



OFFICE OF THE PRESIDENT

August 31, 2010

Vice Chancellor Susan Jeffords  
University of Washington, Bothell  
Box 358522

Dear Susan:

Based upon the recommendations of the Executive Council on General Faculty Organization, the Faculty Council on Tri-Campus Policy has recommended approval of a Bachelor of Science degree in Biology. A copy of the proposal is attached.

I am writing to inform you that the Science and Technology program is authorized to offer this option beginning autumn quarter 2010 and thereafter.

The new requirements should be incorporated in printed statements and in individual department websites as soon as possible. The *General Catalog* website will be updated accordingly by the Registrar's Office.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Mark A. Emmert".

Mark A. Emmert  
President

Enclosure

cc: Dr. Marc Servetnick (with enclosure)  
Ms. Annette Anderson (with enclosure)  
Mr. Robert Corbett (with enclosure)  
Dr. Deborah H. Wiegand (with enclosure)  
Ms. Virjean Edwards. (with enclosure BBIO-20100126)



UNIVERSITY OF WASHINGTON  
**CREATING AND CHANGING UNDERGRADUATE  
ACADEMIC PROGRAMS**

FEB 02 2010

OFFICE USE ONLY

Control #

BBIO-20100126

After college/school/campus review, send a signed original and 8 copies to the Curriculum Office/FCAS, Box 355850.

For information about when and how to use this form: <http://depts.washington.edu/uwcr/1503instructions.pdf>

<b>College/Campus</b> UW Bothell	<b>Department/Unit</b> Science & Technology	<b>Date</b> 1/26/2010
<b>New Programs</b> <input type="checkbox"/> Leading to a Bachelor of _____ in _____ degree. <input checked="" type="checkbox"/> Leading to a Bachelor of <u>Science</u> degree with a major in <u>Biology</u> . <input type="checkbox"/> Leading to a _____ Option within the existing major in _____. <input type="checkbox"/> Leading to a minor in _____		
<b>Changes to Existing Programs</b> <input type="checkbox"/> New Admission Requirements for the Major in _____ within the Bachelor of _____. <input type="checkbox"/> Revised Admission Requirements for the Major in _____ within the Bachelor of _____. <input type="checkbox"/> Revised Program Requirements for the Major in _____ within the Bachelor of _____. <input type="checkbox"/> Revised Requirements for the Option in _____ within the major in _____. <input type="checkbox"/> Revised Requirements for the Minor in _____.		
<b>Other Changes</b> <input type="checkbox"/> Change name of program from _____ to _____. <input type="checkbox"/> New or Revised Continuation Policy for _____. <input type="checkbox"/> Eliminate program in _____.		
Proposed Effective Date: <b>Quarter:</b> <input checked="" type="checkbox"/> Autumn <input type="checkbox"/> Winter <input type="checkbox"/> Spring <input type="checkbox"/> Summer <b>Year: 20 10</b>		
Contact Person: Marc Servetnick	Phone: 425-352-3753	Email: mservetnick@uwb.edu
Box: 3585		
<b>EXPLANATION OF AND RATIONALE FOR PROPOSED CHANGE</b> For new program, please include any relevant supporting documentation such as student learning outcomes, projected enrollments, letters of support and departmental handouts. (Use additional pages if necessary). please see attached proposal		
<b>OTHER DEPARTMENTS AFFECTED</b> List all departments/units/ or co-accredited programs affected by your new program or changes to your existing program and acquire the signature of the chair/director of each department/unit listed. Attach additional page(s) if necessary. *See online instructions.		
Department/Unit:	Chair/Program Director:	Date:
Department/Unit:	Chair/Program Director:	Date:

**CATALOG COPY**

Catalog Copy as currently written. Include only sections/paragraphs that would be changed if your request is approved. Please cross out or otherwise highlight any deletions.

**PROPOSED CATALOG COPY**

Reflecting requested changes (Include exact wording as you wish it to be shown in the printed catalog. Please underline or otherwise highlight any additions. If needed, attach a separate, expanded version of the changes that might appear in department publications).  
**Please note:** all copy will be edited to reflect uniform style in the General Catalog.

Biology, the study of living organisms, informs our understanding of diverse aspects of the living world. Biology encompasses life from its molecular basis to the evolution of diverse life forms, and their interactions with each other and the environment. The Bachelor of Science degree in Biology at the University of Washington Bothell provides a broad education, including required courses in diverse areas of Biology, electives to provide depth in the student's area of interest, and courses on the social and ethical impacts of Biology.

**APPROVALS**

Chair/Program Director:

Date:

Jan 29, 2010

College/School/Campus Curriculum Committee:

Date:

Feb 1, 2010

Dean/Vice Chancellor:

Date:

Feb 1, 2010

Faculty Council on Academic Standards/ General Faculty Organization/Faculty Assembly Chair:

Date:

Feb 1, 2010

**POST TRI-CAMPUS APPROVAL (when needed)**

Faculty Council on Academic Standards/ General Faculty Organization/Faculty Assembly Chair:

Date:

4/2/10

APR 15 2010

**W** UNIVERSITY of WASHINGTON | BOTHELL

---

*Office of the General Faculty Organization*

To: Faculty Council on Tri-Campus Policy

From: Bruce Kochis, Chair, Executive Council of the General Faculty Organization, University of Washington Bothell

Date: 7 April 2010

Re: Executive Council Approval of the Proposed BS in Biology for the Science and Technology Program

The Executive Council (EC) of the General Faculty Organization of University of Washington Bothell reviewed the responses from the tri-campus review of the proposal for a new S&T program BS in Biology at its April 7 meeting. The EC has determined that the proposing faculty in the S&T program have duly considered and responded to the comments posted by faculty from across the three campuses during the tri-campus review period. A letter containing the responses is attached with the checklist. The EC furthermore voted to approve the Biology proposal.

Please let me know if you need any additional information.

# Memo

To: GFO/EC  
From: Annette  
Date: 3/26/2010  
Re: Response to Tricampus Review – Biology Proposal

---

Attached for review is the S & T program response to comments from TriCampus review  
Please review and return to TriCampus ASAP. Form 1503 is also attached for the signature.

Thanks!

Enclosures:

1. Form 1503
2. Response memo to comments
3. Biology proposal

To: GFO Executive Council  
From: Warren Buck, Acting Director of S&T  
Re: Biology BS Proposal  
Date: March 17, 2010

The proposal for a Bachelor of Science degree in Biology was posted to the web site for tri-campus curriculum review. We received a single response to that posting, copied below:

---

posted Feb 6, 2010:

I find it interesting that this new Biology degree is housed in a new STEM program at UWB. What about the S in IAS?? Most colleges of arts and sciences house all the natural science and math courses on campus. Why do you have to create a whole new program to do this?? and how does this fit with Electrical Eng. in that program? and how is this new program going to interface with the Environmental Science degree in IAS - which by the way is a lot closer in curricular requirements that electrical engineering. This does not make organizational sense (or efficient use of resources in a time of limited resources) nor does it promote interdisciplinarity.

It is obvious that this program is designed to attract students (\$), promote more research (\$) and is designed primarily for pre-health and biotech professionals. Do you really need a new degree program to serve these students?? You could add these courses to natural sciences in IAS and serve the same student population thru an ES degree or if you really want a degree program in biology it should be in arts and sciences. Unless your goal at UWB is to create a school of arts and letters and a separate school of science and engineering - in which case you would have to combine CSS and Environmental Science in Science and Eng. On such a small campus, it does not make sense to offer natural science degrees in separate programs.

Cheryl Greengrove  
Associate Professor of Geoscience  
Founding faculty member Environmental Science IAS UWT

---

Our response to this comment (taken largely from the proposal to establish an S&T Program):

The Science and Technology Program was established as a result of extensive analysis, discussion and planning on the part of faculty and administration over the course of several years. The UW Bothell Applied Science and Technology Planning Group (ASTP Group) was charged in 2006 with planning for growth in STEM (science, technology, engineering, and math) fields; the ASTP report served as a basis for further development. In 2008, in conjunction with the campus-wide priorities planning process, a STEM Task Force was appointed to recommend ways to accelerate growth in these fields. The STEM Task Force report outlined several possible organizational options. Based on these recommendations; on comments on the STEM Task Force report; on recommendations obtained through program, faculty and campus-wide meetings; and on analysis of available resources, UW Bothell chose to establish a new program in Science and Technology; that program was

To: GFO Executive Council  
From: Warren Buck, Acting Director of S&T  
Re: Biology BS Proposal  
Date: March 17, 2010

The proposal for a Bachelor of Science degree in Biology was posted to the web site for tri-campus curriculum review. We received a single response to that posting, copied below:

---

posted Feb 6, 2010:

I find it interesting that this new Biology degree is housed in a new STEM program at UWB. What about the S in IAS?? Most colleges of arts and sciences house all the natural science and math courses on campus. Why do you have to create a whole new program to do this?? and how does this fit with Electrical Eng. in that program? and how is this new program going to interface with the Environmental Science degree in IAS - which by the way is a lot closer in curricular requirements that electrical engineering. This does not make organizational sense (or efficient use of resources in a time of limited resources) nor does it promote interdisciplinarity.

It is obvious that this program is designed to attract students (\$), promote more research (\$) and is designed primarily for pre-health and biotech professionals. Do you really need a new degree program to serve these students?? You could add these courses to natural sciences in IAS and serve the same student population thru an ES degree or if you really want a degree program in biology it should be in arts and sciences. Unless your goal at UWB is to create a school of arts and letters and a separate school of science and engineering - in which case you would have to combine CSS and Environmental Science in Science and Eng. On such a small campus, it does not make sense to offer natural science degrees in separate programs.

Cheryl Greengrove  
Associate Professor of Geoscience  
Founding faculty member Environmental Science IAS UWT

---

Our response to this comment (taken largely from the proposal to establish an S&T Program):

The Science and Technology Program was established as a result of extensive analysis, discussion and planning on the part of faculty and administration over the course of several years. The UW Bothell Applied Science and Technology Planning Group (ASTP Group) was charged in 2006 with planning for growth in STEM (science, technology, engineering, and math) fields; the ASTP report served as a basis for further development. In 2008, in conjunction with the campus-wide priorities planning process, a STEM Task Force was appointed to recommend ways to accelerate growth in these fields. The STEM Task Force report outlined several possible organizational options. Based on these recommendations; on comments on the STEM Task Force report; on recommendations obtained through program, faculty and campus-wide meetings; and on analysis of available resources, UW Bothell chose to establish a new program in Science and Technology; that program was

Application to the  
Higher Education Coordinating Board  
for a New Degree

Bachelor of Science  
in Biology

Science and Technology Program  
University of Washington Bothell  
January 22, 2010



**COVER SHEET**  
**NEW DEGREE PROGRAM PROPOSAL**  
*Part I requires the completion of the following forms: Appendices B-4, B-5, and B-6.*  
**Program Information**

Other (describe)

### **Attendance Options**

\_\_\_\_\_ **X** Full-Time

\_\_\_\_\_ **X** Part-Time

Total Credits: \_\_\_\_\_ Quarter ☐ Semester ☐

### **Contact Information (Academic Department Representative)**

Name: **Marc D Servetnick, PhD**

Title: **Associate Professor, Science & Technology**

Address: **University of Washington-Bothell**

**18115 Campus Way NE**

**Box 358530**

**Bothell, WA 98011-8530**

Telephone: **(Office) 425-352-4723; (Dept Office) 425-352-3746**

E-mail: **mservetnick@uwb.edu**

## Contents

I. Introduction .....	6
A. Degree Program Description and Rationale .....	6
B. Relationship to U.W. Bothell Mission.....	7
C. Biology Degree Program.....	12
1. Degree Program Goals .....	13
2. Degree Program Mission .....	14
3. Learning Objectives .....	15
II. Need for Program.....	16
A. Demand.....	16
1. National Demand .....	16
2. Washington State Demand .....	18
3. Snohomish and King County Demand .....	19
B. Student Demand .....	20
III. Statewide Strategic Master Plan for Higher Education.....	23
HECB Strategic Master Plan .....	24
IV. Relationship to Other Institutions .....	26
A. Regional Schools .....	26
B. National Programs.....	28
V. Proposed Curriculum .....	30
A. Bachelor of Science in Biology .....	31
1. A checklist for courses in the Biology major – Form 4.....	40
2. Courses currently offered at UWB.....	45
3. Schedule of course offerings.....	47
4. Course descriptions .....	48
VI. Infrastructure Requirements .....	51
A. Facilities .....	51

1. Teaching laboratories.....	51
2. Research laboratories .....	52
B. Support Services .....	53
1. Academic Transition Program .....	53
2. Counseling Services .....	54
3. Disabled Student Services .....	54
4. Library .....	54
5. Media Center.....	58
6. Quantitative Skills Center .....	59
8. Writing Center .....	59
9. Information Systems .....	59
VII. Faculty .....	60
A. Current Faculty.....	60
B. New Faculty .....	65
VIII. Administration .....	66
IX. Students.....	68
A. Diversity Plan .....	68
1. Students.....	69
X. Assessment Plan .....	70

## **I. Introduction**

The Science and Technology Division of the University of Washington Bothell proposes to offer a Bachelor of Science degree in Biology beginning in Fall 2010.

### **A. Degree Program Description and Rationale**

While the study of Biology, one of the core natural sciences, has a long history, it remains a vigorously-growing field that informs our understanding of diverse aspects of the living world. Biology provides insight into the evolution of life, the effects of climate change, and what it means to be human, to name just a few examples. Students with an education in Biology can pursue career paths in health and medicine, research, education, pharmaceuticals, biotechnology, conservation, sustainability, and a host of related fields.

In 2007-8 UW Bothell convened a faculty and staff task force on Science, Technology, Engineering, and Math (STEM) to critically evaluate needs and opportunities in these areas regionally and at UWB. That task force concluded that there is a strong regional need for students trained in biological sciences and a demand for such education from students. According to the Task Force, “[b]y integrating a Biology program with the hallmark characteristics of a UWB education, we can offer a high quality degree experience, despite our small size.”<sup>1</sup>

UW Bothell has the opportunity to draw on its strengths – strong faculty-student mentorship, a tradition of integrative coursework, and hands-on learning - to implement

---

<sup>1</sup> UW Bothell STEM Task Force. (April 2008). [http://www.uwb.edu/academic/pdf\\_files/UWB0407F.pdf](http://www.uwb.edu/academic/pdf_files/UWB0407F.pdf)

a high caliber biology program to meet this regional demand and support statewide higher education objectives.

### **B. Relationship to U.W. Bothell Mission**

Since it was founded in 1990, the University of Washington Bothell has been committed to providing a world-class education meeting the needs of the community while also proudly upholding University of Washington standards of quality and accessibility. The University of Washington Bothell is home to more than 2,500 students who study a diverse array of programs including Business, Computing & Software Systems, Education, Interdisciplinary Arts & Sciences, Nursing, and a newly established program in Science and Technology.

The campus is situated on 128 acres, which includes 58 acres of protected wetlands; UWB serves as steward of these lands. Local resources include numerous biotechnology firms: Bothell boasts roughly one quarter of Washington's life sciences businesses and jobs. The campus recently established the Biotechnology and Biomedical Technology Institute (BBTI) in part to work with local and regional industry to create educational opportunities for students wishing to enter this field.

The proposed Biology degree program is congruent with UW Bothell's mission, and will enable UWB to better serve the needs of students in the region. The tenets of the UWB mission include the following:

- Serve college-age and established adult students, as well as the community at large, by providing access to a premier institution of higher education.

Biology was identified as a top priority by two separate task forces at UW Bothell, the 2007 Applied Science and Technology (ASTP) Task Force, and the 2008 Science, Technology, Engineering, & Mathematics (STEM) Task Force. The ASTP report focused on regional workforce needs; report data demonstrated the need for college graduates with degrees in STEM fields, with particular emphasis on computing, biosciences (biology, biotechnology, biomedicine and healthcare), secondary school mathematics and science teachers, engineering, and clean technology (Appendix 1).

The STEM Task force report found that students listed Biology as a top priority. More than 500 transfer students to UWB requested the program. Therefore, a biology degree program will further the UWB mission in expanding access, meeting student demand, and serving the community.

- Emphasize and develop critical thinking, writing, and information literacy, in order to graduate students with life-long learning skills.

Critical thinking and scientific and information literacy are central to the Biology degree program Goals and Mission described in Section V of this proposal. The program will employ problem-based approaches and offer research experiences for students inside and outside the classroom.

- Actively recruit and support outstanding faculty scholars with a passion for communication.

Although the degree will be new at UW Bothell, we have in place award-winning faculty whose courses are in high demand on campus. Existing STEM offerings include BA degrees in Environmental Studies and Science, Technology & Society, and a BS degree in Environmental Science. UW Bothell has five biologists already teaching in

these programs (see section VII.A.). The Science and Technology Program, which will house the Biology degree program, is planning three hires (over three years) for Biology upon program approval and will continue to recruit faculty to support the program as it matures.

The UWB Office of Research Support will help faculty members in becoming aware of research funding opportunities, and provides support in the preparation of grant proposals. The Science and Technology Program will actively assist faculty in obtaining external funding to support their research and will support their professional development as both scholars and teachers. The Teaching and Learning Center provides faculty development opportunities to improve teaching skills.

- Build an inclusive and supportive community of learning and incorporate multicultural content and diverse perspectives on ethnic and racial groups, gender, sexual orientation, social class, and special needs.

Support services available at UW Bothell will help to broaden participation in S&T, and in the Biology degree program, to include groups that have historically been underrepresented in the sciences. The Writing Center and the Quantitative Skills Center support diverse student learning styles to help ensure that students who learn in different ways will be nurtured at UWB.

The study of Biology offers an exceptional opportunity to study and explore diversity at multiple levels, as stated in our Mission (section I.C.2). Biodiversity offers an opportunity for students to view the natural world from the perspective of different organisms and biological systems; this can help to illuminate human diversity and diverse human experiences. While building an appreciation of diversity, courses such



as Genetics and Evolution emphasize the essential unity of all human beings. The Bioethics requirement will help students to understand the ethical issues raised by advances in biology, while the Biology and Society requirement will promote understanding of the impact of biology on society.

- Encourage and support collaborative, interdisciplinary, and cross-program initiatives.

Interdisciplinarity is a recognized strength of UW Bothell in education, research, and in its institutional structure. The campus is widely known for its innovative degrees, which encompass and integrate traditional disciplines. The proposed Biology degree program will take advantage of this practice, stressing connections among different areas of Biology, and between Biology and other disciplines. Faculty who can contribute to the Biology degree Program are already in place in several programs at UWB, including Science and Technology (S&T), Interdisciplinary Arts and Sciences (IAS), Nursing, and Computing and Software Systems (CSS). The interaction of faculty across the campus in the Biology degree program will serve to connect Biology with the various programs already in place at UWB. We anticipate that Biology majors will interact extensively with Environmental Science/Studies students (for example in Introductory Biology, and in the Science Methods and Practice course). Finally, the Biology and Society requirement helps to ensure that Biology majors will exchange ideas and perspectives with non-Biology majors in courses dealing with larger societal issues.

- Provide quality curricula by making use of the best of educational technology in support of teaching and learning.

UW Bothell has cutting edge technology on campus and our commitment to keep abreast of this dynamic in education is underscored by the 2009 report from the

*Technology and Teaching Innovation Task Force* (see Appendix 3). The Task Force recommended increased development of on-line and hybrid courses (in which about half the students' course time is devoted to on-line learning); this is a way to broaden participation in degree programs among non-traditional students. The Task Force considered faculty development, online learning goals, tools required to expand the use of educational technology, and support for students using educational technology. The entire UWB campus is therefore engaged in a wide-ranging discussion on the best use of educational technology in teaching and learning. The Biology faculty will continue to play an active role in the discussion as we grow. The Teaching and Learning Center currently provides resources to faculty, encouraging excellent teaching practices, with support in the use of educational technology toward that end.

S&T can be expected to make extensive use of emerging educational technology. The existing degree program in S&T in Electrical Engineering makes extensive use of on-line courses.

- Foster productive relationships with the employment community and promote a strong public service commitment.

UW Bothell is home to a number of award-winning community partnerships. Some partnerships, such as the Biotechnology and Biomedical Technology Institute, already engage areas of biological science, and work with the local employment community. Applied research beyond the campus, community engaged learning, internships, and guests from the professional fields are widespread pedagogical approaches and part of the signature UWB experience (STEM Appendix 1). A number of collaborative projects

involving UWB students in community-based learning are highlighted at <http://www.uwb.edu/cbls/projects.xhtml>.

The proposed biology degree is crafted to take advantage of existing community partnership efforts and to extend and deepen them for students and community partners alike. Given UWB's mission and mandate, we are dedicated to a Biology degree program to serve the region and enhance educational opportunities for current and prospective students.

### **C. Biology Degree Program**

The Biology degree program will admit 20 students at its inception, and will grow to 40 students per year by 2014. We anticipate that the students entering the biology degree program will increase enrollment at UW Bothell, and will not be drawn from existing programs. (That is, Biology will draw new students, and will not compete for students with existing UW Bothell programs.)

The proposed program is a core curriculum, meant to serve as a springboard for students pursuing diverse career paths after earning their degree. Different student populations may supplement this curriculum with additional courses to better prepare them for specific careers. For example, students applying to medical school may take additional courses to meet medical school admission requirements; students pursuing research tracks may take additional research-oriented courses.

## 1. Degree Program Goals

Students in the proposed Biology degree program will combine theory with hands-on experience by utilizing UW Bothell's strengths: small classes, strong faculty-student mentorship, a tradition of integrative coursework, and research and internship opportunities outside the classroom. While addressing traditional content, we will draw on the burgeoning field of college-level biology education research to employ integrative, active, problem-based approaches which are effective features of biology curricula. Undergraduate research is an essential part of the proposed degree program.

The UW Bothell faculty has a tradition of teaching from an interdisciplinary perspective, integrating diverse viewpoints into the curriculum. While this interdisciplinary approach is formalized in the requirements for courses in both Bioethics and in Biology and Society, the Biology faculty will guide students in developing an understanding of the impact of biology on society throughout the curriculum, starting in Introductory Biology. Furthermore, the Biology faculty will interact with faculty in existing programs in Interdisciplinary Arts & Sciences, Nursing, Education, Computing and Software Systems, and Business to provide opportunities for students to link these areas of study. Finally, we anticipate that some courses will be open to non-Biology majors, and that enrollment of students from other programs in these courses will promote science literacy among students across the University. The goals of the program are to:

- offer a challenging, integrative curriculum that allows students to study biology in both breadth and depth
- encourage active learning, including student-faculty collaborative research

- develop and implement innovative methods to enable students to learn biology
- prepare students for advanced study and/or for careers in biology
- nurture and support faculty and student research
- broaden participation of under-represented groups in biology
- establish community connections to foster partnerships in biological research and education with local industry, non-profits, and other community partners
- integrate the teaching and learning of disparate areas within the biological sciences and with other areas of study at UW Bothell
- promote scientific literacy among non-science majors

## **2. Degree Program Mission**

The Mission of the University of Washington Bothell Undergraduate Biology Degree Program is to help students to:

- gain a foundational knowledge of biology
- make connections within biology, and between biology and other areas of study
- learn to critically interpret evidence, through both qualitative and quantitative thinking
- understand how research is conducted through active engagement in original research
- learn to communicate effectively through oral, visual and written presentation
- appreciate diversity at multiple levels: biodiversity, human diversity, and the diversity of approaches used to understand the biological world
- develop an awareness of the impact of biology on society, and the obligation of biologists to conduct their work responsibly

- prepare for careers that are productive and socially responsible

These goals will be addressed through classroom instruction, lab work, and field work that involve active learning, participation in faculty research programs, and ongoing assessment and improvement of the learning environment.

### 3. Learning Objectives

The Learning Objectives of the Biology Degree Program are:

- **Biological knowledge.** Students should understand basic biological processes and principles, integrate disparate areas of biology, and begin developing an emphasis in one or more areas through their research experience.
- **Research.** Students should develop an understanding of the scientific method and use that understanding to conduct and communicate biological research in collaboration with faculty mentors.
- **Critical thinking.** Students should learn to apply qualitative and quantitative methods to critically evaluate and interpret evidence.
- **Communication.** Students should learn to communicate biological concepts effectively in oral, visual and written presentations. Students should communicate the results of original research within and/or outside the University.

## **II. Need for Program**

### **A. Demand**

#### **1. National 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 both nationally and regionally and will continue to grow.

Employment of biological scientists at the national level is projected to grow 9 percent from 2008- 2016. (<http://www.bls.gov/oco/ocos047>) A number of national trends support growth in this profession. These include, in part, the growth of biotechnology companies, bio- agriculture, green economy jobs, medicine and other health professions. 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 biological scientists specializing in botany, zoology, and marine biology.<sup>2</sup> They further assert that biological scientists are less likely to lose their jobs during recessions than are those in many other occupations, because many biologists are employed on long-term research projects.

---

<sup>2</sup> United States Department of Labor, Bureau of Labor Statistics: Occupational Outlook Handbook 2008 - 2009 edition, Biological Scientist: <http://www.bls.gov/oco/ocos047.htm>. Accessed June 2009.

Employment in health care will continue to grow for several reasons. The number of people in older age groups, with greater health care needs, will grow faster than the total population between 2006 and 2016; as a result, the demand for health care will increase.

Advances in medical technology will continue to improve the survival of severely ill and injured patients, who will need extensive therapy and care. New technologies will make it possible to identify and treat conditions that were previously not treatable. Medical group practices and integrated health systems will become larger and more complex, increasing the need for office and administrative support workers with knowledge of biology. Industry growth also will occur as a result of the shift from inpatient to less expensive outpatient and home health care because of improvements in diagnostic tests and surgical procedures, along with patients' desires to be treated at home.

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

\*SOC = Standard Occupational Classification system, US Bureau of Labor Statistics  
Projection data from the National Employment Index: <http://www.bls.gov/oco/ocos047>



## 2. Washington State Demand

The high demand areas for Washington State include numerous specializations in science. Washington developed a strategic vision for 21<sup>st</sup> century health, called Bio 21, “a program of targeted, strategic investment in research and commercialization in 21<sup>st</sup> century medicine, in order to build upon our existing assets; address strategic gaps; and generate economic and health benefits to our state’s citizens” (Bio 21: Implementing Washington State’s Initiative in 21<sup>st</sup> Century Health [www.lsdfa.org/about/timeline/files/bio21execsum101904.pdf]). The Bio 21 recommendations led to the establishment of the Life Sciences Discovery Fund (LSDF), which “supports innovative research in Washington State to promote life sciences competitiveness, enhance economic vitality, and improve health and health care.”<sup>3</sup> The LSDF establishes research in the life science as a priority for the state, committing Washington “to an economic development strategy with health and science at its core”<sup>4</sup> (<http://www.lsdfa.org/about/mission.html>).

Educational Service Districts (ESDs) in Washington report shortages of K-12 math and science teachers. Evidence of this undersupply can be seen in the endorsement records collected by the Standards Board. 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 over 35 percent - were issued to out-of-state teachers,

---

<sup>3</sup> Life Sciences Discovery Fund, Seattle, WA: <http://www.lsdfa.org/about/mission.html>). Accessed June 2009.

<sup>4</sup> Ibid.

not to Washington residents.<sup>5</sup> We anticipate that some students majoring in Biology will subsequently go on to earn their certification to teach biology at the K-12 level.

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

WSED/LMEA: <https://fortress.wa.gov/esd/lmea/countydashboard/Summary.aspx?>  
(Washington State Employment Security Dept, Labor Market and Economic Analysis)

### 3. Snohomish and King County Demand

Snohomish and King Counties can expect growth in demand for students trained in biology in the health sector, as described above (section II.A.1. National Demand). Additionally, UW Bothell is located in the biotechnology corridor which includes the Snohomish-King county region along I-405. Five biotech companies are located in Bothell, including Amgen, ICOS and Nanogen; these companies will require a trained workforce to thrive. The proximity of these companies provides an opportunity for partnerships from which students, faculty, and industry can all benefit.

Occupation	Est. Year - Projected	Estimated Employment	Growth Rate	Change	% Change	Annual Openings
Snohomish County						

<sup>5</sup> WA State HEC Board, "A Skilled and Educated Workforce: An Assessment of Higher Education and Training Credentials Required to Meet Employer Demand" p 23. Excerpted from PESB presentation to the HECB, "Ensuring an Adequate Supply of Well-Qualified Math and Science Teachers Task Force." August 15, 2008, Slide 3.

	Year					
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

WSESD/LMEA: <https://fortress.wa.gov/esd/lmea/countydashboard/Videos/OccupationalWages.swf>

Occupation	Est. Year - Projected Year	Estimated Employment	Growth Rate	Change	% Change	Annual Openings
King County						
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

WSESD/LMEA: <https://fortress.wa.gov/esd/lmea/countydashboard/Videos/OccupationalWages.swf>

## B. Student Demand

Student interest in our proposed STEM programs is tracked on the UW Bothell website. Site visitors are asked to take a brief survey on nine proposed degrees. Interest in Biology is the highest. From April 2009 to June 2009, 117 visitors to the site completed the survey. The results indicate that there is strong demand for this degree program at UW Bothell.

Please select the response that best describes your interest in UW Bothell.

Numeric value

	Answer	Percentage
1	I am planning on enrolling at UW Bothell as a freshman.	18.75%
2	I am currently enrolled at UW Bothell.	16.07%
3	I am planning to transfer to UW Bothell from a community or technical college.	43.75%
4	I am planning to transfer from another 4 year institution.	9.82%
5	I am undecided at this time.	11.61%

Are you interested in pursuing a BS in Biological Sciences degree?

Numeric value

	Answer	Percentage
1	Yes	94.64%
2	No	0.00%
3	Uncertain	5.36%

How important is it to your decision to enroll at UW Bothell or to remain at UW Bothell if a BS in Biological Sciences degree is not available.

Numeric value

	Answer	Percentage
1	Very important	79.46%
2	Somewhat important	13.39%
3	Not important	6.25%
4	No opinion	0.89%

If the start of the BS in Biological Sciences degree was delayed by one year would you:

Numeric value

	Answer	Percentage
1	Pursue the degree at UW Seattle.	40.18%
2	Pursue the degree at another Washington public institution.	44.64%
3	Pursue the degree at a Washington private college.	3.57%
4	Pursue a different degree at UW Bothell.	11.61%

What is your age?

Numeric value

	Answer	Percentage
1	Less than 20 years	36.61%
2	21 - 25	28.57%
3	26 - 30	19.64%
4	31 - 40	9.82%
5	40+	5.36%

Please indicate the county where you live.

Numeric value

	Answer	Percentage
1	King County	50.89%
2	Snohomish County	38.39%
3	Other:	10.71%

Please indicate the city where you live.

Numeric value

	Answer	Percentage
1	Bellevue	4.46%
2	Bothell	16.96%
3	Everett	11.61%
4	Kirkland	7.14%
5	Seattle	14.29%
6	Other:	45.54%

Please add any additional comments about the proposed BS in Biological Sciences degree at UW Bothell.

Total responses (N): 29 Did not  
respond: 83

Comments from respondents include the following:

*"From my understanding this is a smaller institution which would give prospective students like me that do better in smaller classes a greater chance to succeed."*

*"My decision to transfer or staying at this campus depends on this degree."*

*"I really hope the degree option becomes available. I would love to finish my education at UW Bothell!"*

Two key responses that support UW Bothell's mandate include the number of respondents who lived outside of King County (49%) and the number of respondents who were 21 years of age or older (63%). This indicates that UW Bothell, and particularly a degree program in Biology, would provide increased access for students in our region.

### **III. Statewide Strategic Master Plan for Higher Education**

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 programs with the goal of incorporating flexibility and support for our students, particularly those who are non-traditional or from underserved populations. The Biology program 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 program, thereby encouraging secondary schools and pipeline institutions to strengthen and support STEM curricula.

## **HECB Strategic Master Plan**

The proposed Biology degree program promotes the core objectives in the HEC Board Strategic Master Plan:

### **Educational Attainment:**

1. Focus on diversity. UW Bothell strives to bring a significant population of non-traditional students to technology fields, including underserved population and students with disabilities. Included in the seven priorities of the UWB 21<sup>st</sup> Century Initiative is our commitment to diversity and inclusiveness. Part of the Mission of the Biology degree program is to educate students to appreciate diversity; this effort will include efforts to recruit and retain a diverse faculty and student body.
2. Create higher expectations for K-12 students. The Biology program will serve as a gateway program for students wishing to pursue careers in K-12 education. A rigorous education in Biology will help these teachers to meet the HECB goal of creating higher expectations for K-12 students.
3. Create a system of support for lifelong learning. The program will be inclusive, striving to teach non-traditional as well as traditional college students. Support services will facilitate learning by non-traditional students returning to college to earn a degree.

### **Promote economic growth and innovation:**

1. Fill unmet needs in high-demand fields. The need for graduates in Biology is supported by the data presented earlier. Additionally, UW Bothell is located in a

technology corridor and is informed and encouraged by its regional partners (in part via the Biotechnology and Biomedical Technology Institute) to create programs that will provide industry-ready graduates.

2. Promote student enrollment in STEM fields. A Science and Technology Program was launched at UW Bothell in 2009; the Biology degree program will be housed in the new S&T unit. Classes developed for the Biology degree program will complement and support existing programs within Interdisciplinary Arts and Sciences (Environmental Studies; Environmental Science; Behavior, Ethics and Society; Science, Technology and Society), Nursing, and Education. Courses developed for the Biology degree will also support the eventual development of additional STEM degree programs (for example math, chemistry, physics and other fields).
3. Expand research capacity: A focus of the Biology program will be to involve faculty and students in collaborative research. UW Bothell's Office of Research Support (ORS) already provides administrative support for research and will assist in identifying and connecting the program with relevant research opportunities.



## **IV. Relationship to Other Institutions**

### **A. Regional Schools**

#### ***1. UW Seattle***

The University of Washington Seattle is home to several bioscience programs.

The Department of Biology administers undergraduate degree programs that enable students to earn either a B.A. or B.S. degree in Biology. The UW Seattle Biology Department has over 1000 declared majors, and conferred more UW Bachelor's degrees over the 2007-09 period than did any other department. UW Seattle students may elect to earn either a General Biology degree, or they may specialize in one of five tracks (Molecular, Cellular and Developmental Biology; Physiology; Ecology and Evolutionary Biology; Environmental and Conservation Biology; or Plant Biology). Students are encouraged, but not required, to participate in faculty-mentored research projects.

The second largest degree program in the biosciences at UW Seattle is in Biochemistry; other degree programs include Aquatic and Fishery Sciences, Bioengineering, Microbiology, Neurobiology, the Program of the Environment, Oceanography, and a Marine Biology minor.

#### ***2. WSU Vancouver***

Washington State University Vancouver offers a General Biology degree that serves as the basis for a variety of educational goals: environmental sciences, pre-health sciences (medicine, dentistry, physician assistant, etc.), pre-veterinary sciences, graduate

programs and high school teaching. The Biology degree has four tracks: Pre-health, Teaching, Zoology and Environmental Science. The program is designed to attract transfer students from regional community colleges and requires 67 credits including 12 hours of Chemistry and 15 hours of Math & Physics.

### ***3. Western Washington University***

The mission statement of WWU's Biology program reads, "To provide an outstanding learning environment that integrates education, scholarship, and service to actively engage students in the biological sciences and to foster their development as lifelong learners." The program has two phases: Phase I students take a core set of 200-level Biology courses designed to introduce them to the breadth of biological subdisciplines; Phase II Biology majors continue with a set of 300-level core courses, and one 400-level course, designed to cover major biological subdisciplines in greater depth.

### ***4. University of Puget Sound***

UPS has expanded its science offerings to meet demand of both students and the State of Washington. The curriculum for majors covers modern biology from molecules and cells through organisms, populations, and ecosystems, and emphasizes the conceptual, historical, and technical progression of biological science. Specialization in specific areas of biology is made possible by offering a variety of advanced elective courses. For many students the Biology major can be used as preparation for graduate school or professional careers in the health sciences and secondary teaching. The department promotes close contact between faculty and students through faculty-taught laboratories and a highly organized student/faculty research program. It has well-equipped programs for faculty-directed student research in areas such as cell and molecular biology,

physiology, ecology, and evolutionary biology. A unique program for the undergraduate is coursework in the techniques of electron microscopy and its application to biological problems. For marine and other animal studies, the department maintains a cooperative agreement with Point Defiance Zoo and Aquarium. The James R. Slater Museum of Natural History serves not only the students and the staff in the Biology Department but also the entire Northwest region as a resource for research.

## **B. National Programs**

The review of national programs included programs at branch campuses of larger state schools. Programs reviewed have numerous options for students at both the undergraduate and graduate level. While most of the degrees offered were BS degrees, some programs also offered BA versions of the major as well. This has the advantage of attracting a wider array of students, with varying backgrounds and interests.

### ***1. University of Massachusetts Dartmouth***

UMass Dartmouth offers a structured program in which first and second year students take basic courses in science, mathematics, and English. During junior and senior years, students choose upper-level biology electives that are of interest to them and will prepare them for different types of careers in biology. College and general education distribution requirements are also taken in the junior and senior years. Tracks available for students are: General Biology, Marine Biology, Health Professions, Cellular and Molecular Biology, Evolutionary Biology and Ecology.

### ***2. University of Texas Tyler***

The undergraduate Biology program at UT Tyler offers a comprehensive eight semester curriculum leading to a BS degree in biology. It is designed to meet the needs of

students who plan to enter graduate school in the biological sciences, to enter medical, dental, or veterinary school, or to prepare students for positions in industry, state and federal government. These objectives are reached through contact with specific biological content, exposure to laboratory experiences, and encouragement of the creative process and independent research.

### ***3. University of North Carolina Greensboro***

The Department of Biology at UNC Greensboro offers both BA and BS degrees in biology with the objective of preparing students for professional careers and/or advanced study. Students can earn a BA or a BS in Biology, or may earn degrees with concentrations in Environmental Biology, Biotechnology, or Human Biology. The department uses a cross disciplinary approach, maintaining ties with departments such as Nutrition, Chemistry and Biochemistry, Math, and Geography to expand educational opportunities for its students. Departmental facilities include animal-care facilities, environmental sampling and analytical equipment, growth chambers, greenhouses, confocal and electron microscopes, nucleic acid sequencers and other biotechnology equipment. UNC Greensboro also has a Science Advisory Board charged with assisting the science departments within UNC Greensboro in achieving their goals in teaching, research, and service

### ***4. University of Wisconsin LaCrosse***

In addition to a general biology degree, the Department of Biology offers four additional concentrations (biomedical sciences, aquatic sciences, environmental sciences and cellular and molecular biological sciences), each of which is designed to more efficiently prepare students for entrance into advanced programs in graduate and professional schools or for careers in specialized areas of biology. A key component of the Biology

program is providing undergraduate and graduate research opportunities in a variety of areas including (among others) cell and molecular biology, bioinformatics, genetics, developmental biology, biomedical research, organismal biology, parasitology, mycology, plant biology, aquatic and environmental sciences and toxicology.

## **V. 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, and to integrate the teaching of learning of disparate areas within biology. Further, due to the well-developed UWB programs in Interdisciplinary Arts and Sciences, Nursing, and Education, Biology students will also have the opportunity to apply their biological expertise to diverse social, cultural and scientific issues in interdisciplinary elective courses.

The requirements of the proposed Biology degree are:

- foundational courses in Math, Physics and Chemistry
- three quarters of Introductory Biology, including laboratory sections
- three required courses: Genetics, Ecology, and Evolution
- one course (from a menu of three) in Cellular/Subcellular Biology
- one course (from a menu of three) in Physiology

- a research sequence, consisting of Science Methods and Practice (to introduce students to reading, writing, and interpreting scientific papers), followed by 5 credits of Investigative Biology, which will introduce the student to inquiry-based activity conducted through laboratory/field courses, faculty-supervised research, or appropriate internship opportunities.
- a course in Bioethics
- a course examining the impact of biology on society (Biology and Society requirement, described below)
- three upper-level elective courses

The following section describes courses required for students to earn a Bachelor of Science Degree in Biology.

#### **A. Bachelor of Science in Biology**

\* indicates courses currently offered at UW Bothell

##### **Mathematics: 2 quarters**

- Calculus I\*
- Statistics\*
  - The Science and Technology Program will develop a Statistics course for majors in science and engineering; this course will be targeted to students in Biology, Engineering, and a program under development in Climate Science. Until the new S&T Statistics course is offered, we will accept BIS315 Statistics (taught in IAS), which is intended for a broad array of IAS students, not just those in the sciences.

##### **Physics: 2 quarters**

Either of the following sequences:

- General Physics\* (two quarters)
- Mechanics\*; and Electromagnetism and Oscillatory Motion\*

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

In consultation with faculty members in the Science & Technology Program who teach Chemistry, we plan to develop a 4-quarter Chemistry sequence for Biology (and perhaps other) majors when demand is sufficient. The new 4-quarter sequence would integrate essential concepts of General and Organic Chemistry into a single 4-quarter sequence. At the launch of the major, and given current UWB course offerings, we will require that students take the 3-quarter General Chemistry sequence, followed by one quarter of Organic Chemistry.

- General Chemistry\* (three quarters)
- Organic Chemistry\* (one quarter)

**Biology - required courses:**

- a three quarter Introductory Biology course, consisting of:
  - Introductory Biology 1, 2, 3\*
    - we plan to modify this sequence within 4-5 years (see below)
- Genetics\*
- one of the following three courses in Cellular and Subcellular Biology
  - Microbiology
  - Biochemistry
  - Cell Biology\*
- one of the following three courses in Physiology

- Anatomy & Physiology
  - Plant Physiology
  - Animal Physiology
- Ecology\*
- Evolution\* (to be offered initially as Special Topics, W 2010)
- Science Methods and Practice\*
  - This course is currently offered through IAS as BES 301, for Environmental Studies and Environmental Science majors. The course will be listed through both IAS and S&T. As demand for the course increases, faculty from both programs can teach the class, and individual sections will include both Environmental Studies/Science and Biology majors.
- Investigative Biology (described in the following section), from the following:
  - designated Laboratory/Field courses
  - Research in Biology (research supervised by individual faculty members)
  - Internship in Biology
- Bioethics
- Biology and Society
  - one course addressing the relationship of biology and society; described below.
- three electives in Biology



## **Biology – elective courses**

- students may use any of the courses listed above as electives, if they have not been used to fill requirements (for example, students taking Animal Physiology to fulfill the Physiology requirement may take Plant Physiology as an elective.)
- 200-level electives
  - Biodiversity
- 300-level
  - Molecular Biology
  - Marine Diversity and Conservation\*
  - Introduction to Restoration Ecology\*
  - History of Life\*
- 400-level:
  - Genomics/Bioinformatics
  - Developmental Biology
  - Neurophysiology
  - Ecophysiology
  - Animal Behavior
  - Toxicology
  - Conservation Biology\*
  - Wetland Ecology\*
  - Pacific Northwest Ecosystems\*
  - Pacific Northwest Plants in Restoration and Conservation\*

In addition, students will be required to fulfill general requirements for a degree from UWB. These include:

- English Composition (5 credits)
- Additional Writing (10 credits)
- Individual and Societies (15 credits)
- Visual, Literary and Performing Arts (15 credits)

The Quantitative and Symbolic Reasoning [QSR] and Natural World [NW] requirements will be fulfilled through courses in the Biology degree program.

### **Investigative Biology: description and justification**

Science is fundamentally a research activity, and cannot be fully appreciated solely from classroom instruction. Historically, science instruction has included a laboratory or field component, but recently the role of a more comprehensive undergraduate research experience has received increasing attention (Wieman 2007). Undergraduate research experiences enhance education, attract students to science career tracks, retain students in science career tracks, and can act as a pathway to broaden participation of underrepresented minority students (for example, see Loppato, 1994). We therefore want to make undergraduate research experiences available to as many students as possible and to encourage students to maximize the time spent conducting meaningful, hands-on scientific work in the lab or in the field.

We will require that each student earning a Biology degree complete 5 credits of Investigative Biology. This 5-credit requirement may be fulfilled by:

- 5-credit laboratory/field research course. These courses will comprise inquiry-based laboratory research, which teach from the primary scientific literature, and require students to complete a final talk, poster, or paper. Ideally, these courses would include a group research project, building on UW Bothell's tradition of teaching through collaborations. The courses should be problem-based and integrative in nature, requiring students to draw on their background in scientific content areas as well as the ability to design experiments and interpret results. We anticipate a collection of diverse research courses; while these could focus on specific biological subfields (for example, Evolution, Ecology, Cell/Developmental Biology), we will strive to design courses that are integrative and driven by research problems and questions. We expect the breadth of offerings in Investigative Biology to expand both as we hire additional faculty and as we gain experience in directing these courses. To maintain strong faculty/student interaction, these courses will be capped at 12 students. We will initially offer two sections of Investigative Biology per year; as enrollments in Biology grow; we will need to offer a third section each year.
- 5 credits of Research in Biology. This would be a faculty-supervised research project to be conducted in the lab or in the field under the supervision of a faculty member. Because of the time and effort required of supervising faculty members, faculty would receive appropriate teaching credit for supervision of Research in Biology, and would be able to cap the number of students supervised per quarter. (The Biology Task Force recommends 1 hour of

teaching credit per student supervised; when sufficient credits are earned by a faculty member they will earn corresponding course release.)

- internships with a local biotechnology company, or with another appropriate internship sponsor. To ensure that the research component is appropriate, students must apply in advance for an internship to count toward their research credits, and provide appropriate documentation from the internship sponsor. Successful models of internships at UW Bothell include internships through IAS, and through CSS. In both cases, faculty mentors work with both students and industry sponsors to define goals and expectations, and to assess the overall project. This ensures that internships are academic in nature (and not simply work for credit).
- summer research through an appropriate course taken elsewhere (e.g. Friday Harbor Laboratories research apprenticeships) or a Research Experience for Undergraduates (a National Science Foundation program), or similar program at another institution. In these cases, as above, advance approval and appropriate documentation would be required. If the research is appropriate for UW course credit, we would waive the Investigative Biology requirement on a case-by-case basis.

As we launch the biology major, we anticipate that most students will use either an Investigative Biology course and/or faculty-sponsored research to complete this requirement, although we will encourage students and local employers to pursue internship opportunities to build on our campus's tradition of community-based learning.

Internships would foster several important goals: research opportunities for students, student exposure to research as it is conducted in either a non-profit or a for-profit company, allowing employers to interact with UW Bothell students, and providing important connections between UW Bothell and the local community.

### **Bioethics and Biology and Society**

Part of the mission of the Biology degree program is to help students to develop awareness of their responsibilities as practicing scientists, and of the impact of biology on society. Such impacts include, for example, the effects of human activities on ecosystems, genetic screening and testing, and the development of genetically modified agricultural products. Discussion of these themes will be embedded throughout the curriculum, starting in Introductory Biology, and continuing in appropriate courses (e.g. Ecology, Evolution, Genetics, Developmental Biology). In addition, students earning a degree in Biology will be required to take two courses:

- Bioethics. This course will be designed in consultation with the Biology Curriculum Committee, and the Science and Technology Program. The course will include discussion of the ethical and social responsibilities of biologists, integrity in the research process, and some of the ethical questions raised by modern biology.
- Biology and Society. Students will take one course addressing the interaction of biology and society. These courses are generally open to non-Biology majors; by discussing these ideas with students from other disciplines, Biology majors will, at a minimum, better understand the concerns of non-scientists about these issues.

We list courses currently offered at UWB which could fulfill this requirement; this list will be reviewed annually by the Biology Curriculum Committee, and will be modified as appropriate classes are offered. (Courses are offered by IAS, unless otherwise noted.)

Current offerings that would fulfill the requirement are:

- Science, Technology and Society
- Biotechnology and Society
- Genes, Genomes and Heredity
- Embryos, Genes and Reproductive Technology
- Ethics and the Environment
- Environmental Education
- Conservation and Sustainable Development
- Cultural and Social Issues in Health Care (Nursing)
- Relational Leadership in Nursing/Healthcare (Nursing)

# 1. A checklist for courses in the Biology major - Form 4

## Math

Calculus\* \_\_\_\_\_  
 Statistics\* \_\_\_\_\_

## Chemistry

General Chem 1\* \_\_\_\_\_  
 General Chem 2\* \_\_\_\_\_  
 General Chem 3\* \_\_\_\_\_  
 Organic Chem 1\* \_\_\_\_\_

## Physics

General Physics 1\* \_\_\_\_\_  
 General Physics 2\* \_\_\_\_\_

## Biology

Intro Biology 1\* \_\_\_\_\_  
 Intro Biology 2\* \_\_\_\_\_  
 Intro Biology 3\* \_\_\_\_\_  
  
 Genetics\* \_\_\_\_\_  
 Cell/Subcell Bio \_\_\_\_\_  
     Microbiology  
     Biochemistry  
     Cell Biology\*  
 Ecology\* \_\_\_\_\_  
 Physiology \_\_\_\_\_  
     Anatomy & Physiology  
     Plant Physiology  
     Animal Physiology  
 Evolution\* \_\_\_\_\_  
 Science Methods  
     & Practice\* \_\_\_\_\_  
 Investigative Bio \_\_\_\_\_  
  
 Bioethics \_\_\_\_\_  
 Bio & Society\* \_\_\_\_\_  
  
 Electives (3) \_\_\_\_\_  
     \_\_\_\_\_  
     \_\_\_\_\_  
     \_\_\_\_\_

## Electives

Molecular Biology  
 Genomics/Bioinformatics  
 Developmental Biology  
  
 Neurophysiology  
 Ecophysiology  
  
 Animal Behavior  
 Toxicology  
 Biodiversity  
  
 Marine Diversity  
     and Conservation\*  
 Conservation Biology\*  
 Wetland Ecology\*  
 Restoration Ecology\*  
 History of Life\*  
 Pacific NW Ecosystems\*  
 Pacific NW Plants in Restoration  
     & Conservation\*

\*courses marked with asterisks  
 are currently offered at UW  
 Bothell

Below, we list courses according to four categories:

- courses currently offered at UWB
- courses that could be offered by current UWB faculty
- courses that need to be developed to launch the Biology degree program
- courses that would be desirable to fill out the degree program

**Courses currently offered:**

Math:	Calculus	Marine Diversity & Conservation
	Statistics	Conservation Biology
Chemistry:	General Chem 1	Wetland Ecology
	General Chem 2	Restoration Ecology
	General Chem 3	History of Life
	Organic Chem 1	
Physics:	General Physics 1	Bioethics
	General Physics 2	
Biology:	Intro Bio 1	
	Intro Bio 2	
	Intro Bio 3	
	Genetics (offered F 2009)	
	Ecology	
	Evolution (offered W 2010)	
	Sci. Methods & Practice	
	Cell Biology (Sp 2010)	

**Courses required to launch the Biology major**

Biochemistry  
Microbiology  
Animal Physiology  
Anatomy & Physiology

**Courses that could be offered by current UWB faculty<sup>6</sup>**

Plant Physiology  
Developmental Biology  
Neurophysiology  
Animal Behavior  
Investigative Biology courses  
Research in Biology

Biodiversity

**Courses required to build a full Biology major<sup>7</sup>**

Molecular Biology  
Genomics/Bioinformatics  
Ecophysiology  
Toxicology  
Population Biology  
Additional electives

<sup>6</sup> While faculty at UWB have the expertise to teach these courses, some of those faculty have other teaching obligations, so that these courses may be offered on an irregular basis as we launch the major.

<sup>7</sup> These are courses which we would like to offer as we build out the major. Actual offerings may vary somewhat, depending on the newly hired faculty hired, their areas of expertise, and courses they may offer, and changes within the field of Biology itself.



**Prerequisites for admission to the major:**

- General Chemistry 1, 2, 3 (15 credits, or equivalent 1-year sequence)
- Introductory Biology 1, 2 (10 credits, or equivalent 2-quarter sequence)

Students must earn a cumulative GPA of 2.0 or better in the Chemistry and Biology courses to be applied to the major.

**Credits required for the major:**

Because many proposed courses have not yet been established at UW Bothell, the number of credits required will depend on how these courses are credited. However, **the maximum number of required credits will be 115**; this assumes that all 23 courses listed in the checklist on page 38 are 5 credits each.

### Potential paths for undergraduates through the Biology major:

For students more interested in Cell/Molecular/Developmental biology:

Year	Fall	Winter	Spring
1	General Chem 1 (Pre-calc?)	General Chem 2 Calculus	General Chem 3
2	Intro Biology 1 Organic Chem 1	Intro Biology 2 General Physics 1	Intro Biology 3 General Physics 2
3	Genetics Elective 1 (e.g. Biochemistry)	Animal Physiology Sci Meth & Practice	Cell Biology Biology and Society
4	Ecology Statistics Bioethics	Evolution Investigative Biology	Elective 2 (e.g. Developmental Biology) Elective 3 (e.g. Molecular Biology)

For students more interested in Ecology/Evolution:

Year	Fall	Winter	Spring
1	General Chem 1 (Pre-calc?)	General Chem 2 Calculus	General Chem 3
2	Intro Biology 1 Organic Chem 1	Intro Biology 2 General Physics 1	Intro Biology 3 General Physics 2
3	Ecology Statistics	Evolution Sci Meth & Practice	Elective 1 (e.g. Marine Diversity) Microbiology
4	Genetics Plant Physiology Bioethics	Elective 2 (e.g. Animal Physiology) Biology & Society	Elective 3 (e.g. History of Life) Investigative Biology

For students intending to apply to medical school (or other health professional school):

<b>Year</b>	<b>Fall</b>	<b>Winter</b>	<b>Spring</b>
<b>1</b>	General Chem 1	General Chem 2 Statistics	General Chem 3 Calculus
<b>2</b>	Intro Biology 1 Organic Chem 1	Intro Biology 2 Organic Chem 2	Intro Biology 3 Organic Chem 3
<b>3</b>	Genetics General Physics 1 Biology & Society	Animal Physiology Sci Meth & Practice General Physics 2	Elective 1 (e.g. Cell Biology) Bioethics General Physics 3
<b>4</b>	Biochemistry Ecology	Evolution Investigative Biology	Elective 2 (e.g. Molecular Biology) Elective 3 (e.g. Developmental Biology)

## 2. Courses currently offered at UWB

There are several existing courses, created for student populations other than Biology majors, which we will accept until student demand justifies the launch of new courses; we hope that this transition period to the new major will be brief. These are:

***Introductory Biology.*** UWB currently offers BES 180, 200, and 220 as a three-quarter Introductory Biology sequence taught for students in programs in Environmental Studies and Environmental Science.

In collaboration with the rest of the campus biology community, the Science and Technology Program plans to modify the Introductory Biology sequence for our Biology majors in several years. The effort to design and implement a new Introductory Biology sequence will involve faculty members from across UWB who are teaching Biology. In particular, the design effort will draw upon Dr. Rebecca Price, who has expertise in both evolutionary biology and science pedagogy. While the specific form and content of the new sequence remain to be determined, the goals of the revised sequence will be:

- to increase success of underprepared students in the sciences
- to provide support for students beginning the study of science and math, by emphasizing the scientific method and core skills and competencies. These will include metacognitive skills, such as how to study and assess one's own understanding of scientific concepts
- to teach skills central to success in the sciences, including generating hypotheses, designing experiments, interpreting data, etc.

- to modify lab exercises to include skills such as maintaining a lab notebook, how to record observations, and how to visually represent data.
- to incorporate active learning exercises and inquiry-based lab activities

In the Planning Notification of Intent, we described a two-quarter introductory Biology sequence, accompanied by a separate (third) course to prepare students for college-level study in science. We now recognize that (1) students need a three-quarter Biology sequence to transfer to other institutions; and (2) we will be unable to thoughtfully develop this support course before for the anticipated launch of the major.

Nevertheless, a high priority will be the re-design of the Introductory Biology sequence using current pedagogical research both within the sciences and in integrating biology with other areas of study.

***Introductory and Organic Chemistry.*** UWB currently offers a three-quarter Introductory Chemistry sequence and a three-quarter Organic Chemistry sequence. We wish to create a 4-quarter Chemistry sequence for Biology majors, which will cover General and Organic Chemistry. (That is, we wish to reduce the total Chemistry requirement for Biology majors from 6 courses to 4.) We will use the first two quarters of the current Chemistry sequence, followed by two quarters designed specifically for Biology majors. Again, we will not develop the Biology-specific courses until justified by student demand. Until then, we will accept three quarters of Introductory Chemistry, and one quarter of Organic Chemistry to fulfill the Chemistry requirement. (We realize that it will be critical to maintain the option of a full two-year [6-quarter] Chemistry

sequence, which is often required of students applying to medical schools and other post-graduate health programs.)

***Science Methods and Practice.*** UWB currently offers BES 301: Science Methods and Practice, intended for students pursuing degrees in Environmental Science and Environmental Studies. We will require this course of Biology majors as well. We anticipate that Science Methods and Practice would be cross-listed in both programs, with faculty in both IAS and S&T teaching the course, as needed, and that any given section would be made up of both Environmental Studies/Science students, and Biology students, promoting interactions between students in these areas.

### **3. Schedule of course offerings**

The attached spreadsheet shows the anticipated offerings to launch the Biology major. All required courses in Math, Physics and Chemistry, and the Introductory Biology sequence (BES 180, 200, 220), are offered yearly. We anticipate hiring one new faculty member for each of the next three years (AY 2010-2011, 2011-12, and 20102-13) which would enable us to teach almost all courses that could used as required options (i.e. one of three courses in Cellular/Subcellular Biology), as well as a significant number of electives.

At this time, most courses will be offered once per year, with some electives offered only in alternate years. Exceptions will be Science Methods & Practice, and Investigative Biology. As more students are admitted and additional faculty are hired, and as we get a better idea of students demand, it may be possible to offer some courses – especially core courses required of all Biology majors – more frequently.

#### **4. Course descriptions**

***Introductory Biology 1.*** Mendelian genetics, evolution, biodiversity of life forms, ecology, conservation biology. First course in a three-course sequence.

***Introductory Biology 2.*** Metabolism and energetic, structure and function of biomolecules, cell structure and function, animal development. Second course in a three-course sequence.

***Introductory Biology 3.*** Animal physiology, plant development and physiology. Third course in a three-course sequence.

***Genetics.*** Principles of heredity, including a review of basic molecular biology (DNA structure, transcription, translation, mutation, chromosome structure), classical genetics (Mendelian inheritance, pedigree analysis, linkage and genetic mapping), regulation of gene expression, genetic engineering and modern genetic analysis) and an introduction to genomes and genomics.

#### ***Biochemistry***

#### ***Microbiology***

***Cell Biology.*** Cell structure and function, including structural organization (membranes, organelles), flow of information from the nucleus to compartments, transmission of information from the cell surface to the interior (signal transduction), cell cycle, programmed cell death, cell interactions, and causes of aberrant growth (cancer).

***Ecology.*** Introduces major concepts of ecology and relates these concepts to current environmental issues. Topics include the relationship between organisms and the physical environment, evolutionary processes, the structure and function of

ecosystems, population biology, natural resource management, environmental contamination, conservation, and climate change.

***Animal Physiology***

***Plant Physiology***

***Anatomy & Physiology***

***Evolution.*** Explores different mechanism of evolution, including natural selection and genetic drift, using well-studied experiments and applying simple algebraic models. Students learn to explain processes underlying observed evolutionary patterns such as evolution of HIV, as well as predict evolutionary outcomes emphasizing health and crop management, and explain the diversity of living organisms.

***Science Methods & Practice.*** An exploration of the breadth of the scientific process - from the core methods of scientific inquiry to a broad examination of how science actually works in academic and applied settings. The course focuses on honing scientific instincts in an inquiry-based framework. Students also examine and practice using selected quantitative tools in science to foster students' abilities in critical analysis of scientific information and construction of evidence-based arguments.

***Ecological Methods.*** Introduces students to methods used in the analysis of ecological systems and their processes. Employs data analysis tools, graphic presentation, and scientific writing in the presentation of results from laboratory and field studies. Includes lectures, laboratory work, and field investigations.

***Molecular Biology***



## ***Genomics/Bioinformatics***

***Developmental Biology.*** Biology of embryonic development: major features of animal development (both vertebrates and invertebrates), morphological features of early development (fertilization, cleavage, gastrulation, establishment of the body plan), cell determination, pattern formation, and the molecular biology of early embryos. The emphasis is on the molecules controlling development.

***Investigative Biology*** (see p. 29)

***Neurophysiology***

***Ecophysiology***

***Toxicology***

***Biodiversity***

***Marine Diversity and Conservation.*** Exploration of marine biodiversity of the Pacific Northwest. Basic concepts in evolution, development, ecology, and conservation are introduced through inquiry-guided exercises based in the marine environment. Examination of human impacts on marine environments and subsequent consequences for human health and welfare.

***Conservation Biology.*** Exploration of the science underlying methods of species and ecosystem conservation. Emphasis is placed on understanding the limits and promise of scientific approaches to conservation, within the social, political and economic context of conservation problems.

***Restoration Ecology.*** Introduces ecological restoration of damaged ecosystems. Develops a broad understanding of restoration ecology, including diverse ecological aspects of the practice of restoration, conceptual and philosophical

issues underlying the field, and social and political factors that influence restoration outcomes.

***History of Life.*** Explores the principles of evolution by examining the fossil record, focusing on how past events shaped today's biodiversity. Engages with contemporary controversies regarding scientific literacy.

## **VI. Infrastructure Requirements**

### **A. Facilities**

#### **1. Teaching laboratories**

Currently, UW Bothell courses in Biology (Introductory Biology sequence, Ecology courses, Genetics); Chemistry (Introductory Chemistry sequence) and Physics (General Physics sequence) use teaching laboratories that are shared with Cascadia Community College (CCC), and are located in the CCC building. These shared labs are used extensively for CCC courses. The lab spaces are currently near capacity, and it is difficult to envision offering many new courses or lab sections in the current space.

A new building is slated to be built on the UW Bothell campus, which will house science teaching and research labs (among other functions envisioned for this building). Funds have been allocated for the planning of this building; nevertheless, it is scheduled for occupancy only in 2013.

Thus, one requirement will be for additional teaching lab space to accommodate new lab courses, and additional laboratory sections in Biology, Chemistry, and Physics.

We will also require teaching lab space, with appropriate equipment, to teach sections of Investigative Biology. While these courses will be capped at 12 students, we will nevertheless require equipment appropriate to research courses.

We estimate the cost of renovating a current classroom, to convert it to a teaching lab, as \$500,000. Further, this teaching lab space will need to be outfitted with equipment, including pH meters, balances, microscopes (dissecting and compound), glassware, gel apparatuses, etc.

## **2. Research laboratories**

To recruit new tenure-track faculty members in Biology to UWB, and to properly educate our Biology majors, we need to provide research lab space. We propose – for the moment - a single, shared research lab space that would allow researchers to share equipment, facilitate collaboration among Biology faculty members engaged in laboratory research, and encourage communication among undergraduate researchers. In the future, research lab space will be provided in the new UW3 building, currently in planning stages.

A research lab – even one shared among two or three faculty members – will require considerable investment in equipment and supplies. Major pieces of equipment would include a -80° freezer, refrigerators, -4° freezer, centrifuge, fume hood, laminar flow hood for bacterial work, a bacterial incubator, microscopes (dissecting, compound, and fluorescent), etc. A preliminary budget for equipment to be shared among the Biology faculty is attached.

In addition, we expect that any newly-hired faculty member will need to purchase specialized equipment appropriate to their research program. Current start-up packages at undergraduate liberal-arts schools are in the range of \$50,000 - \$100,000; new hires in these positions usually have access to departmental equipment, or to equipment left by retirees. We believe that, to attract excellent candidates, we should allocate sums in the upper end of this range, because we have, effectively, no equipment at this time, so new faculty members will need to purchase more than they would if they were joining an established program.

## **B. Support Services**

As other S&T programs are implemented in tandem with the Biology program, specific support services to meet the needs of science and technology will need to be developed. In any case, S&T students, including Biology majors, will place greater demands on the Quantitative Skills Center. It may also be helpful to establish peer tutoring options for students in S&T.

### **1. Academic Transition Program**

The University of Washington Bothell started the Academic Transition Program in September 2009; the objective of this bridge program is to help talented but under-prepared students of promise to make the transition to college-level coursework. The program runs four days per week from 9 am to 4 pm, providing intensive concentration in areas such as university culture and resources, study skills, writing and quantitative skills, as well as co-curricular activities. The program continues as a follow-up throughout the year. College credits are awarded to students for participation in the program.

## **2. Counseling Services**

Confidential, short-term personal counseling is available to UW Bothell students free of charge. Students may utilize counseling for a wide range of personal concerns such as anxiety, depression, relationship difficulties, or adjustment issues. All services are offered in a safe and supportive environment.

## **3. Disabled Student Services**

The University of Washington Disability Support Services office (DSS) is committed to ensuring that qualified students with documented disabilities are provided with an equal opportunity to participate in the variety of educational, recreational, and social opportunities available at the University. The primary functions of DSS are academic accommodations for students with a documented, permanent or temporary physical, mental, or sensory disability; resource and referral information; and advocacy support as necessary and appropriate. Academic accommodations for each student are determined on an individual basis with input from the diagnostician or physician (usually from the diagnostic report), the student and the Counselor or Director of the DSS office.

## **4. Library**

UW Bothell Library is part of the University of Washington Library system which provides access to over seven million volumes, over 50,000 serials, and hundreds of research databases. Reference services are available during regular library hours and 24/7 through online chat. One of the main features of the UW Bothell Library is an Information Commons, which offers 50+ computer workstations, providing access to the UW Libraries Catalog and online resources, the internet, and a limited suite of productivity software. Rob Estes, Science Librarian and Sarah Leadley, Acting Director

of the Library, provided the following analysis of the support requirements and services already in place to support the Biology program, as well as additional resource needs.

***a. Collections: Research Databases, E-Journals, monographs and media***

UW Bothell Biology students will have access to core databases and electronic resources, through the UW Libraries. The key electronic resources for research in biology are listed on the UW Biology research guide

<<http://www.lib.washington.edu/subject/Biology/>> and include these research databases: Biosis, BioOne, and Web of Science. As electronic database subscriptions increase and UW Bothell use of biology databases increases, UW Bothell will need to contribute a higher level of funding to continue receiving unlimited access to these major databases. It is also anticipated that tri-campus and consortial costs will increase over time, based on inflation, which tends to be high in the sciences. Additional funds will be needed to purchase books and media to support classroom instruction and student research needs in the life sciences, focusing on areas with little or no representation in the Bothell Library collection, including developmental biology, genetics and evolution (see budget below).

***b. Student Support: Information Literacy***

Highly prepared as well as underprepared students need Library and Librarian support to access, use, and critically evaluate essential science resources and databases.

Based on the current level of support given to UWB undergraduate students in related STEM fields, Biology students will need support from Librarians in terms of reference and resource questions (via email, Instant Message and in person) and some Librarian instruction (in person or through online instruction) on Library basics, key electronic and

print resources, and specialized research skills. In alignment with the goals of the UWB Science and Technology program, student access to research librarians is necessary to foster student preparation, retention and achievement. We believe that we can best support biology students and faculty with the addition of a .25 FTE librarian in the first or second year of the Program, with an increase to .5 FTE following this, based on FTE growth and Program needs.

*c. Proposed budget for library resources and services*

**Biology Funding  
Proposal: Library  
Resources and Services**

<b>Operations</b>	<b>2010-11</b>	<b>2011-12</b>	<b>2012-13</b>	<b>2013-14</b>	<b>2014-15</b>
One Time Collections					
New Faculty Teaching & Research Needs @ 2 faculty	2,000.00	2,000.00			
<i>Ongoing Collections* with 12% annual inflation</i>	11,000.00	12,320.00	13,798.40	15,454.21	17,308.71
<i>Operating Expenses</i>					
Staff Computer (assuming 4 year equip. replacement)		1,500.00			
Additional Support Monies (assuming addtnl start-up)					
Includes librarian travel and supplies		2,000.00	1,200.00	1,200.00	1,200.00
<b>Operations Totals</b>	13,000.00	17,820.00	14,998.40	16,654.21	18,508.71

**Staffing: Salary & Benefits\*\***

.25 Librarian (Increase to .5 in 2013-14)	20,688.00	21,722.40	22,808.52	45,617.00	47,897.85
<b>Staffing Totals</b>	20,688.00	21,722.40	22,808.52	45,617.00	47,897.85



<b>Grand Totals</b>	33,688.00	39,542.40	37,806.92	62,271.21	66,406.56
---------------------	-----------	-----------	-----------	-----------	-----------

\*Ongoing/Permanent

Collections:

Collections: \$3000 for monographs and media

\$8000 for increased contributions (@5%) to core electronic resources: research databases and ejournals

Inflation is calculated at 12% annually, which may be a low estimate for science journals and e-resources

Additional database seats and increases in consortia agreements could raise costs by an additional 15-20%

\*\*Benefit Load Rates: 01-70 Professional Staff:  
29.3%

Salary and benefits includes possible 5% annual  
increase

## 5. Media Center

The Campus Media Center (CMC) provides a variety of services to UW Bothell students, faculty and staff. In addition to maintaining and circulating the local media collection, staff members also provide media research and procurement services. The CMC also assists in the development of media-related materials for instruction and provides training to faculty and students in the use of media and technology. Additional services include audio and video production as well as photographic and digital imaging production. The CMC also provides support to UW Bothell's highly technical classrooms. Each room is equipped with state-of-the-art instructional technology

including an electronic podium with an on-board instructor, computer and media playback devices. Finally, the CMC coordinates the distribution of cable television throughout the instructional areas of the campus.

#### **6. Quantitative Skills Center**

The Quantitative Skills Center is open to anyone who wants academic support with a quantitative question for one or more of their classes. The assistance offered by the QSC is for all students at any time; there is no requirement that a student be in a math class to receive help at the QSC. The QSC offers free tutoring for all UW Bothell students, staff, faculty, and alumni. As the Biology program grows it will be necessary for student support services, such as the QSC, to receive additional resources to be able to continue to provide high-quality support.

#### **8. Writing Center**

The UW Bothell Writing Center supports student writing in all academic programs by providing individual and group consultations (face-to-face and online), workshops, and classroom instruction. The WC will assist a student through the entire writing process. This includes organization, research, conducting reviews and the revision process.

#### **9. Information Systems**

The University of Washington Bothell provides a broad array of computing resources and services to all students, staff and faculty. The Information Systems department provides basic computing support to UW Bothell faculty, staff, and students. It maintains computer classroom and labs, provides technical assistance to faculty for both teaching and research, databases, educational technology efforts, and administrative access to

information and maintains a robust, secure and stable networking environment providing e-mail, file storage, and back-up services.

## **VII. Faculty**

### **A. Current Faculty**

There are currently five biologists on the UWB faculty; four have appointments in the Interdisciplinary Arts & Sciences (IAS) Program, while one is in the Science and Technology (S&T) Program.

The biologists and their areas of expertise are listed below. Additional courses that could be taught by these faculty members are in parentheses.

1. Warren Gold (IAS)     Restoration Ecology (Plant Physiology, Ecophysiology)
2. Martha Groom (IAS)     Conservation Ecology (Population Biology)
3. Rebecca Price (IAS)     Evolution, Science Pedagogy (Biodiversity, History of Life)
4. Marc Servetnick (S&T)     Developmental Biology, Cell Biology (Genetics)
5. David Stokes (IAS)     Ecology (Animal Behavior, Conservation Biology)

Additionally, Dr. Michael Stiber, in the Computer and Software Systems Program, has the expertise to teach Neurophysiology.

**Warren Gold** earned a B.S. in Botany and a B.A. in Zoology, both from the University of Washington, and an M.S. and PhD in Plant Ecology from Utah State University. Dr. Gold's research spans a broad range of ecological science, but is most associated with plant physiological ecology and nutrient cycling processes/ecosystem ecology. He has

studied plant-herbivore interactions in the shrub-steppe; vine ecology and physiology in eastern deciduous forests; and plant adaptation, community dynamics, and ecosystem processes in arctic and alpine ecosystems. His present research includes studies of (1) the ecology and restoration of plant species of cultural importance to Northwest Native American tribes, (2) the ecology and physiology of native and non-native species involved in ecological restoration, and (3) alpine ecology, including recreational impact and restoration and links between cryptogamic organisms, vascular plants and ecosystem processes.

Dr. Gold teaches courses on ecology and environmental science in the Interdisciplinary Arts & Sciences (IAS) program at UW Bothell, as well as courses in the University of Washington Restoration Ecology Network curriculum. Specific courses include Ecology, Ecological Methods, and the Restoration Ecology Capstone. Dr. Gold also directs the tri-campus University of Washington Restoration Ecology Network.

**Martha Groom** earned two B.A.s, in Biology and in Public Policy, from Princeton University, an M.S. in Zoology and Tropical Conservation and Development from the University of Florida, and a PhD in Zoology from the University of Washington. Dr. Groom's scholarship emphasizes the careful application of ecological and evolutionary theory and empirical knowledge to conservation concerns. She has studied the population and community effects of life in fragmented habitats, using both plants and animals. For example, she has investigated the dynamics of an annual plant (*Clarkia concinna concinna* (Onagraceae)), documenting a marked threshold effect whereby sufficiently small and isolated patches of the plant do not receive effective pollination

services, and suffer higher extinction rates than plants in large, well-connected patches. In collaboration with Dr. Jaime Collazo and their graduate students, she investigated the influence of land use history on bird communities in Puerto Rico, where more than 98% of the forest cover was removed in the last century, yet few bird species went extinct. This may be because the birds used traditional coffee plantations; shaded coffee plantations contain more bird species that enjoy higher breeding success than do areas with other agricultural practices. However, only plantations with sufficiently large "resting" areas of secondary forest, and with a wide diversity of tree species, are widely used by birds.

Dr. Groom teaches in IAS, primarily courses for the majors in Environmental Studies, Environmental Science, and Global Studies. She has taught part of the Introductory Biology sequence, and courses in ecology and conservation. Specific courses taught include Ecology, Ecology and the Environment, Marine Diversity and Conservation, Restoration Ecology, and Conservation Biology. She is the lead author of *Principles of Conservation Biology*, a textbook intended for advanced undergraduate and graduate students.

**Rebecca Price** earned a BS in Zoology from the University of Washington, and a PhD in Geophysical Sciences from the University of Chicago. Dr. Price's scientific research addresses how species change shape over geologic time scales. While many population biologists accept that such morphological changes result from the same evolutionary processes that occur in populations, most paleobiologists are unconvinced that population-level dynamics can explain phenomena such as mass extinctions and adaptive radiations involving hundreds of species. Dr. Price studies many geologic and

geographic localities, collecting data from museum collections, the literature, and live specimens. Most of her work involves sea shells from a group of snails found throughout the world's oceans and with a rich fossil record extending back at least 140 million years. Earlier research projects studied the function of different shell features (Price, 2003, *Biological Bulletin*), the effect of biases in the fossil record (Jablonski *et al.*, 2003, *Science*), and the evolutionary history of a group of sea slugs (Price *et al.*, in press, *Veliger*). Now she and her students are analyzing the ecological factors that affect growth rates in the phenotypically plastic snail, *Nucella lamellosa*.

Another component of Dr. Price's research program addresses pedagogical issues in the sciences. She has published on ways to recruit under-represented minorities to the sciences (Price *et al.*, 2008, *Journal of College Science Teaching*) as well as novel, interdisciplinary curricula (Droege *et al.*, 2008 in *Exploring the Evidence*).

Dr. Price teaches in IAS; courses taught at UWB include Introductory Biology, History of Life, the Visual Art of Biology, and Evolution (to be offered as a Special Topics course in 2009-10).

**Marc Servetnick** earned a B.A. in Biophysics from the Johns Hopkins University, and a PhD in Zoology from the University of California, Berkeley. He taught for 14 years at Ithaca College, where he also served as Chair of the Biology Department, before moving to UW Bothell. Dr. Servetnick's research focuses on cell fate determination during early embryonic development. His research, on frog embryos, focused on the FGF receptor protein family. His lab at Ithaca College cloned the *Xenopus* FGFR4

gene, mapped the expression of the FGFR genes during development, and carried out studies of the role of different FGFR proteins during development.

Dr. Servetnick has taught in IAS, and is now in S&T. Specific courses taught (at Ithaca College) include Cell Biology, Developmental Biology, and Literature of Biology, and (at UW Bothell) Introductory Biology, Genetics, and two courses intended for non-Biology majors: Genes, Genomes and Heredity; and Embryos, Genes, and Reproductive Technology.

**David Stokes** earned a BA in Geology from Williams College, and a PhD in Zoology from the University of Washington. His research concerns theoretical and applied aspects of conservation biology, avian ecology, behavioral ecology, and landscape ecology. He is currently investigating the ecology and conservation implications of migration and movement of diverse organisms: penguins, salamanders, and invasive plants. He and his colleagues have found that South Atlantic penguins travel great distances-hundreds of kilometers-to forage during the breeding season, and even greater distances during migration; these findings raise questions relating to the ecology of these marine birds (Why do they travel so far? What determines where they go?), as well as conservation issues (How to conserve a species that is so wide ranging?). Similarly, he is researching the movement and metapopulation structure of the California tiger salamander to learn more about the species' ecology and how to better conserve it in its diminishing habitat. In a different way, invasive plants also "move," and he is investigating the patterns of spread of non-native invasive trees. This work may ultimately have applications in the control of environmentally destructive invasive species.

Dr. Stokes teaches courses in the biological realm of environmental science, in subjects such as conservation biology, conservation planning, and ecology. Specific courses taught include Introduction to Restoration Ecology, Conservation Biology, and Environmental History of the Bioregion

### **B. New Faculty**

To launch the new Biology major, we plan to hire three new full-time faculty members within the next three years. The hires will be in the areas of (1) Biochemistry and Microbiology (to teach courses in Biochemistry and Microbiology), (2) Animal Physiology (to teach courses in Animal Physiology, and Anatomy & Physiology), and (3) Molecular Biology, Genetics and Bioinformatics.

In addition to courses in their areas of expertise, we anticipate that these hires will contribute to the Biology program by

- (1) supervising undergraduate research,
- (2) teaching Science Methods and Practice, and Investigative Biology courses
- (3) as the Biology program grows, by participating in the teaching of Introductory Biology (for example, teaching additional Intro Biology lab sections).

The following will apply to the recruitment and hiring of new faculty members in the Biology degree program:

1. We will hire new faculty members in the Biology Program through national searches, by advertising in appropriate professional journals. We will advertise in



*Science* and *The Chronicle of Higher Education*. Other journals may be appropriate for specific sub-areas of Biology.

2. We will strive for faculty expertise in various areas of Biology, placing priority on the hiring of excellent educators and scholars with expertise in their sub-discipline, with the goal of providing outstanding educational and research experiences for students across the breadth of biological sub-disciplines. In hiring faculty, we will also seek candidates whose teaching will fit with the interdisciplinary nature of a UW Bothell education.
3. We will solicit applications from candidates from historically under-represented groups in the sciences by routinely contacting historically black colleges and universities and tribal colleges to publicize our searches. We will also post job ads on the web sites for SACNAS, HBCU, and other appropriate web sites.
4. The mission of the Office of the Associate Vice Provost for Faculty Advancement (working in UW's Office of Minority Affairs and Diversity [OMA&D]) is to ensure that UW recruits, promotes and retains an excellent and diverse faculty. We will work with OMA&D to attract a pool of applicants that includes women and members of under-represented groups.
5. Program materials and web photos will reflect and promote the diversity of the program.

## **VIII. Administration**

The Biology degree program will be housed in the Science and Technology Program at UW Bothell. (Programs at UW Bothell are similar to Departments at UW Seattle.)

### Administrative Structure

The Director of the Science and Technology Program (S&T) will appoint a Biology Degree Coordinator. The Biology Degree Coordinator will work with the Director of S&T to oversee Biology course offerings (including all courses required for the Biology degree) – to determine both which courses will be offered and the frequency of offerings. The Biology Degree Coordinator, in consultation with the Director of S&T, will appoint two Biology Committees: Curriculum/Assessment, and Admissions. The Degree Coordinator will be responsible for overseeing Biology committees, and making recommendations to S&T about the Biology curriculum, staffing, admissions, and assessment. While staffing these committees is the responsibility of the Science and Technology faculty, biology faculty from other UWB programs will be invited to participate to the extent feasible and appropriate.

(Note: at the launch of the degree program, there will be a single Biology Program Committee to take on both tasks; this will help the biologists across campus to establish standards and procedures. As the number of faculty members teaching in Biology grows, we will create different committees, as needed.)

### Committees

The Biology Curriculum Committee will review curricular materials and information obtained through the Assessment process to evaluate the curriculum, and recommend any changes. The Curriculum Committee will also evaluate courses as possible Biology electives and for the Biology and Society requirement (either adding or deleting

courses). The focus of the Curriculum Committee will be on achieving the Biology learning objectives.

The Biology Assessment Committee will gather information as specified in section X. (Assessment) and will recommend changes in curriculum, sequencing of courses, teaching practices, or staffing. The focus of the Assessment Committee will be on achieving Biology Learning Objectives and effective learning on the part of students.

The Biology Admissions Committee will determine standards for admission to the Biology major, and will review applications to the major.

#### Support Staff

The S&T Program currently has a Program Administrator (Christine Howard) and an adviser (Dani Dutro), who serve all degree programs within S&T.

### **IX. Students**

*In 1944, the quota for women at the University was 3 in a class of 65 medical students. The quota was filled for the class I wanted to enter so I had to wait 9 months. This really was not such a hardship because I still entered medical school when I had just turned 20. –Janet Davison Rowley*

#### **A. Diversity Plan**

The proposed Biology program is committed to the principles of a diverse student population as articulated by the University of Washington at large and UW Bothell in particular. Our program mission includes:

***[help students to] appreciate diversity at various levels: biodiversity, human diversity, and the diversity of approaches used to understand the biological world.***

UW Bothell's growing appeal is due to the particularized attention that students receive. There are comprehensive programs and support services in place for students. We are committed to recruiting and retaining diverse student, faculty and staff populations so that the educational experience can be rich and thorough.

Program Initiatives:

### **1. Students**

1. The program will be planned and courses will be scheduled to provide flexibility to meet the demands of nontraditional students.
2. Program will encourage and support student organizations (for example,  $\beta\beta\beta$ , Sigma Xi, Biology club).
3. Formal evaluation of program diversity objectives will be conducted
4. Seminar series
5. Summer institutes/camps will build upon existing programs at UW Bothell & UW

Seattle:

- Multidisciplinary International Research Training (MIRT)
- Stipends for Training Aspiring Researchers (STAR)
- Biomedical Research Identification of Graduate Education Successful Student Support Services (Bridges)  
Pipeline – K-12 programs

#### U-DOC

- Special events for community
  - Dream Project
6. Student Recruitment and Admissions fairs
  7. Research Forums
  8. Centers : Plan programs & special events with existing Centers at UWB & UWS

### **X. Assessment Plan**

Upon approval of the program, we will appoint a Biology Assessment committee to establish and formalize assessment procedures, collect data, evaluate the effectiveness of the program, and to recommend changes in the curriculum or further refine assessment procedures.

The University of Washington mandates reviews of all academic units, including undergraduate degree programs, at least every ten years; these reviews are conducted jointly by the Dean of the Graduate School and the Dean of Undergraduate Academic Affairs (<http://www.grad.washington.edu/fac-staff/programreviews/existing.shtml>).

Our overall assessment practices will rely on:

- use of multiple measures of assessment
- formative, not summative, evaluation
- use of data collected for continuous revision and improvement of the degree program

- focus on the overall program, as opposed to individual faculty or students

Data to be collected to measure the effectiveness of the degree program in meeting its

Learning Objectives will include:

- *student evaluation* of each course. These forms will provide students the opportunity to directly address course learning outcomes (were they successful?) and program learning objectives addressed in that course. Course evaluations also allow students to comment on the relevance of course content, and the role of the course within the degree program.
- *peer monitoring* of instruction, through classroom visits, allowing faculty members to better understand both what other courses cover, and the teaching styles used by other instructors.
- *course-embedded assessment*: student performance on exams, lab exercises, papers, and presentations, and overall course grades
- *student focus groups* and *exit interviews*,
- *success of student-faculty research*
  - number of presentations at conferences
  - number of student co-authored abstracts and publications
- monitoring of *student retention* within the program, to evaluate (among other things) student preparation for the program, admission requirements, and the effectiveness of student support services.
- at least initially, use of a *standardized exam*, the *Major Field Test (MFT) in Biology* (administered by the Educational Testing Service) a nationally-normed exam that

provides percentile scores for each student, and for the program as a whole. The exam will be administered as close to the end of the degree program as possible. The MFT will allow us to identify any weaknesses in the program, and will provide a means, however imperfect, of comparing the content knowledge of our students with their peers nationwide.

- *tracking of program alumni*
  - number of students admitted to medical or other professional schools
  - number of students admitted to PhD programs
  - surveys sent to alumni 3-5 years after graduation, to monitor
    - the number of students employed (or pursuing further education) in Biology, and
    - how well they perceive the program to have prepared them for work in Biology.
- *program evaluation by an outside faculty evaluation group.* One such group that provides evaluation of Biology programs is the Council for Undergraduate Research (CUR). CUR has established specific guidelines, and provides a list of potential outside evaluators who will visit the campus, interview students and faculty, and review material assembled by the degree program, in order to both evaluate the program and to recommend changes (see <http://www.cur.org/consulting.html>).

Data collected will be analyzed by the Biology Assessment Committee, and used to evaluate the overall effectiveness and success of the program and to recommend changes in program instructional practices, content, curriculum or other applicable

areas. Complementary faculty committees will evaluate curriculum and resources (support staff, budget and equipment).

The table on the following page summarizes our anticipated program assessment.



<b>Element</b>	<b>Assessment</b>	<b>Method</b>	<b>Frequency</b>
<b>Curriculum</b>	<ul style="list-style-type: none"> <li>▪ program coherence</li> <li>▪ appropriate learning outcomes</li> </ul>	<ul style="list-style-type: none"> <li>a. student surveys (focus groups, exit interviews),</li> <li>b. alumni surveys,</li> <li>c. Major Field Test,</li> <li>d. course-embedded assessment</li> </ul>	annually
<b>Students</b>	student learning outcomes <ul style="list-style-type: none"> <li>▪ assessment methods</li> <li>▪ evidence of success</li> </ul>	<ul style="list-style-type: none"> <li>a. student surveys (course evaluations, focus groups, exit interviews),</li> <li>b. course-embedded assessment,</li> <li>c. Major Field Test,</li> <li>d. alumni surveys</li> </ul>	quarterly course evaluations, annual student surveys
<b>Enrollment</b>	<ul style="list-style-type: none"> <li>▪ enrollment and retention trends</li> <li>▪ diversity of students</li> </ul>	<ul style="list-style-type: none"> <li>a. data from Office of Institutional Research, UWB Admissions</li> <li>b. recruitment goals</li> </ul>	annually
<b>Faculty</b>	faculty active in: <ul style="list-style-type: none"> <li>▪ research</li> <li>▪ teaching improvement</li> <li>▪ professional organizations</li> <li>▪ college governance:               <ul style="list-style-type: none"> <li>adequate staffing</li> <li>tenure</li> <li>promotions</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>a. faculty self-evaluations,</li> <li>b. personnel committee</li> </ul>	annually
<b>Resources</b>	<ul style="list-style-type: none"> <li>▪ adequate facilities</li> <li>▪ sufficient equipment</li> <li>▪ appropriate technology</li> <li>▪ adequate program budget</li> </ul>	<ul style="list-style-type: none"> <li>a. faculty self-evaluation, budget/operations committee,</li> <li>b. student surveys (focus groups, research success),</li> <li>c. alumni success, alumni surveys</li> </ul>	annually
<b>Student Services</b>	adequate support: <ul style="list-style-type: none"> <li>▪ recruitment</li> <li>▪ admissions</li> <li>▪ advising</li> <li>▪ counseling</li> <li>▪ retention</li> </ul>	<ul style="list-style-type: none"> <li>a. data from Office of Institutional Research, UWB Admissions (data on admissions, retention),</li> <li>b. student surveys</li> </ul>	Annually
<b>Academic Support</b>	adequate support: <ul style="list-style-type: none"> <li>▪ Quantitative Skills Center</li> <li>▪ Writing Center</li> <li>▪ Library</li> <li>▪ Information Technology</li> <li>▪ Advising</li> </ul>	<ul style="list-style-type: none"> <li>a. student surveys,</li> <li>b. course-embedded assessment,</li> <li>c. student retention data</li> <li>d. advising report data</li> </ul>	Annually

Schedule of course offerings for the Biology degree program					
		2009-10	2010-11	2011-12	
Math	Calculus	offered	offered	offered	
	Statistics	offered	offered	offered	
Physics	General Physics 1	offered	offered	offered	
	General Physics 2	offered	offered	offered	
Chemistry	General Chem 1	offered	offered	offered	
	General Chem 2	offered	offered	offered	
	General Chem 3	offered	offered	offered	
	Organic Chem 1	offered	offered	offered	
Biology	Intro Biology 1	BES 180	BES 180	BES 180	
	Intro Biology 2	BES 200	BES 200	BES 200	
	Intro Biology 3	BES 220	BES 220	BES 220	
	Genetics	offered	offered	offered	
	Cell/Subcell Biology				
	Microbiology		new hire	offered	search '09-'10; offered in '10-'11
	Biochemistry		new hire	offered	search '09-'10; offered in '10-'12
	Cell Biology	offered alt years		offered alt years	
	Ecology	offered	offered	offered	
	Physiology				
	Animal Physiology			new hire	search '10-'11; offered '11-'12
	Plant Physiology				
	Anatomy & Physiology			new hire	search '10-'11; offered '11-'12
	Evolution	offered	offered	offered	
	Sci Methods & Practice	BES 301	BES 301	BES 301	
	Invest Bio		1 section	2 sections	
	Bioethics			offered	
Additional electives					
	Microbiology*		new hire	offered	
	Biochemistry*		new hire	offered	
	Cell Biology*	offered alt years		offered alt years	
	Animal Physiology#			new hire	
	Anatomy & Physiology#			new hire	
	Plant Physiology				
	Developmental Biology		offered alt years		starting Spring '11
	Neurophysiology				
	Animal Behavior	offered summer 09			offered occasionally
	Biodiversity				
	Ecological Methods	offered			
	Marine Diversity & Cons'v'n	offered		offered	
	Conserv'n Bio		offered	offered	
	Restoration Ecol	offered	offered	offered	
	History of Life	offered		offered alt years?	
	Molecular Biology				new hire
	Genomics/Bioinformatics				new hire
* if not used to satisfy Cellular/Subcellular Biology requirement					
# if not used to satisfy Physiology requirement					

**Bothell: Bachelor of Science degree in Biology (BBIO-20100126)**

Tri-Campus Review Comments:

CHERYL L GREENGROVE

I find it interesting that this new Biology degree is housed in a new STEM program at UWB.

What about the S in IAS?? Most colleges of arts and sciences house all the natural science and math courses on campus. Why do you have to create a whole new program to do this?? and how does this fit with Electrical Eng. in that program? and how is this new program going to interface with the Environmental Science degree in IAS - which by the way is a lot closer in curricular requirements that electrical engineering. This does not make organizational sense (or efficient use of resources in a time of limited resources) nor does it promote interdisciplinarity.

It is obvious that this program is designed to attract students (\$), promote more research (\$) and is designed primarily for pre-health and biotech professionals. Do you really need a new degree program to serve these students?? You could add these courses to natural sciences in IAS and serve the same student population thru an ES degree or if you really want a degree program in biology it should be in arts and sciences. Unless your goal at UWB is to create a school of arts and letters and a seperate school of science and engineering - in which case you would have to combine CSS and Environmental Science in Science and Eng. On such a small campus, It does not make sense to offer natural science degrees in seperate programs.

Cheryl Greengrove  
Associate Professor of Geoscience  
Founding faculty member Environmental Science IAS UWT

**UNIVERSITY CAMPUSES UNDERGRADUATE PROGRAM REVIEW PROCEDURES\*\***

**CHECKLIST**

Title of Proposal: Bachelor of Science degree in Biology (BBIO-20100126)

Proposed by (unit name): Science and Technology

Originating Campus:

☐ UW, Seattle

☒ UW, Bothell

☐ UW, Tacoma

**I. Phase I. Developed Proposal Review** (to be completed by Originating Campus' Academic Program Review body)

A. Review Completed by: (list name of program review body)

Chaired by:

02/01/10 Date proposal received by originating campus's review body

02/02/10 Date proposal sent to University Registrar

02/02/10 Date proposal posted & email sent to standard notification list

04/02/10 Date of originating campus's curriculum body approval

(Note: this date must be 15 business days or more following date of posting)

B.   1   Number of comments received. Attach the comments and a summary of the consideration and responses thereof : (1-2 paragraphs)

**II. Phase II. Final Proposal Review** (to be completed by FCTCP)

A. Review Completed by:

☒ FCTCP subcommittee

☐ FCTCP full council

Chaired by: Steven Collins

04/15/10 Date request for review received from University Registrar

04/29/10 Date of FCTCP report

B. Review (attached)

YES NO

☒ Was notice of proposal posted on UW Website for 15 business days?

☒ Was notice of proposal sent to standard mailing list 15 business days in advance of academic program review?

- ☒ Were comments received by academic program review body?
- ☒ Was response to comments appropriate? (explain, if necessary)
- ☒ Was final proposal reviewed by FCTCP within 14 days of receipt?
- ☒ Was there adherence to the University Campuses Undergraduate Program Review Process? (explain, if necessary)

### C. Recommendation

The FCTCP Curriculum Review Sub-Committee completed the Phase II review of this proposal. The proposal generated one response from a faculty member at UWT, who raised a question about why the degree is being housed in the Science and Technology Program instead of the Interdisciplinary Arts and Sciences Program. We find that the proposing program responded appropriately to the concern, and that this response was affirmed by the relevant faculty council at UWB.

The FCTCP sub-committee is pleased to have the Registrar forward the final proposal for final action. Thank you. Steven Collins, Chair, FCTCP

- ☒ Forward for final approval
- ☐ Forward to Provost because of University issues (Explain)
- ☐ Return to campus council because of insufficient review (Explain).

\*\*Endorsed by Faculty Senate Executive Committee, 1/10/05, modified 1/31/06; These procedures apply to new undergraduate degrees, majors, minors (and certificates) and substantive changes to same

# WASHINGTON HIGHER EDUCATION COORDINATING BOARD

July 2010

## **DRAFT: Bachelor of Science in Biology University of Washington Bothell**

### **Introduction**

The University of Washington Bothell (UWB) seeks approval to establish a Bachelor of Science in Biology degree program beginning Fall 2010. Housed within UWB's Science and Technology unit, the proposed program would provide a foundation for careers or graduate study in fields such as medicine, dentistry, veterinary, pharmaceuticals, biotechnology, environmental science, and biology education.

It is estimated that 20 FTE students would enroll the first year, and full enrollment of 50 FTE students would be achieved by the fifth year. At full enrollment, the program would graduate 35 students per year.

### **Relationship to Institutional Role and Mission and the Strategic Master Plan for Higher Education in Washington**

UWB's mission includes serving college-age and established adult students and the community at large. The proposed program would support the mission by expanding student access to a field two UWB task forces<sup>1</sup> identified as a top institutional priority. The program's courses would support future development of additional STEM degree programs and provide a fundamental step in UWB's plan to increase STEM offerings.

In addition, it would complement existing offerings, which include bachelor's degree programs in Environmental Studies; Science, Technology, and Society; Nursing; and Education. Furthermore, the proposed program would support the *2008 Strategic Master Plan for Higher Education* policy goal of expanding STEM degree programs.

---

<sup>1</sup> UWB's 2007 Applied Science and Technology Task Force examined workforce and student demand for various fields, as well as factors contributing to academic quality; and the 2008 Science, Technology, Engineering, and Mathematics (STEM) Task Force found Biology to be a high student priority.

## Diversity

The Biology program and Science and Technology Unit are developing a diversity plan to reach and retain under-represented students. It will include outreach, on-site, and community Science and Technology events, as well as coordination with existing high school and community college programs that engage under-represented students in STEM activities.

Program planners submitted a detailed list of high-quality plan elements that includes ideas not commonly found in other proposals, such as recruiting minority emeritus STEM faculty to mentor and support students. Upon approval by the UWB Diversity Council, the plan will be integrated into the Science and Technology evaluation process, becoming part of formal program review.

## Program Need

Several measures indicate significant student demand for the proposed program. More than 500 transfer applicants to UWB have requested it. Nearly all of 117 visitors to the UWB website, who completed a survey on nine proposed degrees in 2009, indicated they were interested in pursuing a B.S. in Biological Sciences. However, the most compelling measure of student demand may be that 50 students have completed a “major intention” form for the program and are waiting to enroll.

The 2009 statewide employer needs assessment<sup>2</sup> identifies a gap between current supply and forecast demand for researchers, scientists, and technical workers, which the proposed program would help fill. The B.S. in Biology degree program would help fill the gap particularly well and, because it would produce employable bachelor’s-level graduates, would serve as a key foundational degree for advanced study in a number of STEM and health-related graduate programs.

Although current Employment Security Department occupational data<sup>3</sup> indicate slower-than-average job growth for biologists, growth for life scientists and healthcare practitioners will be much higher than the average for all occupations. At the national level, the Bureau of Labor Statistics’ *Occupational Outlook Handbook* predicts employment of biological scientists will grow much faster than average. At the local level, the Bothell area is home to roughly one-fourth of Washington’s life sciences businesses, several of which sent letters of support.

The proposed program would respond to community need by broadening UWB’s current community partnership efforts, such as the Biotechnology and Biomedical Technology Institute, and by training students in a field that supports statewide initiatives such as Bio21. Since some courses would be open to non-biology majors, the proposed program would also respond to community need by promoting science literacy among non-science majors. Finally, it would respond to state and national growth trends in various industries, such as biotechnology and healthcare.

---

<sup>2</sup> The employer needs assessment, *A Skilled and Educated Workforce: An assessment of the number and type of higher education and training credentials required to meet employer demand* (2009), was prepared jointly by the Higher Education Coordinating Board, State Board for Community and Technical Colleges, and Workforce Training and Education Coordinating Board.

<sup>3</sup> *Washington Occupational Employment Projections* (May 2010). The occupations examined were microbiologists, zoologists and wildlife biologists, other biological scientists, life scientists, and healthcare practitioners and technical occupations. Biology serves as a springboard for healthcare careers.

Biology is an essential part of a general education curriculum and a critical foundational degree for many graduate-level health sciences programs as well as a range of other science and technology fields. While four nearby institutions offer a B.S. in Biology (Northwest University, Seattle Pacific University, Seattle University, and University of Washington Seattle), the proposed program would not represent an unnecessary duplication.

The program curriculum would differ somewhat from other programs. In addition, student interest in the proposed program is very high and the program is important to the growth and development of the campus as it expands to a more comprehensive curriculum and aligns well with the UW's emphasis on science and technology.

### **Program Description**

The proposed program seeks to help students gain a foundational knowledge of biology, and make connections within biology and between biology and other areas of study. Students could complete the program part- or full-time, and would typically be admitted as juniors. Courses would be scheduled to provide access for nontraditional students.

The proposed program would serve both transfer and non-transfer students. To facilitate access for transfer students, UWB plans to establish articulation agreements with Cascadia Community College and Bellevue College. In addition, UWB is included in biology-oriented Major Related Programs (MRPs) signed by UW Seattle. UWB would promote use of these MRPs by working with college partners to ensure that program marketing and recruitment efforts include the MRPs.

To be eligible for admission to the program, students must first complete 10 quarter credits of introductory biology and 15 of general chemistry. In addition to these prerequisites, up to 30 credits of foundational math and science courses and up to 60 credits of upper-division biology-related coursework would be required.<sup>4</sup> Upper-division coursework would include required courses in genetics, ecology, evolution, statistics, science methods, and bioethics. Students would also select courses from menus in each of the following areas: cellular/subcellular biology, physiology, investigative biology, and biology and society.<sup>5</sup> Students also would focus on individual areas of interest by selecting three biology electives such as conservation biology, neurophysiology, or toxicology. The investigative biology course would provide opportunities for experiential learning through research or internships.

Instruction would be delivered primarily face-to-face (supplemented with technology) by full-time tenured/tenure track faculty.<sup>6</sup> Based on research in the field of college-level biology education, instruction would employ integrative, active, problem-based approaches. Program planners intend to make undergraduate research experiences available to as many students as possible. About one-fourth of the curriculum would need to be developed.

---

<sup>4</sup> The credit numbers listed here are upper limits, with the exact numbers to be determined as courses are developed. The complete upper-division course menu would include about 40 courses, six of which would be specifically required.

<sup>5</sup> The biology and society courses would be open to non-majors, giving majors a chance to understand concerns of non-scientists. In addition, themes such as the societal impact of genetic screening and genetically modified agricultural products would be embedded throughout the curriculum.

<sup>6</sup> This includes three new faculty to be hired at the rate of one per year from 2010 through 2012.



Students would normally complete the program in two years (full-time) or at their own pace (part-time), achieving all of the following broad learning outcomes:

- **Biological knowledge:** students should understand basic biological processes and principles, integrate disparate areas of biology, and begin developing an emphasis in one or more areas through their research experience.
- **Research:** students should develop an understanding of the scientific method and use that understanding to conduct and communicate biological research in collaboration with faculty mentors.
- **Critical thinking:** students should learn to apply qualitative and quantitative methods to critically evaluate and interpret evidence.
- **Communication:** students should learn to communicate biological concepts effectively in oral, visual, and written presentations. Students should communicate the results of original research within and/or outside the University.

These student learning outcomes would be measured using a variety of assessment tools, including problem sets, labs, written examinations, and papers. Students would be assessed within their individual courses, based on learning outcomes identified for those courses, and course learning outcomes would be mapped to program learning outcomes.

For program assessment, UWB would employ multiple direct and indirect measures, including all of the following:

- Student course evaluations, focus groups and exit interviews; and student retention.
- Success of student-faculty research (measured by number of conference presentations and student co-authored publications).
- Results of a standardized, nationally normed exam (Educational Testing Services' Major Field Test in Biology) administered close to graduation to provide a means of comparing students with national peers and identify program weaknesses.<sup>7</sup>
- Alumni surveys (tracking admissions graduate programs, employment, and perceptions about how well the program prepared graduates for work).
- Peer monitoring of instruction.
- Program evaluation by an outside faculty evaluation group, such as the Council for Undergraduate Research.

Assessment data would be analyzed by the Biology Assessment Committee and used to evaluate the overall effectiveness of the program. It would form the basis for recommending changes in instructional practices and curriculum.

---

<sup>7</sup> This measure would be used at least during start-up and possibly ongoing.

## Program Costs

The proposed program would be funded by general fund state support and tuition, requiring substantial up-front investment (about \$900,000) for start-up costs to develop lab facilities and purchase equipment. It would enroll 20 FTE students in the first year and 50 FTE students by the fifth year.

To implement the program, its planners have budgeted for 1.7 FTE instructional faculty<sup>8</sup> initially, increasing to 4.1 FTE by the fifth year; 0.85 FTE administrative, advising/recruiting, and library/technology staff; and a 0.4 FTE faculty program director. During the fifth year, the direct cost of instruction for 50 FTE students would be \$552,910,<sup>9</sup> or \$11,058 per FTE. In comparison, according to the HECB's *2005-06 Education Cost Study (July 2007)*, the direct cost of instruction per average annual FTE upper-division undergraduate sciences student ranged from \$6,226 at Eastern Washington University to \$10,906 at University of Washington Seattle. If these amounts were adjusted for 2 percent annual inflation, the range would \$6,739 to \$11,805, and the proposed program's cost would lie within the range.

## External Review

Two reviewers reviewed the proposal: Dr. Akif Uzman, Professor of Biology and Biochemistry and Chair, Department of Natural Sciences, University of Houston Downtown; and Dr. Ginger Withers, Chair, Biology Department, Whitman College.

Both were supportive of the program. Dr. Uzman said "This proposal describes a potentially outstanding program; all the elements to make it great appear to be in place." Dr. Withers said, "The proposal is sound, reasonable, and addresses a significant need for training in the state of Washington."

Dr. Uzman saw the curriculum as modern and adaptable, calling it "current and forward thinking in its pedagogic approach." He also noted the strength of the faculty; however, he felt that student learning outcomes should be phrased more directly and articulated as measurable outcomes. Program planners responded they would rephrase the outcomes more directly as the program is established. He also suggested adding a learning outcome dealing with the integration of biology and society, which program planners said they would consider.

Calling the program "well designed," Dr. Withers noted the value of the experiential learning provided by student research or internships. According to her, the required courses are included in most well-rounded biology curricula, but the research component is innovative. She said student assessment was well planned and saw the standardized exam as particularly valuable. She recommended prioritizing revision of the three-course introductory sequence, and program planners agree that this is a high priority. However, they wish to focus first on developing new courses and hiring faculty, whose input they want to have for the introductory sequence redesign process.

---

<sup>8</sup> FTE instructional faculty figures include 1.3 FTE provided by Interdisciplinary Arts and Sciences (IAS) faculty. The fifth-year FTE faculty figure (4.1 FTE) includes 2.4 FTE Biology faculty to be hired (3 new hires at 0.8 FTE each).

<sup>9</sup> The \$552,910 figure reported here reflects a budget adjustment to include compensation for IAS faculty.

## **Staff Analysis**

The proposed program would support University of Washington Bothell's mission and the *2008 Strategic Master Plan for Higher Education*. It was identified as a top priority by two UWB task forces, and courses developed for it would support future development of additional STEM degree programs, making it a fundamental step in UWB's plan to increase STEM offerings. In addition, it would complement existing offerings, which include bachelor's degree programs in Environmental Studies; Science, Technology, and Society; Nursing; and Education. Furthermore, it would build on UWB's strengths, which include strong faculty-student mentorship and a tradition of integrative coursework.

It also would help fill a gap identified by the statewide employer needs assessment. Although Employment Security Department data send mixed signals, the Bureau of Labor Statistics predicts employment of biological scientists will grow much faster than average, and several local businesses submitted letters supporting the program. Also, biology is an important foundation for graduate study that would lead to employment in a number of other high-demand Health and STEM-related occupations.

Significant student need for the program is demonstrated by frequent transfer student inquiries, strong survey results, and the large number of students who have already completed paperwork indicating their intent to major. Students would graduate with training that would help them respond to community need arising from state and national growth trends in various industries, such as biotechnology and healthcare.

Students would be taught primarily by tenured and tenure-track faculty, who would follow UWB's tradition of teaching from an interdisciplinary perspective. Students would benefit from a curriculum (called modern and adaptable by one reviewer) which provides opportunities to study societal impacts and carry out undergraduate research. Student and program assessment would employ multiple measures.

Program planners presented evidence that the program would be offered at a reasonable cost and would not unnecessarily duplicate existing programs. The diversity plan is of high quality and, to their credit, program planners have explicitly made broadening participation of under-represented groups in biology a program goal.

## **Staff Recommendation**

After careful review of the proposal and supporting materials, staff recommends approval of the Bachelor of Science in Biology at University of Washington Bothell. The Higher Education Coordinating Board's Education Committee discussed the proposal during its June 23, 2010 meeting and recommended approval by the full Board.

**RESOLUTION 10-13**

**WHEREAS,** The University of Washington Bothell proposes to offer a Bachelor of Science in Biology; and

**WHEREAS,** The program would support University of Washington Bothell's mission and is a top priority for the institution, as well as a fundamental step in UWB's plan to increase STEM offerings; and

**WHEREAS,** The program would support the *2008 Strategic Master Plan for Higher Education* by expanding STEM degree programs; and

**WHEREAS,** The program would respond to student, employer, and community need without unnecessarily duplicating other programs; and

**WHEREAS,** The program's students would benefit from University of Washington Bothell's strong diversity efforts, from the institutional level down to the departmental level; and

**WHEREAS,** The program's students would study a curriculum called well-designed, current, and forward thinking by external reviewers; and

**WHEREAS,** Student and program assessment would employ multiple measures; and

**WHEREAS,** The program would be offered at a reasonable cost;

**THEREFORE, BE IT RESOLVED,** That the Higher Education Coordinating Board approves the Bachelor of Science in Biology at the University of Washington Bothell, effective July 15, 2010.

Adopted:

July 15, 2010

Attest:

\_\_\_\_\_  
Jesús Hernandez, Chair

\_\_\_\_\_  
Roberta Greene, Secretary