

**Graduate Program Review Committee Report**  
**University of Washington Department of Bioengineering**  
**10-11 February 2011**

**Review Committee:**

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This report approved and submitted by the Review Committee 11 March 2011.

## Executive Summary

This review covers the Department of Bioengineering's undergraduate BS program, the MS program, and the PhD program, as well as the two fee-based master's programs (MS in Medical Engineering and MS in Pharmaceutical Bioengineering). The department was last reviewed in December 2001. In this Executive Summary we distill the most important strengths, weaknesses, and opportunities for the department at this time; details will be found in the following sections. **Our major recommendation is for continuing status with a subsequent review in 10 years.**

### Strengths:

- Excellent departmental culture and collegiality
- High-quality personnel at all levels and in all roles
- Excellent academic programs and research
- Excellent national and international reputation

### Weaknesses:

- Lack of a robust strategic planning process
- Lack of a robust Development activity (alumni/donor cultivation, building of formal ties to industry partners, etc.)

### Opportunities:

- Growth in new areas with opportunities to hire new faculty
- Expanding the educational program to include new Master's degree programs to meet new demands of a potentially growing and changing market
- Establishing an industrial partnership program (leavened with academic advisors) to guide the department and leverage industrial and clinical ties

# **Graduate Program Review Committee Report University of Washington Department of Bioengineering**

## **Review Process**

By memo (10/21/10) from the UW Graduate School, the Bioengineering Review Committee was charged with assessing the quality of the degree programs offered by the Department of Bioengineering and providing the faculty with constructive suggestions for strengthening the programs. Toward that end, we were provided a copy of the program's self-study and other materials. We conducted a site visit on February 10-11, 2011, during which we met with faculty, students, staff, members of the department's Accreditation and Continuous Improvement, Curriculum, and Executive Committees, and other constituents, including the Dean of Engineering and the Vice Dean of Research and Graduate Education of the School of Medicine. At the end of the second day, the committee met with a number of representatives of the University of Washington Graduate School and Administration to discuss our findings.

This report of our findings is organized as follows: overall assessment, research areas and quality, PhD program and students, master's programs, undergraduate program and students, faculty development and other faculty issues, relationship to other units on campus, ways to enhance the reputation and financial security of the Department, and broad departmental issues.

## **Overall Assessment**

The Department of Bioengineering is a very healthy program that is performing well. We found the quality of the faculty, staff, and students to be superb. The Department as a whole has both a local and a national reputation as a collegial, interactive, productive department. **We recommend that the Department be granted continuing status with a subsequent review in 10 years.**

## **Research Areas and Quality**

The quality of research in the Department of Bioengineering is outstanding, as evidenced by the very high research funding and quality of publications of the faculty. As a moderately sized bioengineering department, it must focus its research programs in key areas in order to attain and maintain high national and international visibility. This strategy has been historically successful for the UW (for example, the Department's key national leadership position in the field of biomaterials). Growth into newer areas should be carefully balanced against investments to maintain excellence in the more established fields in the Department, especially given this period of tightly limited financial resources.

The Department should engage in rigorous strategic planning and develop prioritized implementation plans towards clear goals as it further considers what research areas should be targeted for future hiring and other investments.

### **PhD Program and Students**

The PhD program is the core graduate educational program for the Department of Bioengineering. This is a high quality program that overall provides strong education and research experiences for its students. Students in the program are successfully recruited from top universities, and often choose to come to the UW over other highly ranked programs because of the highly collegial environment of this department, the quality of life for UW graduate students, and the excellence of the faculty and their research. The majority of the PhD students in this program appear to be interested in pursuing careers in industry. They value the opportunity to take classes in the business school and the emphasis on entrepreneurship. Students value the rotation system for advisor selection, a process that seems to generally work well. Relatively few of the graduate students appear interested in careers in academia; this point may be worth further exploration as more of a balance between academia and industry in the career paths of its graduates may be beneficial to the long-term reputation and stature of the Department.

The graduate curriculum has recently been substantively revised, and this seems to have led to a better experience for students. However, there was some dissatisfaction with the 501-503 series of core courses, as well as a sentiment that the offerings of elective courses are too limited. Students generally value their relationships with the faculty, and indicated that the administrative staff very positively impacted their development and success. Some faculty voiced concerns about the work ethic of the graduate students. While it may be good to address this issue, it should be done with the understanding that many students choose the UW based in part on their perception that the work/life balance for graduate students in this program is superior to that of students at other highly ranked universities.

### **Master's Programs**

Bioengineering offers four Master's degree programs, and is considering a fifth one. First, the BS/MS option is for undergraduates in their senior year to continue an additional year (typically working further on the capstone project) for a Master's degree; 2-4 students pursue this option each year. Second, students with a BS can do course work and research in a Department lab for about three years to gain a Master's; few students are enrolled this way. Third, a Master's of Medical Engineering is designed for those in industry to take evening classes over four years; the program is now entirely course work-based and 19 students

are currently enrolled. Fourth, a new Master of Pharmaceutical Engineering has been launched, which is a similar program to the MME, and has 35 enrolled. With the end of Boeing support for its employees to take courses that are not directly job-related, the professional Master's programs have suffered. The Dean of Engineering sees the Master's programs, including the BS/MS option, as potentially of considerable economic benefit to the Department, and feels that they are under-enrolled compared to what they could be. Bioengineering faculty differed in their assessment of the professional master's programs, with some viewing them almost solely as a source of revenue and others arguing that they had intrinsic value. The Department is considering a new Master's program – comparable to one offered at Berkeley/UCSF – that would involve daytime instruction along with some research component.

The Review Committee feels that the Department needs to much more clearly define the roles that its Master's programs serve, and that the Department should do so in the context of an overall vision for Bioengineering. Before initiating a new program or trying to expand current offerings, the Department should investigate the demand for these programs among prospective students and industrial partners. It should determine whether proposed degree offerings will make those holding the degrees more marketable. It should also carefully examine the effects that an expansion of these programs will have on classroom instruction and laboratory experiences overall.

### **Undergraduate Program and Students**

The undergraduate program, part of the College of Engineering, began in 2001 and was accredited by ABET in 2008 (retroactive to 2006). It now ranks among the top 10 programs according to U.S. News & World Report. The BS program accepts 50 students per year, with a much larger demand for these spots that cannot be filled. The Review Committee gives a strong endorsement to the quality of the undergraduate major and the students it is attracting.

Courses are taught equally by Engineering and Medical faculty, with a standard load of two courses per academic year, lighter than is typical within Engineering. In addition, two lecturers – Chris Neils and Alyssa Taylor – do teaching, develop curricula, and provide continuity to the undergraduates whom they follow throughout their years in the program. The lecturers viewed themselves as integral to the teaching mission of the Department and appreciated their autonomy and their support from the other faculty. Staff, headed by the Lead Academic Counselor Kelli Jayn Nichols, were praised as useful and informative and crucial to the high morale of the undergraduates.

The department curriculum has been significantly revamped, with much of the change in response to student requests. Innovations include a new introductory course (Introduction to Bioengineering Problem Solving), which can be taken by

freshmen and which provides a more exciting vision than the previous one for what bioengineering can do. Students concentrate in Molecular and Materials Bioengineering; Cells, Tissue, and Systems Bioengineering; or Diagnostics and Therapeutic Instruments; and they must complete a capstone project. Capstone options have been increased to include either a yearlong research and design project within a faculty lab, or a two-quarter research project plus a two-quarter design-and-build course for small teams of students. The Review Committee commends the Department both for its strong commitment to undergraduate teaching and its responsiveness to student input. We encourage the faculty to closely monitor the results of the new curriculum to determine whether it is achieving the intended objectives.

The students we met – about 15, all but two of whom were men – were an impressive group. They were smart and articulate, felt a strong camaraderie with each other, and had lofty goals for their post-baccalaureate careers. They believed that the major was a demanding one, but that it taught them a lot of useful material as well as the ability to work in teams. The students appreciated the mentorship shown by the faculty, especially in the capstone project. They have also been able to take advantage of funding from the Department for a Bioengineering Student Design Fund, which led, for example, to the creation of the student organization “Bioengineers Without Borders.”

A major issue faced by the Department is whether to expand the number of majors by about 50%, which is a goal clearly sought by the dean of the College of Engineering. Such an expansion engendered a number of faculty concerns, including increased demand on faculty labs to carry out capstone projects, a need for more teaching assistants, funding for supplies for the lab courses, and a possible deterioration in currently close faculty/student relationships. The Review Committee endorses an increase in majors only insofar as additional resources from the College of Engineering will ensure the maintenance of all teaching metrics consistent with what is currently in place. Both the College and the Department must also ensure that the research mission of the Department is not compromised.

### **Faculty Development and Other Faculty Issues**

The Department has done a superb job of attracting top-flight faculty from highly ranked programs. In addition to the well-established senior faculty, both associate and assistant professors are exceptionally accomplished and are doing a terrific job of building research programs, training students, and building the educational programs.

It is critical to continue to develop faculty through a formal mentoring program. Although the collegiality of the Department promotes the easy exchange of information and regular interactions between faculty, a more formalized process

would ensure against more passive faculty or faculty not naturally affiliated with current faculty slipping through the cracks. Such a program would retain the current informal, flexible mentoring interactions, while ensuring that junior faculty have access to a formal mentoring structure.

Faculty mentoring must include succession planning and training to prepare the next generation of department leaders. Mentoring of assistant and associate professors should include leadership opportunities as well as involvement in decision-making processes in the Department. Departmental governance is open, and faculty members appear to participate in departmental decision-making. Active leadership mentoring will prepare faculty to assume increasing leadership roles.

An important component in the retention and promotion of faculty is the establishment of an organized, systematic Awards Committee that manages the nomination of faculty at all levels for national and international awards. This activity would not only build loyalty within the Department, but also validate the faculty quality and recognize their achievements. A record of accomplishment and awards will be essential for establishing a track record of recognition for the next generation of NAE members in the department.

### **Relationship to Other Units on Campus**

The success of Bioengineering has been contingent on cooperation with other departments to provide the array of classes necessary for this hybrid field. The Review Committee heard a consistent and strong message from all levels that Bioengineering has excellent interdisciplinary collaborations across campus (Engineering, Medicine, Arts & Sciences, Business). Students enthusiastically congratulated the staff for helping them secure the critical classes and collaborations necessary for achieving their goals. A large number of students indicated that their freedom to branch out of the sciences and into business school classes was extremely important to them.

Cost sharing has been a necessary component of Bioengineering's growth. The expansion of cost sharing and support for collaboration will be necessary to maintain high standards of quality if increased enrollment is pursued.

### **Ways to Enhance the Reputation and Financial Security of the Department**

Enhancing the reputation and financial security of the Department in a time of fiscal distress requires a combination of boldness and efficiency in public relations and fundraising. The program needs to communicate to its alumni, supporters, and friends that, nationally and internationally, the strategic value of bioengineering has been recognized, and that other major institutions are

aggressively establishing well-funded efforts that threaten to dislodge the UW from its leadership position.

Bioengineering's young and still small alumni population puts the department at a major disadvantage compared with the donor bases supporting other engineering or medicine departments. A dedicated effort needs to be implemented to cultivate and nurture a sustainable donor base. The Department needs to educate undergraduates, graduates, and post-graduate populations of the need to support their department. All graduates of Bioengineering benefit from the Department's stature and prestige; their efforts and contributions are needed to maintain the esprit de corps into the future.

An institutional commitment to sustaining the department must also include efforts to work with the department to solicit support from non-Bioengineering alumni. In this context, the Department does not appear to be benefiting fully from the fundraising and other development efforts on campus (the Advancement Offices at the UW level and at the College of Engineering/School of Medicine level). As a relatively young department, it does not yet have a sizeable alumni pool at the highest levels in industry, but it has other strengths that could be exploited to enlarge its donor base. To cite just one example, Bioengineering might be able to cultivate public awareness of its contributions to health by telling the stories of specific individuals who have benefited from its innovations, in an effort to create an equivalent of the "grateful patient" that the School of Medicine benefits from.

Bioengineering should work closely with and ask for services from the UW and COE/SOM development staff to locate and track alumni and friends of the department. It should target the high-net-worth individuals on that list to engage them with the Department and to work toward defining goals that they would want to support (for instance, named professorships). We learned that there is an effort to upgrade the website; this is an excellent channel for telling the Department's story. The Department might also consider a LinkedIn and Facebook presence to keep its alumni and friends connected and aware of events and speakers, etc.

Bioengineering is taking positive steps to establish an Affiliates program to attract funding from corporations. The strategic planning of this program should be given a top priority. A study should be implemented or consultant retained to identify the characteristics and best practices of highly successful Affiliate programs at the UW and other institutions.

The Department should also consider establishing an External Advisory Board. Many departments build such programs by drawing on the companies and organizations that hire their graduates. The fee-based certificate and degree programs are excellent sources of graduates who might want to continue their relationship with the Department by contributing their service in this way.



We recognize that this development effort takes substantial departmental focus, time, and energy on an ongoing basis, but the ultimate return to the Department will be worth the investment.

## **Broad Departmental Issues**

The Department has done an outstanding job of building a strong faculty with an impressive list of achievements. A department signature is the strong cohesiveness and collegiality that exists throughout all levels of the faculty, staff, and students. This collegiality is valued by all members of the Department and is a significant factor in attracting students.

The ability of the faculty to raise research support is impressive. A distinguishing feature is the large number of projects with close ties to the clinic and industry, as well as the drive to commercialization. The close connection to real-world applications and global health is attractive to both graduates and undergraduates.

The faculty, students, and staff have built a remarkable program, which has matured to the stage where an emerging generation is now poised to assume leadership roles. The Department is at an important transition point, and is facing substantial opportunities and challenges. It needs to develop a clear strategic plan to address these challenges in a focused, thoughtful way, in order to ensure continued excellence in the face of rising external competition.

### **Opportunities**

- Growth in new areas with opportunities to hire new faculty
- Expanding the educational program to include Master's degree programs to meet new demands of a potentially growing and changing market
- Establishing an industrial partnership program (leavened with academic advisors) to guide the department and leverage industrial and clinical ties

### **Challenges**

- Financial constraints due to the Washington economy and declining federal research support
- Limited alternative revenue streams
- Limited financial resources to recruit and retain faculty
- Pressures to increase undergraduate enrollment

The faculty is acutely aware of these challenges and opportunities. However, there does not appear to be a unified plan for addressing these issues and moving the Department forward. In order to effectively capitalize on opportunities and address the related challenges, the Department needs to develop a strategic plan that clearly defines and justifies a unified vision for the future. This plan

should define a vision for effectively addressing both short- and long-term financial challenges. It should also include clear goals for departmental growth, including well-defined implementation strategies for realizing these goals. For example, there appears to be differing views regarding the value of “strategic hiring” versus “strategic opportunism.” A stated goal is to build faculty numbers in synthetic and computational biology. However, this was not clearly justified at the time of our conversations. At the same time, recent “opportunistic” hires successfully enhanced cooperation with the medical school. In financially constrained times, the Department may not have the luxury of adopting both approaches simultaneously.

The Department needs to define a clear 5-10 year hiring strategy, and justify the plan in terms of how this will enable it to maintain preeminent stature in Bioengineering. Similarly, it needs to establish a clear plan that addresses the potentially conflicting desire to maintain a highly personalized undergraduate program in the face of pressures to expand the educational program, both in student numbers and degree offerings. To address the financial obstacles, this plan must include strategies for diversifying and increasing revenue streams to enable the Department to target both short- and long-term goals. In this context, it will be important to clearly define the mission of the industrial partners program and actively build this into an effective, working partnership with the Department. These efforts will be critical for managing the competing demands and opportunities the Department will face through the transitional period of the next 5-10 years.