475	3	2
Microbes and their Environment	MICR485	3	2
Virology	MICR490	3	2

E. Molecular Cell Biology enrollment at UH benchmark and peer institutions: The University of Washington and UC Davis:

University of Washington Department of Biology

Molecular, Cellular, & Development:	407
Physiology:	295
General Biology BS/BA:	277 (267 BS/10 BA)
Ecology & Evolution:	67
Environment & Conservation:	46
Plant Biology:	21
Old Zoology, Botany, and Cellular Biology Majors:	15
Most current total # of life science students:	1,128

Total Molecular, Cellular, & Development/total enrolled at U of Washington...407/1128=36%

UC Davis College of Biological Sciences

Enrollment by Declared Majors (Fall Quarter 2006)

	Number	% of declared
*Biochemistry and Molecular Biology	1,090	22.9%
Biological Sciences	1,914	40.2%
*Cell Biology	111	2.3%
Evolution, Ecology, and Biodiversity	69	1.4%
Exercise Biology	444	9.3%
*Genetics	449	9.4%
Microbiology	168	3.5%
Neurobiology, Physiology, and Behavior	492	10.3%
Plant Biology	27	0.6%
Total Enrollment	4,764	100%

*Molecular Cell Biology (MCB) students at UC Davis:
 Biochem and molecular Biol ... 1090
 Cell Biology 111
 Genetics..... 449
 Total MCB/Total enrolled..... 1650/4764=35%