



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 forces¹ 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.

¹ 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 assessment² 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 data³ 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.

² 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.

³ *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.⁴ 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.⁵ 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.⁶ 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.

⁴ 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.

⁵ 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.

⁶ 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.⁷
- 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.

⁷ 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 faculty⁸ 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 \$552,910,⁹ 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.

⁸ 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).

⁹ 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