**COVER SHEET**
**NEW DEGREE PROGRAM PLANNING NOTIFICATION OF INTENT**
**(PLANNING NOI)**

## Program Information

Program name: Biology

Institution name: University of Washington Bothell

Degree Granting Unit: Science and Technology Program

Degree: B.S. Biology Level: Bachelor Type: Science

Major: Biology CIP Code: 26

Minor: _____

Concentration(s):

Proposed Start Date: Winter 2010

Projected Enrollment (FTE) in Year One: 20 At Full Enrollment by Year: 40: 2014

Proposed New Funding: _____

Funding Source: ■ State FTE ☐ Self Support ☐ Other

## Mode of Delivery

■ Single Campus Delivery UW Bothell

☐ Off-site

☐ Distance Learning

## Substantive Statement of Need (attached)

## Contact Information (Academic Department Representative)

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Endorsement by Chief Academic Officer Date

## Statement of Need

## I. Degree Program Description and Rationale

The University of Washington Bothell proposes to offer a Bachelor of Science degree in Biology. Biology is an established, yet vigorously-growing field with students pursuing career paths in health, medicine, research, education, pharmaceuticals, biotechnology, sustainability, and other fields. Additionally, advances in the biological sciences will offer growing opportunities in genomics and genetic counseling, biomedical testing and technology, environmental sciences, toxicology, and research in these and other areas.

### A. Goal

The Biology degree proposed by UW Bothell will allow students to combine theory and classroom learning with research and hands-on experience by utilizing UW Bothell's strengths: small classes, and strong faculty-student mentorship. While addressing traditional content, we will use integrative, problem-based approaches that have proven successful at UW Bothell. An undergraduate research experience is an essential part of the proposed degree program. The degree will interact with existing degree programs in Interdisciplinary Arts & Sciences, Nursing, Education, Computer Science and Business to provide opportunities for students to integrate these areas of study.

## II. Relationship to Institutional and Unit Priorities

### A. Mission.

The University of Washington Bothell Mission Statement states: "We provide access to excellence in higher education through innovative and creative curricula, interdisciplinary teaching and research, and a dynamic community of multicultural learning." Further, our mission is to "Encourage and support collaborative, interdisciplinary and cross-program initiatives." The Biology degree strives to be inclusive by providing pedagogical support, especially to underprepared students, early in the degree program.

### B. Strategic Plan

The 21st Century Initiative is a recently completed plan that establishes the priorities for growth until 2020 for the University of Washington Bothell. Our top priority is to "serve the citizens of the State of Washington by providing access to a premier university education," with special emphasis on developing new degree programs that respond to the economic development needs of the state and region. Specifically, the areas of Science, Technology, Engineering and Math (STEM) and Health were identified as top priorities for immediate growth. The proposed degree will support, and be housed in, our Science and Technology Program. It will emphasize UW Bothell's signature strength in interdisciplinary scholarship, bridging disparate fields within the biological sciences as well as making connections between biology and the social sciences and humanities.

## III. Demand

A Biology degree provides a strong basis for continued education and specialization within the biological sciences. The degree also serves as a springboard to many health and health care careers. Regardless of the direction graduates may pursue, current reports indicate that demand for science degrees is strong nationally and regionally and will continue to grow.

### A. National Demand

Employment of biologists is projected to grow 9 percent from 2008- 2016. (Table 1) There are a number of national trends that support growth in this profession. These include, in part, the growth of biotechnology companies, bio- agriculture and green economy jobs. Many biological scientists work in research and development supported by private industry and government agencies.

Additionally the Bureau of Labor Statistics noted that there will continue to be demand for biologists specializing in botany, zoology, and marine biology and asserted that biological scientists are less likely to lose their jobs during recessions than are those in many other occupations because many are employed on long-term research projects.

| Occupational title | SOC Code* | Employment, 2006 | Projected employment, 2016 | Change, 2006-16 | |
|---|---|---|---|---|---|
| | | | | Number | Percent |
| **Biological scientists** | 19-1020 | 87,000 | 95,000 | 8,000 | 9 |
| **Biochemists and biophysicists** | 19-1021 | 20,000 | 23,000 | 3,200 | 16 |
| **Microbiologists** | 19-1022 | 17,000 | 19,000 | 1,900 | 11 |
| **Zoologists and wildlife biologists** | 19-1023 | 20,000 | 22,000 | 1,700 | 9 |
| **Biological scientists, all other** | 19-1029 | 29,000 | 30,000 | 1,100 | 4 |

**Table 1: Projection data from the National Employment Index: http://www.bls.gov/oco/ocos047.htm**

***Standard Occupational Classification, Bureau of Labor Statistics**

### B. Washington State Demand

The high demand areas for Washington State include numerous specializations in science. A stated policy goal of the HEC Board is, "Expand bachelors and advanced degree programs in science, technology, engineering, mathematics and health

sciences…."[1] Current and projected demand exceeds the number of graduates in the state. Community colleges are increasing the numbers of students enrolled in biology and science programs. It becomes imperative to increase postsecondary education and training capacity to close the gap between employers need and the supply of Washington residents prepared to meet that need.[2]

There is also a demand for science and math certified teachers in Washington K-12 as reported by Educational Service Districts (ESDs). Evidence of this undersupply can be seen in the endorsement records the Standards Board collects. The shortage of Washington science and math teachers is evident in the results of a five-year study of the subject-area endorsements issued to high school teachers between 2002 and 2006. Of the 906 endorsements issued for math, biology, chemistry, earth science, science, physics, and mid-level math/science, 343—or almost 38 percent—were issued to out-of-state teachers, not to Washington residents.

| Occupation | Est. Year - Projected Year | Estimated Employment | Growth Rate | Change | % Change | Annual Openings |
|---|---|---|---|---|---|---|
| Biological Scientists, All Other | 2006 - 2016 | 1,463 | 1.2 | 189 | 12.9 | 101 |
| Biological Technicians | 2006 - 2016 | 3,406 | 1.5 | 552 | 16.2 | 372 |
| Biological Science Teachers, Postsecondary | 2006 - 2016 | 1,053 | 1.5 | 166 | 15.8 | 71 |

**Table 2: WSESD/LMEA: https://fortress.wa.gov/esd/lmea/countydashboard/Summary.aspx?**

## C. Snohomish and King County Demand

UW Bothell is located in the biotech corridor which includes the Sno-King region along I-405. Located in Bothell are five biotech companies including Amgen, ICOS and Nanogen. The location also provides an opportunity for partnerships from which students can benefit.

| Occupation Snohomish County | Est. Year - Projected Year | Estimated Employment | Growth Rate | Change | % Change | Annual Openings |
|---|---|---|---|---|---|---|
| Biochemists and Biophysicists | 2006 - 2016 | 69 | 3.8 | 31 | 44.9 | 10 |
| Biological Scientists, All Other | 2006 - 2016 | 228 | 3.5 | 93 | 40.8 | 30 |
| Biological Technicians | 2006 - 2016 | 168 | 3.2 | 63 | 37.5 | 26 |

**Table 3:** WSESD/LMEA**:**
**https://fortress.wa.gov/esd/lmea/countydashboard/Videos/OccupationalWages.swf**

[1] 2008 Strategic Master Plan for Washington State, WHECB, Olympia, WA 2008, p26.
[2] Workforce Training and Education Coordinating Board: http://www.wtb.wa.gov/Activities_HighSkills.asp.

| Occupation King County | Est. Year - Projected Year | Estimated Employment | Growth Rate | Change | % Change | Annual Openings |
|---|---|---|---|---|---|---|
| Biomedical Engineers | 2006 - 2016 | 337 | 1.5 | 56 | 16.6 | 28 |
| Biochemists and Biophysicists | 2006 - 2016 | 271 | 1.6 | 48 | 17.7 | 22 |
| Biological Scientists, All Other | 2006 - 2016 | 742 | 1.5 | 115 | 15.5 | 55 |
| Biological Technicians | 2006 - 2016 | 1,552 | 1.7 | 287 | 18.5 | 178 |
| Biological Science Teachers, Postsecondary | 2006 - 2016 | 585 | 1.6 | 102 | 17.4 | 42 |

**Table 4:** WSESD/LMEA**:**
**https://fortress.wa.gov/esd/lmea/countydashboard/Videos/OccupationalWages.swf**

## IV. Student Demand

UW Bothell is collecting data on student interest in our proposed STEM programs under development. Of the proposed degrees, interest in biology is the highest. Data from October 2008 to January 2009 indicate that 248 students have inquired about the program. This number does not include interest expressed in the biology degree program by freshmen students currently enrolled at UW Bothell.

The Biology Degree Program will strive to admit 20 FTE (students) in its first year, attending full- or part-time. UW Bothell expects student flow to come from a combination of UWB students and students at neighboring colleges, especially Community Colleges.

## V. Relationship to HECB Master Plan & State and Regional Needs Assessment

The Higher Education Board outlines two primary goals in its strategic plan:
**Goal 1:** We will create a high-quality higher education system that provides expanded opportunity for more Washingtonians to complete postsecondary degrees, certificates, and apprenticeships.
**Goal 2:** We will create a higher education system that drives greater economic prosperity, innovation and opportunity.

UW Bothell's charge is to provide educational opportunity and increase access for the region and community. We structure every program with the goal of incorporating flexibility and support for our students who are non-traditional or from underserved

populations. The Biology degree will address regional prosperity by educating graduates who will be prepared to enter high demand and growth industries in the State. It has the additional focus of being a STEM-oriented degree program thereby encouraging secondary education and pipeline institutions to strengthen and support STEM curricula.

## A. HECB Master Plan Strategies

The Biology degree structure promotes the core objectives in the Master Plan:

**Educational Attainment:**

1. *Focus on diversity*. UW Bothell strives to bring a significant population of non-traditional students to science and technology fields, including underserved populations and students with disabilities. Included in the seven priorities of the 21st Century Initiative is our commitment to diversity and inclusiveness. Implementation of the "21st Century Initiative" included identifying barriers to enrollment and developing strategies to surmount barriers.

2. *Create higher expectations for K-12 students*. The Biology degree will serve as gateway for students wishing to pursue careers in K-12 education. There is a great regional need for secondary biology teachers. This degree program will help support the new secondary endorsement in Biology offered by the UW Bothell Education Program. Through innovative teaching apprenticeships for teachers seeking the secondary endorsement in biology, we can assist in future teacher training. Such a partnership will also help to make teachers aware of advances in biology that can be used to motivate students at all levels.

3. *Create a system of support for lifelong learning*. The Biology degree will employ traditional classroom and hands-on modes of learning while addressing subject matter using problem-based and integrative approaches. Such a combination of approaches will speak to students with a diversity of learning styles and equip them to tackle a range of future challenges. Advising and support services will contribute to the academic success of students.

## B. State & Regional Needs Assessment

According to the State and Regional Needs assessment, the state is not producing graduates to meet demand in health professions or research, scientists and technical professions. (WHECB, 2005)

1. **Fill unmet needs in high-demand fields**. The need for graduates in Biology is supported by the data in the proposal. Additionally, UW Bothell is located in a technology corridor and is informed and encouraged by its regional partners to create programs that will provide industry-ready graduates. The Biology degree program will encourage leadership and innovation in its graduates.
2. **Promote student enrollment in STEM fields**. A Science and Technology(S&T) unit was recently approved at UW Bothell. The Biology degree will be housed in, and help to define, the new S&T unit. Classes developed and implemented for

the Biology degree will provide infrastructure that will be needed to launch programs in math, chemistry and physics. The growth of the STEM disciplines at UW Bothell directly address the SRNA stated need.

3. **Expand research capacity:** The SRNA report refers to a declining number of graduates in research while noting a need for higher levels of training. A focus of the Biology degree will be to involve faculty and students in collaborative research. UW Bothell's Office of Research Support (ORS) will provide administrative support for research and assist in identifying and connecting the program with relevant research opportunities regionally and nationally.

## VI. Proposed Curriculum

Degrees in Biology are offered at most colleges and universities. Nevertheless, according to Bio2010 (National Research Council, 2003), "in contrast to biological research, undergraduate biology education has changed relatively little during the past two decades." The proposed curriculum will respond to recommendations for improving the quality and effectiveness of biology education, by combining mastery of fundamental concepts in biology, chemistry, physics and math with hands-on learning and collaborative student/faculty research. Further, due to the well-developed Interdisciplinary Arts and Sciences program at UWB, Biology students will also have the opportunity to apply their biological expertise to diverse social, cultural and scientific issues in interdisciplinary elective courses.

### A. Bachelor of Science in Biology

**Mathematics:** 2 quarters

B CUSP 124 Calculus I or BCUSP 125: Calculus II
Statistics

**Physics:** 2 quarters

Either of the following sequences:

BCUSP 143, 144: General Physics
BCUSP 149: Mechanics; and BCUSP 150: Electromagnetism and Oscillatory Motion

**Chemistry:** 4 quarters, covering basic Inorganic and Organic Chemistry

We hope to develop a 4-quarter Chemistry sequence for Biology (and perhaps other) majors when demand is sufficient. Given current UWB course offerings, we will require that students take the 3-quarter General Chemistry sequence, followed by one quarter of Organic Chemistry.

BCUSP 142, 152, 162: General Chemistry
BCUSP 237: Organic Chemistry

**Biology**:

**Required courses**
*(Courses in italics are currently offered or could be offered by current UWB faculty)*

1st year:
- *Introductory Biology* (2 quarters)
- *Scientific Concepts (see new course descriptions below)*
  - *(OR an acceptable 3 quarter Introductory Biology sequence [e.g., BES 180, 200, 220])*

2nd/3rd year:
- *Genetics*
- *Ecology*
- Cellular and Subcellular Biology
  (one of the following three courses):
  - Microbiology
  - Biochemistry
  - *Cell Biology*
- Physiology (one of the following three courses):
  - Anatomy & Physiology
  - *Plant Physiology*
  - Animal Physiology

3rd/4th year:
- *Evolution*
- Literature in Biology
- Research in Biology

**Additional elective offerings** will include

200-level:
- Biodiversity
- Nutrition

300-level:
- Molecular Biology
- *Marine Diversity and Conservation*
- *Restoration Ecology*
- *History of Life*

400-level:
- Genomics/Bioinformatics
- Bioengineering
- *Developmental Biology*
- Neurophsyiology
- *Ecophysiology*
- *Animal Behavior*
- Toxicology

*Evolution Laboratory*
*Conservation Biology*
*Restoration Ecology/Capstone*

## B. Descriptions of proposed new courses

Most Required and Elective courses (for example, Genetics, Biochemistry, Animal Physiology) are accepted and well-defined sub-areas of Biology; we will not describe these proposed new courses in detail here. However, we do propose three courses that do not fall into this category; these are described below.

***Scientific Concepts***
Many students enter college underprepared for the academic rigor of the courses they will take. This is especially true in the sciences, where students often become disengaged or change their major because of inadequate preparation. To address this problem, *Scientific Concepts* will serve as a support course for students beginning the study of science and math. The course will emphasize the scientific method, core skills and competencies, and how to study and understand scientific concepts. We envision that this course will help all students to adjust to the learning of science at the college level, and will be especially important for underprepared students.

***Literature in Biology***
Once students are grounded in the fundamentals concepts of biological science, this course will serve as a more structured introduction to research in the field of biology. . Students will learn the structure of scientific papers, how to read papers, and how to interpret data as presented by researchers to their peers. Students will make presentations, thereby enhancing both oral communication and presentation skills. Ideally, the class will meet in small groups, each focused on a sub-area of biology, so that students will learn biological content as well as other skills. Finally, in collaboration with their faculty research mentor, students will prepare a research proposal, to guide their research in a subsequent research course.

***Research in Biology***
Students will engage in a quarter-long research project under the supervision of a faculty mentor. These projects can be laboratory-based, or, until appropriate infrastructure is developed at UWB, field-based or library-based. For the research experience to be meaningful for students, a mechanism will need to be established to grant faculty members appropriate teaching credit to supervise student research.

***Elective courses:***
Some courses can be offered by current UW Bothell faculty (in italics), depending on their availability and the need to offer other courses. Many of the proposed electives will be offered only as the program grows, and additional faculty are hired. Clearly, the repertoire of course offerings will depend on the faculty members hired, student demand, and on changes in Biology itself.

## C. Assessment

A formal system of assessment of student learning and long-term success, and curricular effectiveness, will be developed. This will allow us to assess newly-developed courses and approaches for student preparation, learning, career outcomes, and faculty development. Critical reflection and response will allow us to continually improve student experiences and outcomes through the early years of degree development and into the future.