

**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 Neurobiology  
**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> :** 26.1501  
**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 Emphasis for Regent-Approved Program</b> <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> <b>Biology</b> <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 Neurobiology 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 Neurobiology is the outcome of a three-year effort to reform the undergraduate curriculum in the School of Biological Sciences. 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), and its goals were to assess (and remediate, if needed) the freshman-year experience and to make it easier for undergraduates to navigate the major in four years.

Discussions were held among faculty in each of the departmental 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 problems. First, biology students were not offered laboratory classes, nor being exposed to the full breadth of the biological sciences, during their first year. Second, biology has grown enormously in the 20+ years since the last curriculum reorganization, and this explosive growth has also led potential employers of our undergraduates to seek more specialized training. Third, the diversity of course offerings make it challenging for many undergraduates to identify the set of course choices 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, Fundamental 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 the students beginning Fall 2019.

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

This proposed emphasis in Neurobiology is one of four new emphases being proposed by the school, with the others being Genetics & Genomics, Microbiology, and Plant Biology. These emphases were approved by the school's Curriculum Committee, presented to the faculty on October 22nd, 2018, and won near unanimous approval (29 for, one abstention).

The proposed emphasis is designed to assist students in the identification of elective coursework relevant to the field, providing a coherent path to the Biology BA/BS degree and strong foundation in the area of Neurobiology. The transcriptable emphasis will underscore students' preparation and skills, and will likely improve their success in applications for professional and graduate training as well as careers in public and commercial sectors.

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). Clearly, emphases are appealing to students who wish to focus their studies on a particular area within Biology. The remaining 52% of students are not pursuing a particular emphasis. We anticipate that the demand for a new emphasis in Neurobiology will be quite high around 10-15%, similar to other emphases.

Currently, a number of undergraduate students at the University of Utah are taking an individually tailored set of courses for a B.U.S. degree in Neuroscience. These students are typically advised by Biology faculty. A number of these students will likely find a Biology emphasis in Neurobiology an appropriate fit for their interests. Moreover, many Biology students taking basic neurobiology classes such as BIOL. 3240 Introduction to Cellular Neurobiology ask the instructor (Dr. Sophie Caron) if there are additional neurobiology course that they can take.

The University of Utah stands to benefit from the introduction of a Neurobiology emphasis in Biology. A brief sampling of the degree programs available at 5 comparable PAC-12 institutions (listed below) reveals that the University of Utah is embarrassingly behind the curve in providing any sort of undergraduate specialization in the area of Neuroscience. There are a number of departments that offer neuroscience themed undergraduate courses besides Biology (e.g. Bioengineering, Psychology) but there is no degree program that offers a neuroscience emphasis. In order to compete with and retain students at the University of Utah it is imperative that we introduce an emphasis in this area. Like many comparable institutions the University of Utah does have an interdepartmental graduate PhD program in Neuroscience. However, the lack of any opportunity for University of Utah undergraduates to indicate a specialization in neurobiology or neuroscience on their undergraduate transcripts means that they are at a disadvantage when competing for places in Neuroscience PhD programs, not just at PAC-12 institutions but around the country.

University of Arizona: Department of Neuroscience in the School of Mind, Brain and Behavior, undergraduate degree in Neuroscience and Cognitive Science. Interdepartmental graduate PhD program in Neuroscience.

Arizona State: BS and PhD programs in Neuroscience, also Biological Sciences concentration (=emphasis) in Neurobiology, Physiology and Behavior in School of Life Sciences.

UCLA: Interdepartmental BS and PhD programs in Neuroscience.

UC Berkeley: BS degree in Department of Molecular and Cell Biology: Neurobiology emphasis. Graduate PhD program in Neuroscience

## University of Washington: interdisciplinary BS in Neurobiology, graduate PhD program in Neuroscience

### 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)).*

This emphasis will also assist with the Governor's vision of a well-educated workforce. We expect this emphasis to increase 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 emphasizes Neurobiology. As described above, this area is important to the Utah economy, and a degree carrying this emphasis should help to meet the demands of our current and future workforce.

Students graduating with a degree in biology pursue a wide variety of careers in both public and commercial sectors. A large percentage of Biology majors self identify as preprofessional health (medical, dental, veterinary etc.) or allied health (e.g. physical therapy, pharmacy, physicians assistant) and many pursue additional post-graduate training in their field of choice. Health-related jobs are one of the fastest growing sectors of our nation's economy. The healthcare field encompasses a wide range of careers, including hospitals, health practitioners, nursing and residential care facility workers, home health care services, and laboratory and ambulatory care services. In 2013, the U.S. Bureau of Labor Statistics (BLS) estimated that these five areas employed approximately 15.9 million workers. And this is a growth industry; a report from the BLS projects an addition of more than 4 million new health-related jobs between 2012 and 2022.

Beyond typical health professions such as medicine, there exist significant career opportunities for undergraduates with degrees that show a specialization in neuroscience. These include speech & language therapist, occupational therapist, physical therapist, social worker, nursing, pharmacist, technician (imaging such as MRI), care giving - all of which have specializations that deal with neurological disorders in both adults and children (note that many of these careers require additional education or licensure). With an aging population it is expected that growth in these areas will be robust for many years to come (see above).

### 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/).*

Central to the mission of the University of Utah is to provide students of diverse backgrounds with a foundation for future success, including becoming leaders and engaged citizens, and including promotion of education, health and quality of life. The Department of Biology contributes to this mission by providing broad training in the biological sciences. Graduates with a BS/BA in Biology pursue a diversity of careers both in the public and private sectors. Many seek to continue their education with additional postgraduate training in health-related or academic fields. While Biology majors have a high success rate in these endeavors, this emphasis will help students in several ways. First, it guides students along a cohesive intellectual path toward an in-depth yet broad exposure to neurobiology while additionally providing excellent preparation for postgraduate careers and professional schools. Second, because this emphasis will be featured on their transcript and diploma, it will help the students to convey the depth of their preparation to other educational institutions and to potential employers. The program will not be delivered outside of the designated service area.

### Broad learning objectives for the Neurobiology 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 and variation in nervous systems.

### Transmission, flow and interpretation of biological information

Students will understand the chemical basis of heredity 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 neurological networks.

### **Structure and function**

Students will be able to apply knowledge of molecular, cellular, and tissue structures to explain the diverse set of functions of the central and peripheral nervous system of various organisms. Students will know structural and functional features of cells that constitute the nervous system.

**Systems:** Students will be able to explain how biological units interact to give rise to emergent properties at multiple levels of neural circuits and how the nervous system impacts cognition and behavior.

### **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 the nervous system, and execute experiments in neurobiology model systems.

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

Students will be able to use mathematical and computational methods and tools to understand nervous systems and be able to apply quantitative approaches, such as statistics, quantitative analysis of dynamic systems, or 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 neurobiology to communicate neurobiology research data 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 societal impacts of neurobiology research on development of products for human use. Students will also evaluate public perception and decision-making about science relevant to neurobiology, 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 the seminar course 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 Neurobiology 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 in Neurobiology will have no impact on the finances of the University of Utah. All are approved courses within the School of Biological Sciences, most are already offered, and those not currently offered will easily be covered by modest rearrangements of teaching responsibilities of existing faculty.

### 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:		Neuroscience	
required		BIOL 3240 Introduction to Cellular Neurobiology	3
required		BIOL 3510 Biochemistry 1	3
select 3 of 6		BIOL 3245 Cellular Neurobiology Lab	2
		BIOL 3320 Comparative Physiology	3
		BIOL 3330 Behavioral Neurobiology	3
		BIOL 4955 Independent Research (also avail for 1 credit)	2
		BIOL 5285 Biological Microscopy Lab (1-3 credits)	3
		BIOL 5315 Advanced Human Anatomy	3
Add Another Emphasis Course			
Emphasis Credit Hour Sub-Total			15
Total Number of Credits to Complete Program			15

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.*

The precise number of credits earned in the "select 3 or 6" could vary from 7 - 9, resulting in the total number of emphasis-specified credits to range from 13 to 15 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 Neurobiology

Year 1, Fall

WTRG 2010 3cr

MATH 1210 or MATH 1170 4cr

BIOL 1610 3cr

BIOL 1615 1cr

BIOL 2870 1cr

University Credits 3cr

TOTAL 15cr

Year 1, Spring

BIOL 1620 3cr

BIOL 1625 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 14-15cr

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 or CHEM 3510 3cr

BIOL 3240(Emphasis required) 3cr

General Education-FF 3cr

Bachelor Degree DV 3cr

TOTAL 16cr

Year 3, Spring  
PHSY 2020 (or PHYS 2120 or 2220 or 3220) 4cr  
BIOL 3245 (Emphasis specific) [L1] 2cr  
General Education-FF 3cr  
Bachelor Degree-CW 3cr  
Biology 5000+elective 3cr  
TOTAL 15cr

Year 4, Fall  
Biology 5000+ Elective 3cr  
BIOL 3525 [L2] 3cr  
General Education-HF 3cr  
Bachelor Degree QI 3cr  
BIOL 3330 (Emphasis specific) 3cr  
TOTAL 15cr

Year 4, Spring  
BIOL 3320 (Emphasis specific) 3cr  
Bachelor Degree QI 3cr  
Upper division electives 3cr  
University credits 3cr  
TOTAL 12

BA in Biology with an emphasis in Neurobiology

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 BIOL 2021 4cr) 3cr  
General Education-AI 3cr  
TOTAL 11-12cr

Year 2, Spring  
CHEM 2310 4cr  
BIOL 3510 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 3240 (Emphasis required) 3cr  
General Education-HF 3cr  
Bachelor Degree DV 3cr  
TOTAL 16cr

Year 3, Spring  
PHSY 2020 (or PHYS 2120 or 2220 or 3220) 4cr  
BIOL 3245 [L1] 2cr  
Upper division General elective 3cr  
Bachelor Degree-CW 3cr  
Bachelor Degree-IR 3cr  
TOTAL 16cr

Year 4, Fall  
Biology elective-5000+ 3cr  
BIOL 3330 3cr  
General Education-HF 3cr  
Upper division General elective 3cr  
BIOL 3320 3cr  
TOTAL 15cr

Year 4, Spring  
BIOL 5000+ elective 3cr  
Biology -3000+elective lab [L2] 3cr  
Upper division General electives 3cr  
General Education-FF 3cr  
General Education-BF 3cr  
TOTAL 15cr