

**Utah System of Higher Education  
New Academic Program Proposal  
Cover/Signature Page - Abbreviated Template**

**Institution Submitting Request:** University of Utah  
**Proposed Program Title:** BS/BA in Biology with emphasis in Plant Biology  
**Sponsoring School, College, or Division:** College of Science  
**Sponsoring Academic Department(s) or Unit(s):** School of Biological Sciences  
**Classification of Instructional Program Code<sup>1</sup> :** 26.0301  
**Min/Max Credit Hours Required of Full Program:** Min Cr Hr / Max Cr Hr  
**Proposed Beginning Term<sup>2</sup>:** Fall 2019  
**Institutional Board of Trustees' Approval Date:**

**Program Type:**

<input type="checkbox"/>	Certificate of Proficiency	<input type="checkbox"/>	Entry-level CTE CP	<input type="checkbox"/>	Mid-level CP
<input type="checkbox"/>	Certificate of Completion				
<input type="checkbox"/>	Minor				
<input type="checkbox"/>	Graduate Certificate				
<input type="checkbox"/>	K-12 Endorsement Program				
<input checked="" type="checkbox"/>	<b>NEW</b> Emphasis for Regent-Approved Program <i>Credit Hours for NEW Emphasis Only:</i> <b>Min Cr Hr</b> / <b>Max Cr Hr</b> <i>Current Major CIP:</i> <b>26.01</b> <i>Current Program Title:</i> Biology <i>Current Program BOR Approval Date:</i>				
<input type="checkbox"/>	Out of Service Area Delivery Program				

**Chief Academic Officer (or Designee) Signature:**

I, the Chief Academic Officer or Designee, certify that all required institutional approvals have been obtained prior to submitting this request to the Office of the Commissioner.

Please type your first and last name \_\_\_\_\_ Date: \_\_\_\_\_

☐ I understand that checking this box constitutes my legal signature.

<sup>1</sup> For CIP code classifications, please see <http://nces.ed.gov/ipeds/cipcode/Default.aspx?y=55>.

<sup>2</sup> "Proposed Beginning Term" refers to first term after Regent approval that students may declare this program.

**Utah System of Higher Education  
Program Description - Abbreviated Template**

**Section I: The Request**

University of Utah requests approval to offer the following Emphasis: BS/BA in Biology with emphasis in Plant Biology effective Fall 2019. This program was approved by the institutional Board of Trustees on .

**Section II: Program Proposal/Needs Assessment**

**Program Description/Rationale**

*Present a brief program description. Describe the institutional procedures used to arrive at a decision to offer the program. Briefly indicate why such a program should be initiated. State how the institution and the USHE benefit by offering the proposed program. Provide evidence of student interest and demand that supports potential program enrollment.*

This proposal for a new emphasis in Plant Biology is the outcome of a three-year effort to reform the undergraduate curriculum in the School of Biological Sciences (School). The initial organization of the reform effort was carried out by a task force that included members from all Divisions within the School (previously Department), whose goals were to assess (and remediate, if needed) the freshman-year experience and to make it easier for undergraduates to complete the major in four years.

Discussions were held among faculty in each of the Divisions as well as groups of faculty representing specific teaching areas (e.g. Cell Biology or Ecology). There was strong participation among both tenure-line and career-line faculty, and the discussions identified three major curriculum problems. First, in their first year, Biology students were not being exposed to the full breadth of the biological sciences, nor being offered laboratory classes. Second, biology has grown enormously in the 20+ years since our last curriculum reorganization, and this explosive growth has led potential employers of our undergraduates to seek more specialized training. Third, the diversity of course offerings makes it challenging for many undergraduates to identify the set of courses that best meets their interests and career goals.

To address the first of these challenges, a new first-year Biology curriculum has been developed. This course sequence, Fundamentals of Biology, includes two 3-credit lecture-type courses, and two 1-credit inquiry-based labs (8 credits total). The wide-ranging content of these courses was developed in consultation with the entire Biology faculty. This course sequence is being offered now (Fall 2018) with limited enrollment (~100 students), and will be available to all students beginning Fall 2019.

To address challenges two and three (the growth of the field of biology and difficulty for undergraduates to identify coherent sets of courses), the School proposes to expand number of emphases. In addition, the School proposes changes in the required Biology core courses to allow increased flexibility and greater specialization. The proposed new core series will include the BIOL 1600 sequence (8 credits), BIOL 2020 (Cell Biology, 3 cr), and BIOL 2030 (Genetics, 3 cr). This core series will be accompanied by emphasis-specific requirements and electives.

Our proposed emphasis in Plant Biology is one of four new emphases being proposed by the

School, with the others being Genetics & Genomics, Microbiology, and Neuroscience. These emphases were approved by the School's Curriculum Committee, presented to the faculty for a vote on October 22nd, 2018, with near unanimous approval (29 for, 0 against, 1 abstention).

Currently there are approximately 1160 majors in Biology. Of these, about half are enrolled in existing emphases (20% Anatomy and Physiology, 14% Cell and Molecular, 9% Environmental & Organismal, and 5 % Biochemistry), indicating the appeal for students to focus their studies within Biology. The remaining 52% are not pursuing a particular emphasis. We anticipate that 10-15% of our students will choose to pursue a new emphasis in Plant Biology.

The University will benefit from this new emphasis. Our competing PAC-12 institutions offer a variety of plant-focused degrees, including Plant Biology, Plant Science, Plant Pathology, Botany, Molecular Plant Science, Crop Science, Horticulture, Forestry, and Rangeland Science. Stanford houses the Carnegie Institution Department of Plant Biology. The University of Arizona has a School of Plant Sciences, and the U. of California at Berkeley has a Department of Plant and Microbial Biology. If we want to compete with these institutions for students, we must provide appropriate areas of study, including Plant Biology.

### **Labor Market Demand**

*Provide local, state, and/or national labor market data that speak to the need for this program. Occupational demand, wage, and number of annual openings information may be found at sources such as Utah DWS Occupation Information Data Viewer ([jobs.utah.gov/jsp/wi/utalmis/gotoOccinfo.do](http://jobs.utah.gov/jsp/wi/utalmis/gotoOccinfo.do)) and the Occupation Outlook Handbook ([www.bls.gov/oco](http://www.bls.gov/oco)).*

There are many job opportunities within Utah and the nation in Plant Biology. Utah has a strong industry requiring understanding of plant biology, including agriculture (fields, nurseries, orchards, greenhouses), ranching (crops to feed animals), forestry, horticulture, and plant-based manufacturing (e.g. dietary, herbal, and nutritional supplements, essential oils, personal care products, etc.). The United States Bureau of Labor Statistics lists the following occupations with number of jobs nationally (2015 and 2016 data): soil and plant scientists (14,180), environmental scientists (89,500), conservation scientists and foresters (34,600), agricultural and food scientists (43,000), farming, ranching, and agricultural managers (1,028,700), agricultural inspectors (13,960), forest and conservation workers (6,870), forest and conservation technicians (29,810), urban planners (36,000), and green industry jobs (e.g., landscape architects and designers, landscape contractors, greenhouse managers and workers, 912,360).

This emphasis will also assist with the Governor's vision of a well-educated workforce. We expect this emphasis to increasing the rates at which young adults earn a BS/BA in Biology because its core requirements allow greater flexibility than the standard BS/BA in Biology at the University of Utah. In addition, the emphasis will help undergraduates to enroll in a coherent set of courses that that emphasizes Plant Biology. As described above, this area is important to the Utah economy, and a degree carrying this emphasis will help to meet the demands of our current and future workforce.

### **Consistency with Institutional Mission/Impact on Other USHE Institutions**

*Explain how the program is consistent with the institution's Regents-approved mission, roles, and goals. Institutional mission and roles may be found at [higheredutah.org/policies/policyr312/](http://higheredutah.org/policies/policyr312/). Indicate if the program will be delivered outside of designated service area; provide justification. Service areas are defined in [higheredutah.org/policies/policyr315/](http://higheredutah.org/policies/policyr315/).*

The proposed emphasis in Plant Biology is quite consistent with the mission of the U: "The University of Utah fosters student success by preparing students from diverse backgrounds for lives of impact as leaders and citizens. We generate and share new knowledge, discoveries, and innovations, and we engage local and global communities to promote education, health, and quality of life."

The program will be delivered within our designated service area (at the U of U. in Salt Lake County).

## **Broad learning objectives for the Plant Biology Emphasis in Biology**

**Evolution:** Students will be able to understand the role of genetic mechanisms in evolution and apply the principles of natural selection and mechanisms of genetic change, including trait variation and heritability, to explain the observed diversity of plants and their structure and function.

### **Transmission, flow and interpretation of biological information**

Students will understand the chemical basis of heredity (inheriting traits from parents) and apply knowledge of genetics, gene expression, growth and development, signal perception and transduction, and physiological regulation to explain how information is stored, transmitted and utilized in plant contexts.

### **Structure and function**

Students will be able to apply knowledge of molecular, cellular, and organismal plant structures and community assemblies to explain the diverse set of functions – ranging from the sub cellular to biochemical to physiological to ecological – that underlie the remarkable diversity of plants in nature.

**Systems:** Students will be able to explain how biological units interact to give rise to emergent properties at multiple levels of organization (organelles, cells, organs, plants, plant communities, ecosystems, biomes, planet).

### **Ability to apply the process of science.**

Students will be able to apply the process of science to identify knowledge gaps, formulate hypotheses, and test them against experimental and observational data to advance an understanding of plants and plant communities in nature, in agriculture (including forests and grasslands), and in the laboratory/greenhouse, including experiments with plant model systems.

### **Ability to use quantitative reasoning.**

Students will be able to use logical, mathematical and computational methods and tools to describe plant systems and be able to apply quantitative approaches, such as statistics, quantitative analysis of dynamic systems, bioinformatics, and mathematical modeling.

### **Ability to participate in the interdisciplinary nature of science through clear communication and collaboration with other disciplines**

Students will be able to use and apply concepts in plant biology to communicate plant research results to scientific colleagues and to broad audiences, write research articles and/or grant proposals, and present posters at meetings or symposia.

### **Ability to explain the relationship between science and society**

Students will be able to evaluate the interactions between plants and society, including the societal benefits of plant research (e.g., enhancing agriculture) or plant products for other human use (e.g., plant-derived medicines, dietary supplements, and industrial products), and environmental sustainability. Students will be able to understand and evaluate public perception and decision-making about plant-relevant science, and clearly communicate their

implications to broad audiences.

### **Assessment of ELOs**

**Assessments and grades in courses.** Assessments (formative and summative) and grades in the emphasis-required and emphasis-recommended elective courses will be used to evaluate student performance in the various targeted learning outcomes. For example, presentations in seminar courses will be used to evaluate communication skills, and grades in laboratory courses will be used to evaluate the ability to apply the process of science. These data will be used by the School to interpret trends and, as needed, address curricular changes to improve certain outcomes.

**Exit surveys.** Graduating students will be encouraged to fill out an on-line survey that asks for self-assessment in emphasis-specific learning outcomes.

**Feedback from alumni and tracking students after graduation.** Alumni will be periodically surveyed to ask how well their training in the Plant Biology emphasis has helped them in their careers. The program will also collect data on the first position taken by graduates after completing their emphasis with the assumption that obtaining professional positions/admissions is a measure of our graduates achieving the desired learning outcomes.

### **Finances**

*What costs or savings are anticipated in implementing the proposed program? If new funds are required, indicate expected sources of funds. Describe any budgetary impact on other programs or units within the institution.*

This new emphasis will have no impact on the finances of the University of Utah. All courses in the emphasis are already being taught.

### Section III: Curriculum

#### Program Curriculum

List all courses, including new courses, to be offered in the proposed program by prefix, number, title, and credit hours (or credit equivalences). Indicate new courses with an X in the appropriate columns. The total number of credit hours should reflect the number of credits required to receive the award. **For NEW Emphases, skip to emphases tables below.**

For variable credits, please enter the minimum value in the table below for credit hours. To explain variable credit in detail as well as any additional information, use the narrative box below.

Course Number	NEW Course	Course Title	Credit Hours
General Education Courses (list specific courses if recommended for this program on Degree Map)			
<b>General Education Credit Hour Sub-Total</b>			
Required Courses			
Add Another Required Course			
<b>Required Course Credit Hour Sub-Total</b>			
Elective Courses			
Add Another Elective Course			
<b>Elective Credit Hour Sub-Total</b>			
<b>Core Curriculum Credit Hour Sub-Total</b>			0

Are students required to choose an emphasis for the already-existing degree?	Yes or	No
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Course Number	NEW Course	Course Title	Credit Hours
Name of Emphasis:		Plant Biology	
required		BIOL 3340 Intro to Plant Biology	3
required		BIOL 3410 Ecology & Evolution	3
Select 3 of 12		BIOL 2355 Field Botany	2
		BIOL 3230 Developmental Biology	3
		BIOL 3350 Physiol. of Plants	3
		BIOL 3460 Global Env. Issues	3
		BIOL 3470 Conservation Biology	3
		BIOL 3510 Biochemistry	3
		BIOL 5120 Gene Expression	3
		BIOL 5140 Genome Biology	3
		BIOL 5435 Plant Systematics	3
		BIOL 5460 Plant Ecology in a Changing World	3
		BIOL 5490 Ecosystem Ecology	3
		BIOL 5495 Biophysical Ecology	4
Add Another Emphasis Course			
Emphasis Credit Hour Sub-Total			14
Total Number of Credits to Complete Program			14

Propose a NEW Emphasis to an existing Regent approved program

### Program Curriculum Narrative

*Describe any variable credits. You may also include additional curriculum information, as needed.*

Note that the precise number of credits earned from the "select 3 or 12" category will depend on the courses selected, as the list includes one 2-credit course and one 4-credit course, while most are 3-credits. Thus, the range is 14 - 16 credits.

## Degree Map

*Degree maps pertain to undergraduate programs ONLY. Provide a degree map for proposed program. Degree Maps were approved by the State Board of Regents on July 17, 2014 as a degree completion measure. Degree maps or graduation plans are a suggested semester-by-semester class schedule that includes prefix, number, title, and semester hours. For more details see <http://higheredutah.org/pdf/agendas/201407/TAB%20A%202014-7-18.pdf> (Item #3).*

*Please cut-and-paste the degree map or manually enter the degree map in the table below*

BS in Biology with an Emphasis in Plant Biology

Year 1, Fall

WTRG 2010 3cr

MATH 1210 or MATH 1170 4cr

BIOL 1610 3cr

BIOL 1615[L1] 1cr

BIOL 2870 1cr

University Credits 3cr

TOTAL 15cr

Year 1, Spring

BIOL 1620 3cr

BIOL 1625 [L1] 1cr

CHEM 1210 4cr

CHEM 1215 1cr

MATH 1220 or MATH 1180 4cr

General Education-AI 3cr

TOTAL 16cr

Year 2, Fall

CHEM 1220 4cr

CHEM 1225 1cr

BIOL 2020 (or 2021 4cr) 3cr

General Education-AI 3cr

Bachelor Degree IR 3cr

TOTAL 14-15

Year 2, Spring

CHEM 2310 4cr

BIOL 2030 3cr

General Education-BF 3cr

Biology Science Elective 3cr

General Education-HF 3cr

TOTAL 16cr

Year 3, Fall

PHSY 2010 (or PHYS 2110 or 2210 or 3210) 4cr

BIOL 3510 (Biology elective) 3cr

BIOL 3340 (Emphasis required) 3cr

General Education-FF 3cr

Bachelor Degree DV 3cr

TOTAL 16



Year 3, Spring  
PHSY 2020 (or PHYS 2120 or 2220 or 3220) 4cr  
BIOL 3410 3cr  
General Education-FF 3cr  
Bachelor Degree-CW 3cr  
BIOL 5140 (Emphasis specific) 3cr  
TOTAL 16

Year 4, Fall  
BIOL 5435 [L2] 3cr  
General Education-HF 3cr  
Bachelor Degree QI 3cr  
BIOL 5495 [L1] 4cr  
TOTAL 13cr

Year 4, Spring  
Biology science elective 3cr  
Bachelor Degree QI 3cr  
Upper division electives 3cr  
University credits 3cr  
TOTAL 12cr

BA in Biology with an emphasis in Plant Biology

Year 1, Fall  
WTRG 2010 3cr  
MATH 1210 (or MATH 1170) 4cr  
BIOL 1610 3cr  
BIOL 1615 1cr  
BIOL 2870 1cr  
Bachelor Degree-Language 4cr  
TOTAL 16cr

Year 1, Spring  
BIOL 1620 3cr  
BIOL 1625 1cr  
CHEM 1210 4cr  
CHEM 1215 1cr  
MATH 1220 (or MATH 1180) 4cr  
Bachelor Degree-Language 4cr  
TOTAL 17cr

Year 2, Fall  
CHEM 1220 4cr  
CHEM 1225 1cr  
BIOL 2020 (or 2021 4cr) 3cr  
General Education-AI 3cr  
TOTAL 11-12

Year 2, Spring  
CHEM 2310 4cr  
BIOL 3410 3cr  
General Education-BF 3cr

Bachelor Degree-Language 4cr  
General Education-HF 3cr  
TOTAL 17cr

Year 3, Fall  
PHSY 2010 (or PHYS 2110 or 2210 or 3210) 4cr  
BIOL 2030 3cr  
BIOL 3340 (Emphasis required) 3cr  
General Education-HF 3cr  
Bachelor Degree DV 3c  
TOTAL 16cr

Year 3, Spring  
PHSY 2020 (or PHYS 2120 or 2220 or 3220) 4cr  
BIOL 3510/ CHEM 3510 (Biology elective) 3cr  
Upper division General elective 3cr  
Bachelor Degree-CW 3cr  
Bachelor Degree-IR 3cr  
TOTAL 16cr

Year 4, Fall  
BIOL 5495 [L1] 4cr  
BIOL 5435 [L2] 3cr  
General Education-HF 3cr  
Upper division General elective 3cr  
TOTAL 13

Year 4, Spring  
Biology science elective 3cr  
Biology -3000+elective 3cr  
Upper division General electives 3cr  
General Education-FF 3cr  
General Education-BF 3cr  
TOTAL 15cr