

Cover/Signature Page - Abbreviated Template/Abbreviated Template with Curriculum

Institution Submitting Request: *University of Utah*

Proposed Title: *BS/MS in Biology*

Currently Approved Title:

School or Division or Location: *College of Science*

Department(s) or Area(s) Location: *Department of Biology*

Recommended Classification of Instructional Programs (CIP) Code¹ (for new programs):

Current Classification of Instructional Programs (CIP) Code (for existing programs):

Proposed Beginning Date (for new programs): *08/01/2016*

Institutional Board of Trustees' Approval Date:

Proposal Type (check all that apply):

Regents' General Consent Calendar Items		
<i>R401-5 OCHE Review and Recommendation; Approval on General Consent Calendar</i>		
SECTION NO.		ITEM
5.1.1	<input type="checkbox"/>	Minor*
5.1.2	<input type="checkbox"/>	Emphasis*
5.2.1	<input type="checkbox"/>	(CER P) Certificate of Proficiency*
5.2.3	<input type="checkbox"/>	(GCR) Graduate Certificate*
5.4.1	<input type="checkbox"/>	New Administrative Unit
	<input type="checkbox"/>	Administrative Unit Transfer
	<input type="checkbox"/>	Administrative Unit Restructure
	<input type="checkbox"/>	Administrative Unit Consolidation
5.4.2	<input type="checkbox"/>	Conditional Three-Year Approval for New Centers, Institutes, or Bureaus
5.4.3	<input type="checkbox"/>	New Center
	<input type="checkbox"/>	New Institute
	<input type="checkbox"/>	New Bureau
5.5.1	<input type="checkbox"/>	Out-of-Service Area Delivery of Programs
5.5.2	<input type="checkbox"/>	Program Transfer
	<input type="checkbox"/>	Program Restructure
	<input type="checkbox"/>	Program Consolidation
5.5.3	<input type="checkbox"/>	Name Change of Existing Programs
5.5.4	<input type="checkbox"/>	Program Discontinuation
	<input type="checkbox"/>	Program Suspension
5.5.5	<input type="checkbox"/>	Reinstatement of Previously Suspended Program
	<input type="checkbox"/>	Reinstatement of Previously Suspended Administrative Unit

**Requires "Section V: Program Curriculum" of Abbreviated Template*

Chief Academic Officer (or Designee) Signature:

I certify that all required institutional approvals have been obtained prior to submitting this request to the Office of the Commissioner.

Signature

Date: *MM/DD/YEAR*

Printed Name: *Name of CAO or Designee (Ruth Watkins – Signature will be collected after BoT Approval)*

¹ CIP codes must be recommended by the submitting institution. For CIP code classifications, please see <http://nces.ed.gov/ipeds/cipcode/Default.aspx?y=55>.

Program Request - Abbreviated Template
University of Utah
BS/MS in Biology
08/01/2016

Section I: Request

The Department of Biology in the College of Science at the University of Utah requests permission to establish a combined BS/MS degree program in Biology. The faculty in the Department of Biology discussed and developed this proposal over the course of several meetings that initially involved a subgroup of faculty and finally the full faculty. Representatives from Utah's biotechnology and entrepreneurial sectors were also included in these discussions. All tenured and tenure track faculty were given the opportunity to vote on the adoption of this program at a faculty meeting held on December 16, 2015. The final vote for adoption of a BS/MS program in Biology was 33 in favor, 0 not in favor with 0 abstentions.

Section II: Need

The most successful undergraduate educational experience usually includes a component of original research. By becoming involved in undergraduate research, students not only develop scientifically and creatively but they also hone critical thinking, problem solving and communication skills. For the U.S. to maintain and advance its preeminence in science and technology, we must invest in educational programs that emphasize experiential learning and the scientific method. Along these lines, as one of the premier public institutions in the United States, the University of Utah offers a number of unique research opportunities to undergraduate students. While many of our undergraduates take advantage of these opportunities, with their heavy work and class load, more do not. Many students probably opt out of participation in existing undergraduate research opportunities because the relevance to future careers is missing, and this is especially unfortunate given that the highly competitive job market demands exactly the skills they will miss by opting out. Thus, through the program outlined below, we propose to provide students with enhanced educational opportunities through an accelerated BS/MS degree program in Biology. This program will provide an opportunity and mechanism for students to receive a more in-depth and focused biology education than they would receive over the course of obtaining their BS degree and will better prepare our students for careers in industry or for entry into professional schools. A primary goal of this program is to combine practical training in advanced molecular biology techniques with the business acumen necessary for a successful career in the biotechnology industry.

The proposed BS/MS Biology degree program is intended to attract qualified undergraduate students into the graduate program early, decrease the time required to obtain an MS degree, and to involve students in research early in their careers. The proposed combined degree program is designed to be completed by students in five years and to culminate with simultaneous conferral of the Bachelor of Science and Master of Science degrees.

The proposed BS/MS provides a different educational opportunity than the Professional Master of Science and Technology at the University of Utah. The primary difference in these two programs is the BS/MS degree in Molecular Biology is a research intensive degree that requires a substantial research effort culminated with the submission of thesis and oral defense. Our industry partners tell us that independent research is a highly desirable component of the proposed program, and one that can not be replaced with a series of courses.

As envisioned, students in the BS/MS program will begin their required research project and complete a portion of their MS courses after their junior year. Minimum requirements will include the following:

- 1) That the students complete the normal course load for both the BS and MS degrees in Biology (122 and 30 credit hours, respectively).
- 2) That the students apply for admission into the program by March 1 of their junior year. Applications for entry into the program will be processed through the Graduate Admissions Office and requirements for the combined BS/MS program will be consistent with the requirements for the normal MS program. Notification of acceptance into the program will take place before May 1 of their junior year.
- 3) Upon acceptance into the program students will be expected to complete the program within 2 years.
- 4) A student will submit a detailed research plan to his/her Advisory Committee on or before May 1 of the 4th year of the BS course of study, or within one year of acceptance into the program.
- 5) Transfer of the student from undergraduate to graduate status occurs after the completion of 122 hours of qualified studies.
- 6) The BS and MS degree will be conferred simultaneously following the completion of the program. No student will be awarded a separate MS degree in Biology without satisfying all requirements for the BS degree.
- 7) Students wishing to exit the combined program can apply qualifying coursework toward the traditional BS requirement without penalty.

Procedures:

- 1) Application for admission to BS/MS program will be submitted at the end of a student's junior year by March 1. This application will be processed and decisions made at the departmental level (this is consistent with current admission policies). Entering students must have at least a 3.0 cumulative GPA.
- 2) Students must be enrolled as Biology majors at the time of applying for the BS/MS Biology degree option.
- 3) The student will apply for graduate status during the semester in which 122 credit hours are completed and will follow the regular University of Utah Graduate School application process. All university requirements for graduate admissions must be met except posting of an undergraduate degree. (Note: On the referral sheet that the department returns to graduate admissions, the department will note that the student has been accepted to the combined BS/MS program. Graduate Admissions will then approve admission without the BS completed.)
- 4) No course can be counted toward both degrees.
- 5) Students will choose a research advisor before August 30th of their senior year or the semester after being admitted into the program.
- 6) Students will choose an Advisory Committee before October 1 of their senior year. The committee will consist of two faculty members in Biology (1 of whom will be the student's advisor).
- 7) Students will write a thesis detailing their project in the format of a scientific paper, with the goal of submitting the work for publication in a peer-reviewed journal.
- 8) Students will present and defend their project at the end of their 5th year after beginning at the U of U (assuming 4 years for the BS, one for the MS) although we recognize that the course of study may be longer than 5 years until completion.

9) The Department will ensure that all requirements are met for each degree. Courses taken for the graduate degree will not be eligible for graduate credit until the requirements for both degrees are satisfied. Both BS and MS degrees will be awarded when all work is completed.

66% by 2020

This proposal aligns with the Governor's call that 66% of the citizens of Utah should have a post secondary degree. Engaging students in original research accelerates degree completion. This proposal will shorten the time to advanced degrees. Finally, this program will be an attractive recruiting tool for students who might not otherwise attend the University of Utah. Once these students are here, there is strong likelihood that they will (a) graduate and (b) work in Utah, employed in companies that need their technical and critical thinking skills. Leaders of the biotechnology community have informed us that there is a demand for students with the skills acquired in this program.

Section III: Institutional Impact

We anticipate that a combined BS/MS degree will be attractive to students and will likely result in increased enrollment in the Biology program. As a combined BS/MS program is somewhat unique in a Biology program at a highly research intensive institution, we believe that this program will attract well-qualified students who might otherwise go to other institutions. As other similar combined BS/MS programs exist at the University of Utah, procedures to institute this program will not necessitate changes in existing administration within the University. As no new courses or research programs will be needed, no changes in faculty, staff, or physical facilities will be required. However, the program will take advantage of the facilities in the new Crocker Science Center, particularly the new teaching labs and commercial incubator. No student will be adversely affected by this change as students can complete their BS degree without penalty.

Section IV: Finances

No costs are anticipated to result from this program. In the event that the number of Biology majors increases as a result of its institution, we anticipate that the cost per degree will decrease. In addition to this, we anticipate that this program will expedite the time to degree completion thus decreasing the overall cost.

Section V: Program Curriculum

*****THIS SECTION OF THE TEMPLATE REQUIRED FOR EMPHASES, MINORS, AND CERTIFICATES ONLY*****

Additional Information Explaining Program Need:

The current requirements for the BS in Biology provide a rigorous foundation for an MS degree student. While there is no reduction in credit hours associated with the combined degree program, it will provide several notable benefits to Biology students.

- a) The combined degree will encourage qualified students in the BS program to begin taking graduate level classes towards the MS degree while still enrolled in the BS degree program.

- b) The combined BS/MS degree program will provide undergraduate students with the opportunity to interact more closely with faculty and to be mentored by senior graduate students and postdoctoral fellows.
- c) The proposed program will allow the Biology Department to provide a structure to encourage high quality undergraduate students to get involved in research.
- d) The proposed program will be unique for Biology Departments among institutions with very high research activity in the Pac 12 and will provide us with a competitive advantage.
- e) It provides a research intensive Master's program.

Additional Information Explaining Procedures for Application and Admission:

- a) Application for admission to BS/MS program will be submitted during the spring semester of the student's junior year.
- b) The application process, requirements and evaluation will be consistent with the criteria for the tradition MS Biology as follows:
 - Minimum 3.0 cumulative GPA
 - Three letters of recommendation
 - Essay explaining why the student is applying for BS/MS degree program
 - CV
 - Graduate School online application with fee

Other Admission Requirements:

- a) Application processing and recommendations for admission will be made in the Department of Biology under the authority of the Program Director responsible for the BS/MS degree program.
- b) Students must be enrolled as a Biology major at the time of applying for the BS/MS degree option.
- c) All university requirements for graduate admissions must be met except posting of the undergraduate degree.
- d) Recommendations for admission will be made by the Department of Biology to the Graduate School by May 1st of each year.

Additional Information

The program will be overseen by the Curriculum Committee and the Graduate Program Committee in the Department of Biology.

Section V: Program Curriculum

Note: there are no proposed changes in the undergraduate or graduate curriculum to complete the BS/MS degree.

Requirements for the Biology BS:

Core Courses for the Major (credits noted in brackets)

Calculus I, II (4)

General Chemistry I, II (4 each)

General Chemistry Lab I, II (1 each)

Organic Chemistry I (4)
Physics I, II (4)
BIOL 2020 Cell Biology (3)
BIOL 2030 Genetics (3)
BIOL 3510 Biochemistry (3)
BIOL 2010 Evolution and Diversity of Life (3)
BIOL 3410 Ecology and Evolution (3)

One Form & Function Course from: Bio 3310 Comparative Vertebrate Morphology (3), Bio 3320 Comparative Physiology (3), Bio 3330 Behavioral Neurobiology (3), Bio 3380 Evolutionary and Physiological Basis of Health (3), Bio 3350 Physiology of Plants (3), Bio 3370 Microbial Biology (3), Bio 5365 Form, Function, and Adaptation of Plants (4)

Complete 3 courses from the following menu. At least one must be 5000-level.

BIOL 3210 General and Pathogenic Microbiology (3)
BIOL 3230 Developmental Biology (3)
BIOL 3240 Introduction to Cellular Neurobiology (3)
BIOL 3370 Microbial Biology (3)
BIOL 3520 Biological Chemistry II (3)
BIOL 3550/3551 Physical Principles in Biology (3) **new course number-formerly 3820**
BIOL 5030 Basic Immunology (3)
BIOL 5050 Mechanisms of Bacterial Pathogenesis (2)
BIOL 5110 Molecular Biology and Genetic Engineering (3)
BIOL 5120 Gene Expression (3)
BIOL 5140 Genome Biology (3)
BIOL 5210 Cell Structure and Function (3)
BIOL 5275 Microbial Diversity, Genomics and Evolution (4)
BIOL 5510 Evolutionary Developmental Biology (3)
BIOL 5810 Nanoscience: Where Biology, Chemistry and Physics Intersect (3)

Complete 2 courses from the following menu of C&M labs in addition to 2 additional labs for the BS degree for a total of 5 lab credits.

BIOL 2115 [L2] Basic Techniques Laboratory (2)
BIOL 3125 [L2] Molecular Tools for Evolutionary and Population Biology (3)
BIOL 3205 [L1] General and Pathogenic Microbiology Lab (1)
BIOL 3215 [L1] Cell Biology laboratory (2)
BIOL 3235 [L1] Developmental Biology Laboratory (3)
BIOL 3246 [L1] Basic Cellular Neurobiology Lab (2)
BIOL 3515 [L1] Biological Chemistry Laboratory (3)
BIOL 3525 [L2] Molecular Biology of DNA Lab (4)
BIOL 4955 [L2] Individual Research 4995 Biology Honors Research (1-3)
BIOL 5255 [L2] Prokaryotic Genetics (3)
BIOL 5275 [L1] Microbial Diversity, Genomics and Evolution (4)
BIOL 5285 (var.) Biological Microscopy Laboratory (1-3)

Requirements for the Biology MS:

30 credit hours total:

9 credits of BIOL 6950/70 Thesis Research

2 credits of BIOL 7810 Research in Progress

Students are encouraged to design a curriculum customized for their career goals with advice from their mentor and committee member. The MS requires a minimum of 16 credits that must differ from those taken for the 122 credits for the BS; however, 6 of these credits can be taken while the student is an undergraduate as long as they are in addition to those taken for the BS. Students are strongly encouraged to take BIOL 6500: Advanced Statistical Modeling for Biologists. Potential courses are listed below; however, other courses may be substituted with approval of the committee.

BIOL 5030 Basic Immunology (3)
BIOL 5050 Mechanisms of Bacterial Pathogenesis (2)
BIOL 5110 Molecular Biology and Genetic Engineering (3)
BIOL 5120 Gene Expression (3)
BIOL 5130 Plant Biochemistry, Genomics and Molecular Biology (3)
BIOL 5140 Genome Biology (3)
BIOL 5210 Cell Structure and Function (3)
BIOL 5221 Human Evolutionary Genetics (4)
BIOL 5240 Plant Developmental Biology (3)
BIOL 5255 Prokaryotic Genetics (3)
BIOL 5260 Advanced Eukaryotic Genetics ****NEW COURSE**** (3)
BIOL 5270 Microbial Ecosystems (3)
BIOL 5275 Microbial Diversity, Genomics and Evolution (4)
BIOL 5285 Biological Microscopy Laboratory (1-3)
BIOL 5510 Evolutionary Developmental Biology (3)
BIOL 5540 Biochemistry of Membrane Processes (3)
BIOL 5810 Nanoscience: Where Biology, Chemistry and Physics Intersect (3)
BIOL 5960 Advanced Special Topics in Biology (1-5)
BIOL 6040 Cellular and Molecular Neuroscience (4)
BIOL 6245 Cellular and Molecular Neurophysiology Laboratory (2)
BIOL 6420 Genetics and Genomes (3)
BIOL 6500 Advanced Statistical Modeling for Biologists (3)
BIOL 6510 Fundamentals of Microbial Biology (1.5)
BIOL 6520 Current Topics in Microbial Biology (1.5)
BIOL 6530 Biological Chemistry I [meets w/BIOL 3510] (3)
BIOL 6540 Biochemistry of Membrane Processes (3)
BIOL 6980 Faculty Consultation (2)
BIOL 7206-001 Introduction to MCEB Research (1)
BIOL 7962-002 Seminal Papers in Biology (3)
PED 5750 Genomic Analysis 1 (1.5)

Students are strongly encouraged to select one course from the Business School relevant to career goals. Recommended courses are:

BUS 5500 Business Analytics Practicum: Tech Ventures (3)

ACCTG 6000 Financial Accounting (3)
MGT 6051 Managing and Leading Organizations (1.5-3)



Memorandum

To: COS Admissions, Standards and Degree Committee
From: Denise Dearing, Distinguished Professor and Chair, Department of Biology
Date: December 22, 2015
Subject: **Proposal for a BS/MS Degree in Biology**

I enthusiastically endorse the proposed accelerated BS/MS Biology degree program. I believe this program will allow us to attract new students and to better educate our current undergraduates.

The proposed program would not be difficult to adopt. It will utilize resources that are already at our disposal and will not require the development of a new curriculum or the hiring of faculty or administration. There is precedence for a BS/MS program in the Department of Chemistry at the University of Utah as well as in the College of Engineering.

Finally, I have met with local leaders in the biotechnology industry to design this program. They have assured me that these graduates will be in demand and that the differential in their starting salaries as a result of the training provided through the MS degree will likely exceed the costs of an additional year of education beyond the BS.



THE UNIVERSITY OF UTAH
College of Science

January 8, 2016

David B. Kieda
The Graduate School
University of Utah
201 Presidents Circle, Room 302
Salt Lake City, UT 84112-9016

Dear Dean Kieda:

It is my pleasure to join Distinguished Professor and Chair of Biology M. Denise Dearing in my strong support of the establishment of a combined BS/MS degree in the Department in Biology.

Such a degree program would provide an increased level of training to prospective Biology students, preparing them both with the foundations of an undergraduate degree, as well as the substantial, dedicated research required to submit and defend a master's thesis. In the professional world, research experience is increasingly critical to graduates' employment prospects, and I agree completely with Dr. Dearing's contention that the combined BS/MS degree program "... will better prepare our students for careers in industry or for entry into professional schools."

Furthermore, this degree program will likely result in increased enrollment, as well as reduced time to degree completion. The latter is a significant priority not only for the College of Science, but also for the Senior Vice President of Academic Affairs.

In her memorandum to the College of Science Admissions, Standards, and Degree Committee, Dr. Dearing mentions that there is already precedent for a combined BS/MS program in the College of Science and the College of Engineering. I can personally attest to the success of the Department of Chemistry's iteration of this degree program, which has been popular and effective since its establishment. I see no reason why the same should not be true in the Department of Biology.

In addition to the many positives, the combined curriculum is likely cost-neutral or slightly positive: it would consist wholly of courses and resources currently available to Biology BS and MS students, while enrollment increases or reduced time to degree completion may even reduce costs.

In short, the proposed degree program will yield sustained and significant academic and professional benefits for our students, at no cost to either the Department, College, or University. This proposal has already secured the unanimous support of Dr. Dearing,

the Department of Biology faculty, and the College of Science Admissions, Standards, and Degree Committee. I am happy to add my endorsement to theirs, and hope you will do the same. Thank you.

Sincerely,

A handwritten signature in cursive script that reads "Henry S. White". The signature is written in dark ink and is positioned below the word "Sincerely,".

Henry S. White
Dean, College of Science, and
Distinguished Professor of Chemistry