

**BOARD OF HIGHER EDUCATION**  
**REQUEST FOR COMMITTEE AND BOARD ACTION**

**COMMITTEE:** Academic Affairs

**NO:** AAC 17-21

**COMMITTEE DATE:** June 13, 2017

**BOARD DATE:** June 20, 2017

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**APPLICATION OF UNIVERSITY OF MASSACHUSETTS DARTMOUTH TO AWARD  
THE DOCTOR OF PHILOSOPHY DEGREE IN INTEGRATIVE BIOLOGY**

**MOVED:** The Board of Higher Education hereby approves the application of **University of Massachusetts Dartmouth** to award the **Doctor of Philosophy in Integrative Biology**.

Upon graduating the first class for this program, the University shall submit to the Board a status report addressing its success in reaching program goals as stated in the application and in the areas of enrollment, curriculum, faculty resources, and program effectiveness.

**Authority:** Massachusetts General Laws Chapter 15A, Section 9(b)

**Contact:** Winifred M. Hagan, Ed.D., Associate Director for Academic Affairs and Student Success

## BOARD OF HIGHER EDUCATION

June 2017

### University of Massachusetts Dartmouth Doctor of Philosophy in Integrative Biology

#### INTENT AND MISSION

The mission of the University of Massachusetts Dartmouth (UMD) is to act as an intellectual catalyst for regional, national, and global economic and cultural development and to provide educational opportunities for the residents of Southeastern Massachusetts. UMD reports that a doctoral program in Integrative Biology will help achieve these objectives.

The purpose of the proposed Ph.D. program in Integrative Biology (PhD/IB) at UMD is to foster the training and experience of students across biological sub-disciplines. The main objectives of the proposed PhD/IB program are to provide students with a scientific background that spans the three broad categories of Molecular and Cellular Biology, Organismal and Developmental Biology, and Evolution and Ecology with deep content knowledge in one of these areas. UMD plans that this integrated training will characterize the program and differentiate graduates who are capable of thinking beyond the traditional boundaries of biology subfields. UMD intends that this capacity to synthesize the ideas and tools of disparate sub-disciplines will enable graduates to investigate life and perform independent research in ways that encompass the full range of modern biological techniques used across disciplines (e.g., statistical analysis, genome sequencing, advanced microscopy, chemical analysis, field methods, microsurgery). UMD further intends that graduates will develop competency in scientific communication with a focus on publication, presentation, public rhetoric, ethics, and civic engagement. It is anticipated that graduates will be prepared for professions in industry, government and academia.

The proposed program has obtained all necessary governance approvals on campus and was approved by the University of Massachusetts, Board of Trustees on April 12, 2017. The required letter of intent was circulated on December 29, 2016. No comments were received.

#### NEED AND DEMAND

##### *National and State Labor Market Outlook*

Employment of biologists is projected to grow at 7% nationally, over the period of 2014-2024<sup>1</sup>. The statewide increase is expected to be as high as 21% over the same period.<sup>2</sup> The Brookings Institute reports that job openings for Ph.D. level STEM positions are in high demand and that employers have the hardest time filling these positions and report a skill shortage for Ph.D. STEM workers<sup>3</sup>.

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<sup>1</sup> Bureau of Labor Statistics, 2016

<sup>2</sup> MassBio 2015: Industry Snapshot

<sup>3</sup> <http://www.brookings.edu/research/interactives/2014/job-vacancies-and-stem-skills#/M10420>. Retrieved April 2017

The need for scientists with cross-disciplinary training has been well established in Massachusetts (MassBio 2015). UMD plans to assist the Southcoast region by fueling local science industry and research with graduates invested in the region. The Southcoast has one of the lowest levels of educational attainment of any region in the state, while Massachusetts has the most educated population in the country <sup>4</sup>.

Low levels of education are particularly evident in the region's cities: 32.0% of residents in Fall River and 32.7% of residents in New Bedford have no high school diploma, compared to 11.1% statewide. Only 14.1% of Fall River residents and 14.6% of New Bedford residents have a bachelor's degree or higher. Graduate degrees fare worse, with less than 5% of the southcoast population holding a graduate degree, compared to 17% at the state level.

UMD reports that understanding that the lack of a local well-educated population hampers economic growth, and that companies in the biological sciences are likely to locate in a region with a steady supply of highly qualified scientists, Southcoast cities and towns are working to streamline the administrative hurdles required by biotech business to move to the area. Today, New Bedford has earned a high rating for being "bio-ready" (Platinum Community) by the Massachusetts Biotechnology Council<sup>5</sup>. At the same time, workforce shortages have negatively impacted prosperity for the whole region<sup>6</sup>. UMD maintains that supplying the region with expertise and new research in integrative biology would have a multiplier effect in seeding increased prosperity. The proposed PhD/IB program is expected to prepare graduates with in-demand<sup>7</sup> quantitative skills, experimental design experience, and excellence in writing and communication skills through coursework or required presentations and projects. By providing an integrative approach to graduate education UMD expects to prepare students to be highly competitive.

### *Student Demand*

Based on UMD surveys of senior undergraduates and MS candidates, there is a strong demand for a PhD program in Integrative Biology on the Dartmouth campus. Additionally, UMD holds that the southcoast has a substantial community of students in search of advanced education who, due to family or cultural reasons, choose to stay in the area. The proposed program is expected to provide the only Biology Ph.D. program for these students. As well, biology faculty conduct research programs that are published in international, highly cited publications and high impact journals. UMD expects this to attract regionally, national, and international students to campus. And finally, evidence from UMD graduate admissions is reported to indicate an average of 32 applications per year, all of which focus on topics relevant to a PhD/IB program.

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<sup>4</sup> <https://www.forbes.com/sites/karstenstrauss/2017/02/03/the-most-and-least-educated-states-in-the-u-s-in-2017/#38eae79871be>  
Retrieved April 2017

<sup>5</sup> UMD cites work force shortages are negatively impacting the regional economy with the following examples: LaVioeHealthSciences t moved out of the region; SIRION Biotech GmbH did not relocate to the region; and the Mass Biologics Fall River facility sources its' workforce from outside of the region.

<sup>6</sup> *Ibid*

<sup>7</sup> [Burning-Glass.com/research/baseline-skills](http://Burning-Glass.com/research/baseline-skills)

## OVERVIEW OF PROPOSED PROGRAM

UMD plans that PhD/IB program will be administered by the Biology Department, with a graduate program director and a graduate program committee appointed from the faculty to oversee the program. It is also planned that UMD's Graduate Studies Office and the campus Marketing department will facilitate marketing and recruiting. It is further planned that UMD will reach a steady state of 23 active students in the PhD/IB program, with 4-5 degree completions per year. Calculating the current number of tenure-track faculty in Biology (14) and the projected enrollment, an average of 1.6 active PhD/IB students per tenure-track faculty member is expected.

### *Duplication*

Based on curriculum structure, teaching and research integration, and research facilities there are no state or private universities in the New England region with a comparable program. Regional public universities have biology-related Ph.D. programs, which are specific to particular disciplines. Regarding peer institutions, only Virginia Commonwealth University has a comparable integrative biology PhD. Although there are numerous Ph.D. programs in biology in Massachusetts, there is only one private PhD program in southeastern Massachusetts that offers a biology PhD program at the Woods Hole Oceanographic Institution, and this is an oceanography program.

## ACADEMIC AND RELATED MATTERS

### *Admission*

It is expected that applicants to the PhD/IB program will submit official Graduate Record Examination (GRE) scores. Biology GRE scores are recommended, but not required. It is planned that candidates will have a minimum grade point average (GPA) of 3.00 on a 4.00 scale. International applicants whose native language is not English or who have graduated from an institution where the medium of instruction is not English must submit results of the Test of English as a Foreign Language (TOEFL). A satisfactory TOEFL score of 80 or IELTS of 6.5 is required for admission. In all cases, undergraduate training in biology or a related field will help determine admission as other disciplines with appropriate coursework and training will be considered. Candidates will be expected to have completed a minimum of the equivalent of the Biology Department under-graduate core courses as detailed in the table below. Students with non-Biology undergraduate degree are expected to have completed these (or equivalent) courses before being admitted into the PhD program. UMD plans that the graduate admissions committee may on a case-by-case basis, approve alternative courses.

<b>Biology Courses</b>		<b>Other Courses</b>	
BIO 121, 122	Introductory Biology I & II	CHM 151, 152	Principles of Modern Chemistry I & II
BIO 131, 132	Introductory Biology Lab I & II	CHM 161, 162	Intro to Applied Chemistry I & II
BIO 214	Experimental Design and Analysis	CHM 251, 252	Organic Chemistry I & II
BIO 215	Ecology and Evolution	CHM 263, 264	Bio-organic Chemistry Laboratory I & II
BIO 261	Expts in Ecology & Evolution Lab	PHY 101, 102	Introduction to Physics I & II
BIO 234	Cell Biology	MTH 148	College Algebra
BIO 235	Genetics	MTH 149	Introductory Calculus
BIO 236	Cells and Genetics Laboratory		

UMD plans that prospective students will be expected to have a thesis advisor willing to accept him/her as a member of their research team. Applicants with course deficiencies may be required to take additional undergraduate courses.

Candidates for the PhD/IB program with an earned M.S. degree in biology or a related field may be admitted with advanced standing. In this case, the number of formal course credits required in order to complete the Ph.D. will be determined by the graduate programs director and approved by the graduate programs committee. In all cases at least 6 credits from formal courses must be completed at UMD. All other program requirements apply to students with an M.S., including the qualifying examinations.

### **PROGRAM ENROLLMENT PROJECTION**

	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>
New Full-Time	4	4	4	5
Continuing Full-Time	-	4	7	11
<b>Totals</b>	<b>4</b>	<b>8</b>	<b>11</b>	<b>16</b>

#### *Curriculum (Attachment A)*

UMD plans that the first three semesters of the program will be devoted primarily to completing coursework, although it is expected that students will begin work on research no later than the end of the second semester. Upon completion of formal coursework, successful qualifying and oral examinations, students will advance to the doctoral candidate stage to complete a dissertation under the guidance of a faculty research advisor. An approved written dissertation, public presentation, and an oral defense to the Dissertation Committee are required to earn the Ph.D. Alternatively, students may earn a Master of Science degree and opt out of completing the Ph.D. by satisfying the requirements for master's degree in Biology/Marine Biology at UMD.

### **RESOURCES AND BUDGET**

#### *Fiscal (Attachment B)*

#### *Faculty and Administration (Attachment C)*

The faculty, staff, and technological infrastructure to create the proposed program in Integrative Biology in the Department of Biology at UMD already exists. The current slate of 14 faculty members provides the foundation for producing Ph.D. students with integrative training across a range of biological sub-disciplines. UMD plans a minor increase in the departmental budget to cover program marketing and to accommodate the additional needs of doctoral students. It is also anticipated that there will be a need for a new part-time lecturer for two courses per

semester to replace faculty who will be teaching new Ph.D. courses. At the third year, after the program has demonstrated its' sustainability, UMD plans a new tenure line hire to handle the expanded teaching load. UMD has designed the proposal such that, costs associated with the program will be offset by the beneficial effects on the department, University and region. Because the program emphasizes integrative and cross-cutting activities pertinent to research in the field, UMD anticipates advantages to current faculty applying for grants.

*Facilities, Library and Information Technologies*

UMD expects that current library resources will be sufficient to support the Ph.D. program. It includes rapid access to journals and books through inter-library loans that will need to be maintained. As the PhD/IB program grows with new faculty and students, UMD anticipates that additional resources may be required. A regular yearly review of the program is planned in order to assess any additional library resources, administrative needs, and teaching assistantships.

**PROGRAM EFFECTIVENESS**

Goal	Measurable Objective	Strategy for Achievement	Timetable
Initial enrollment	4 students in program	Recruit regionally, nationally, and internationally	Year 1
Increase enrollment	16 students in program	Recruit regionally, nationally, and internationally	Year 4
First graduating students	5 students graduated	Retain students with good rate of progress	Year 5
Stabilize enrollment	23 students in program	Recruit regionally, nationally, and internationally	Year 7
All graduates successfully employed	Maintain database of graduates' postdoctoral positions and employment.	Mentoring and networking for students and graduates.	Year 7

## EXTERNAL REVIEW AND INSTITUTIONAL RESPONSE

The proposed program was reviewed by Dr. Marta Gomez-Chiarri, Ph.D., Professor and Chair, Department of Fisheries, Animal Biology and Veterinary Sciences at the University of Rhode Island and Dr. Jacqueline F. Webb, Ph.D., Professor, George and Barbara Young Chair in Biology in the Department of Biological Sciences at the University of Rhode Island. The team found congruity and alignment of the curriculum with program goals and the strategic plan, admission and degree requirements of sufficient rigor to produce competitive graduates, research and teaching faculty of sufficient quality, breadth and depth to mount the proposed program, strong institutional support, the availability of adequate facilities, equipment, and library resources, and a compelling need and demand for the proposed program.

The team suggested that more information is needed for some courses to demonstrate doctoral level quality (e.g., seminar-style discussions of research literature). They also recommended clarification on admissions requirements such as how many credits can be transferred from a MS program and expressed concern that more faculty will likely be required as the program grows and that the nature of new hires may be constrained by limitations of the animal care facilities. The review team also recommended dedicated resources for marketing and recruitment and adjustments to the measurement of student learning outcomes that would more clearly assess the breadth and integrative nature of the training in the program.

UMD modified the descriptions of the required activities and courses to include the suggested information and edited with more clarification on admissions requirements for students who enter the program with an earned masters including the number of credits that can be transferred from prior masters level work. UMD agreed that additional faculty lines may be needed after the initial start-up period and will assess enrollment growth and hiring decisions at the appropriate time. UMD also responded that it has made research laboratory innovations and currently has adequate animal facilities to support faculty in addition to cultivated working relationships with faculty at other UMass and New England universities. UMD will assess the need for expansion of research facilities. As well UMD modified the proposed program budget to include marketing and added benchmarks and measures to be used for assessing the success of the proposed program.

Staff thoroughly reviewed all documentation submitted by the **University of Massachusetts Dartmouth** and external reviewers. Staff recommendation is for approval of the proposed **Doctor of Philosophy in Integrative Biology**.

**ATTACHMENT A: CURRICULUM**

**Ph.D. in Integrative Biology**

<b>Major Required (Core) Courses (Total # of courses required = 7)</b>		
<i>Course Number</i>	<i>Course Title</i>	<i>Credit Hours</i>
BIO 530	Biological Statistics	4
BIO 5XX*	One course from Molecular and Cellular Biology offerings	3 or 4
BIO 5XX*	One course from Organismal and Developmental Biology offerings	3 or 4
BIO 5XX*	One course from Evolution and Ecology offerings	3 or 4
e.g. CHM, PHY**	Cross-disciplinary topic – Graduate level	3 or 4
BIO 5XX ***, ENL ***	Professional Communication	3
BIO 525	Graduate Student Seminar (two semesters – 1 credits each)	2
BIO 699	Doctoral research credit Graduate	34
	Sub-Total # Core Credits Required	55 (min)
	Sub-Total # Elective Credits Required	

<b>Curriculum Summary</b>	
Total number of courses required for the degree	7
Total credit hours required for degree	55

**Prerequisite, Concentration or Other Requirements:**

\*Students will need to take one course from each of three categories 1: Molecular and Cellular Biology (BIO 501, 508, 534, 527, 571) 2: Organismal and Developmental Biology (BIO 511, 513, 514, 515, 523, 540, 554) and 3: Evolution and Ecology (BIO 502, 511, 520, 537, 545). The specific course will be determined by the student's interest and must be approved by student's committee.

\*\*An interdisciplinary graduate course from outside the Biology Department will also be required. The specific course will be determined by the student's interest and approved by student's committee.

\*\*\* A Biology professional communications course or an approved graduate level communications course from the English department.

ATTACHMENT B: BUDGET

<b>REVENUE ESTIMATES</b>										
	<b>Year 1 2018</b>		<b>Year 2 2019</b>		<b>Year 3 2020</b>		<b>Year 4 2021</b>		<b>Year 5 2022</b>	
<i>Full-Time Tuition Rate: In-State</i>	11245.50		11470.41		11699.82		11933.81		12172.49	
<i>Full-Time Tuition Rate: Out-of-State</i>	20301.00		20707.02		21121.16		21543.58		21974.46	
<i>Mandatory Fees per Student (In-State)</i>	405.00		405.00		405.00		405.00		405.00	
<i>Mandatory Fees per Student (out-of-State)</i>	405.00		405.00		405.00		405.00		405.00	
<i>FTE # of New Students: In-State</i>	2		2		2		3		3	
<i>FTE # of New Students: Out-of-State</i>	2		2		2		2		2	
<i># of In-State FTE Students transferring in from the institution's existing programs</i>		0		0		0		0		0
<i># of Out-of-State FTE Students transferring in from the institution's existing programs</i>		0		0		0		0		0
<b>Tuition and Fees</b>	Newly Generated Revenue	Revenue from existing programs	Newly Generated Revenue	Revenue from existing programs	Newly Generated Revenue	Revenue from existing programs	Newly Generated Revenue	Revenue from existing programs	Newly Generated Revenue	Revenue from existing programs
<b><u>First Year Students</u></b>										
Tuition										
In-State	\$22,491	\$0	\$22,941	\$0	\$23,400	\$0	\$35,801	\$0	\$36,517	\$0
Out-of-State	\$40,602	\$0	\$41,414	\$0	\$42,242	\$0	\$43,087	\$0	\$43,949	\$0
Mandatory Fees	\$1,620	\$0	\$1,620	\$0	\$1,620	\$0	\$2,025	\$0	\$2,025	\$0
<b><u>Second Year Students</u></b>										
Tuition										
In-State			\$22,941	\$0	\$23,400	\$0	\$23,868	\$0	\$36,517	\$0
Out-of-State			\$41,414	\$0	\$42,242	\$0	\$43,087	\$0	\$43,949	\$0
Mandatory Fees			\$1,620	\$0	\$1,620	\$0	\$1,620	\$0	\$2,025	\$0
<b><u>Third Year Students</u></b>										

Tuition										
In-State					\$23,400	\$0	\$23,868	\$0	\$24,345	\$0
Out-of-State					\$42,242	\$0	\$43,087	\$0	\$43,949	\$0
Mandatory Fees					\$1,620	\$0	\$1,620	\$0	\$1,620	\$0
<b>Fourth Year Students</b>										
Tuition										
In-State							\$23,868	\$0	\$24,345	\$0
Out-of-State							\$43,087	\$0	\$43,949	\$0
Mandatory Fees							\$1,620	\$0	\$1,620	\$0
<b>Fifth Year Students</b>										
Tuition										
In-State									\$24,345	\$0
Out-of-State									\$43,949	\$0
Mandatory Fees									\$1,620	\$0
<b>Gross Tuition and Fees</b>	\$64,713	\$0	\$131,950	\$0	\$201,786	\$0	\$286,638	\$0	\$374,724	\$0
<b>Grants</b>	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>Contracts</b>	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>Campus budget allocation</b>	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>Other Revenues (specify in cell 54)</b>	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>Total</b>	\$64,713	\$0	\$131,950	\$0	\$201,786	\$0	\$286,638	\$0	\$374,724	\$0

<b>EXPENDITURE ESTIMATES</b>										
	Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022	
	New Expenditures required for Program	Expenditures from current resources	New Expenditures required for Program	Expenditures from current resources	New Expenditures required for Program	Expenditures from current resources	New Expenditures required for Program	Expenditures from current resources	New Expenditures required for Program	Expenditures from current resources
<b>Personnel Services</b>										
Faculty	\$30,000	\$0	\$30,000	\$0	\$30,000	\$0	\$30,000	\$0	\$30,000	\$0

Administrators	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Support Staff	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Others	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Fringe Benefits _30.8_%	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>Total Personnel</b>	<b>\$30,000</b>	<b>\$0</b>	<b>\$30,000</b>	<b>\$0</b>	<b>\$30,000</b>	<b>\$0</b>	<b>\$30,000</b>	<b>\$0</b>	<b>\$30,000</b>	<b>\$0</b>
<b>Operating Expenses</b>										
Supplies	\$3,000	\$0	\$3,000	\$0	\$6,000	\$0	\$6,000	\$0	\$6,000	\$0
Library Resources	\$3,000	\$0	\$3,000	\$0	\$3,000	\$0	\$3,000	\$0	\$3,000	\$0
Marketing/Promotional Expenses	\$3,000	\$0	\$3,000	\$0	\$3,000	\$0	\$3,000	\$0	\$3,000	\$0
Laboratory Expenses	\$3,000	\$0	\$3,000	\$0	\$3,000	\$0	\$3,000	\$0	\$3,000	\$0
General Administrative Overhead	\$3,000	\$0	\$3,000	\$0	\$3,000	\$0	\$3,000	\$0	\$3,000	\$0
Other (specify)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>Total Operating Expenses</b>	<b>\$15,000</b>	<b>\$0</b>	<b>\$15,000</b>	<b>\$0</b>	<b>\$18,000</b>	<b>\$0</b>	<b>\$18,000</b>	<b>\$0</b>	<b>\$18,000</b>	<b>\$0</b>
<b>Net Student Assistance</b>										
Assistantships (university funded TAs)	\$32,000	\$32,000	\$64,000	\$64,000	\$96,000	\$80,000	\$96,000	\$80,000	\$96,000	\$80,000
Fellowships	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Stipends/Scholarships	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
tuition waivers	\$22,491	\$22,491	\$44,982	\$44,982	\$44,982	\$44,982	\$44,982	\$44,982	\$44,982	\$44,982
<b>Total Student Assistance</b>	<b>\$54,491</b>	<b>\$54,491</b>	<b>\$108,982</b>	<b>\$64,000</b>	<b>\$140,982</b>	<b>\$124,982</b>	<b>\$140,982</b>	<b>\$124,982</b>	<b>\$140,982</b>	<b>\$124,982</b>
<b>Capital</b>										
Facilities / Campus recharges	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Equipment	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Other	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
<b>Total Capital</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>
<b>Total Expenditures</b>	<b>\$99,491</b>	<b>\$54,491</b>	<b>\$153,982</b>	<b>\$64,000</b>	<b>\$188,982</b>	<b>\$124,982</b>	<b>\$188,982</b>	<b>\$124,982</b>	<b>\$188,982</b>	<b>\$124,982</b>

**BUDGET SUMMARY OF NEW PROGRAM ONLY**

	Year 1 2016	Year 2 2017	Year 3 2018	Year 4 2019	Year 5 2020
Total of newly generated revenue	\$64,713	\$131,950	\$201,786	\$286,638	\$374,724
Total of additional resources required for program	\$99,491	\$153,982	\$188,982	\$188,982	\$188,982
Excess/ (Deficiency)	(\$34,778)	(\$22,032)	\$12,804	\$97,656	\$185,742

**Revenues:**

New revenue/expenditure estimates from student support. The revenue estimates assume 4 new full-time students per year. As noted in the proposal, when the program is fully implemented, about 50% of full-time students are expected to be funded by external grants or self-funded. Tuition and fees for 18 graduate credits per year are currently \$11,245.50 for in-state students and \$20,301.00 for out-of-state students, and a 2% tuition increase per year was assumed. Based on previous departmental trends, we estimate about 50% in-state and 50% out-of-state students. Living stipends for Teaching Assistants is calculated at \$16,000 per year.

**Expenditures:**

New Faculty expenditures include a PTL for years 1 & 2 and are replaced with a tenure line faculty in year 3. The tenure line faculty cost is presented as 30% of the salary and fringe as all faculty will be also involved in undergraduate education as well as the graduate program. Assistantships are listed as coming from current resources as many TA will be transitioned from the MS program to the PHD program. In addition the cost of assistantships is offset by the cost of PTLs that would be needed to teach the laboratory sections that are being taught by graduate students. As the undergraduate program grows and the need for more laboratory instruction increases a growing doctoral program will fill the need for instructors.

**ATTACHMENT C: FACULTY**

Name of faculty member (Name, Degree and Field, Title)	Tenured Y/N	Courses Taught Put (C) to indicate core course. Put (OL) next to any course currently taught online.	# of sectio ns	Full- or Part- time in Program	Full- or part- time in other departme nt or program (Please specify)
Bernal, Diego PhD Scripps Institute of Oceanography UCSD in Physiology of high performance fishes, shark biology Professor	Y	<ul style="list-style-type: none"> <li>• Animal Physiology</li> <li>• Biology of Sharks</li> <li>• Animal Biology</li> </ul>	(1) (1) (1)	Full-Time	SMAST adjunct
Bromage, Erin Ph.D. James Cook University, Australia in Immunology, microbiology, biosensor and vaccine development Associate Professor	Y	<ul style="list-style-type: none"> <li>• Infection and Immunology</li> <li>• Comparative Immunology</li> </ul>	(1) (1)	Full-Time	No
Bucci, Vanni Ph.D. Northeastern University in Computational Biology Assistant Professor	N	<ul style="list-style-type: none"> <li>• Intro Biological Stats</li> <li>• Dynamics of Biological Systems</li> </ul>	(1) (1)	Full-Time	No
Connor, Richard C. Ph.D. University of Michigan in Evolution of social interactions, marine mammal biology Professor	Y	<ul style="list-style-type: none"> <li>• Topics in Marine Mammals</li> <li>• Biology of Marine Mammals</li> <li>• Biology of Populations</li> <li>• Animal Behavior</li> </ul>	(1) (1) (1) (1)	Full-Time	No
Drew, Robert E. Ph.D. Washington State University in Genomic analysis of quantitative traits Associate Professor	Y	<ul style="list-style-type: none"> <li>• Genomics</li> <li>• General Genetics w lab</li> </ul>	(1) (1)	Full-Time	No
Hable, Whitney E. Ph.D. Univ of Arizona in Molecular, cellular and developmental biology Associate Professor	Y	<ul style="list-style-type: none"> <li>Biology of Cells</li> <li>Biology of Cells Lab</li> <li>• Developmental Biology</li> </ul>	(1) (2) (1)	Full-Time	No

Kavanagh, Kathryn Ph.D. James Cook University, Australia in Evolutionary development biology Associate Professor	Y	<ul style="list-style-type: none"> <li>•Comparative Vertebrate Anatomy w lab</li> <li>•Evolutionary Developmental Biology w/lab</li> </ul>	(1) (1)	Full-Time	SMAST adjunct
Koop, Jennifer Ph.D. University of Utah in Evolutionary ecology of host-parasite interactions Assistant Professor	N	<ul style="list-style-type: none"> <li>•Biology of Organisms Lab I</li> <li>•Evolutionary Biology</li> </ul>	(1) (1)	Full-Time	No
Ladino, Cynthia Ph.D. in Cell Biology and biochemistry, biotechnology Full Time Lecturer	N	<ul style="list-style-type: none"> <li>•Cancer Biology</li> <li>•Biology Orgs Lab I</li> <li>•Biology Orgs Lab II</li> </ul>	(2) (3) (2)	Full-Time	No
Laxer, Marc A. Ph.D. in Anatomy and physiology, parasitology Full Time Lecturer	N	<ul style="list-style-type: none"> <li>•Anatomy and Physiology I</li> <li>•A &amp; P Lab I</li> <li>•A and P II/Lab</li> <li>•Human Parasitology</li> </ul>	(2) (2) (1,3) (1)	Full-Time	No
McCliment, Elizabeth Ph.D. University of Delaware in Molecular Biology Full Time Lecturer	N	<ul style="list-style-type: none"> <li>•General Biology I</li> <li>•General Biology II</li> <li>•Molecular Biology</li> </ul>	(5) (2) (1)	Full-Time	No
Moisander, Pia Ph.D. Univ. of North Carolina, Chapel Hill in Marine microbiology, microbial ecology Assistant Professor	N	<ul style="list-style-type: none"> <li>•General Microbiology lab</li> <li>•Biology of Cells Lab</li> <li>•Marine Microbiology w lab</li> </ul>	(1) (1) (1)	Full-Time	SMAST adjunct
O'Connor, Nancy Ph.D. N. Carolina State Univ in Invertebrate ecology, nonindigenous marine species Professor	Y	<ul style="list-style-type: none"> <li>•Biology of Invertebrates w lab</li> <li>•General Ecology</li> </ul>	(1) (1)	Full-Time	SMAST adjunct
Oliveira, Kenneth Ph.D. University of Rhode Island in Fish Biology, life history strategies and age & growth of fishes Professor	Y	<ul style="list-style-type: none"> <li>•Biology of Fishes w lab</li> <li>•Advanced Ichthyology</li> </ul>	(1) (1)	Full-Time	SMAST adjunct
Rajaniemi, Tara K. Ph.D. University of Michigan in Community ecology, plant	Y	<ul style="list-style-type: none"> <li>•Intro to Biological Stats</li> </ul>	(1) (1)	Full-Time	No

biology, biostatistics Associate Professor		<ul style="list-style-type: none"> <li>•Intro to Biological Stats lab (1)</li> <li>•Plant Biology (1)</li> <li>•Ecology &amp; Environmental Issues</li> </ul>			
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Silby, Mark W. Ph.D. Univ. of Canterbury, New Zealand in Bacterial genetics and genomics, environmental microbiology Assistant Professor	N	<ul style="list-style-type: none"> <li>•General Microbiology (1)</li> <li>•General Microbiology lab (1)</li> <li>•General Genetics Lab (1)</li> <li>•Microbial Genetics</li> </ul>		Full-Time	No
Turner, Jefferson T. Ph.D. Texas A & M University in Biological oceanography, marine plankton, biogeography Chancellor Professor	Y	<ul style="list-style-type: none"> <li>•The Ocean Environment (1)</li> <li>•Descriptive Oceanography (1)</li> <li>•Biological Oceanography with lab (1)</li> </ul>		Full-Time	SMAST adjunct
Ventetuolo, Alan Ph.D. in Medical microbiology, anatomy and physiology Full Time Lecturer	N	<ul style="list-style-type: none"> <li>•Medical Microbiology (1)</li> <li>•Med Micro Lab (3)</li> <li>•Human Microbe Interactions (OL) (3)</li> <li>•AIDS: The Biological Basis (2)</li> <li>•A &amp; P Lab II</li> </ul>		Full-Time	No
Winslow, Benjamin B. Ph.D. Wesleyan Univ. in General biology, developmental biology Full Time Lecturer	N	<ul style="list-style-type: none"> <li>•Biology of Orgs I (2)</li> <li>•Biology of Orgs lab I (2)</li> <li>•Biology of Orgs II (1)</li> <li>•Biology of Orgs Lab II (2)</li> </ul>		Full-Time	No