

Biomedical Engineering (BME) Program Review

April-May 2017

Review Committee Members

- Parmesh Ramanathan, Professor of Electrical and Computer Engineering (Chair)
- Brian Pfleger, Professor of Chemical and Biological Engineering
- Daniel Noguera, Professor of Civil and Environmental Engineering
- Nicole Perna, Professor of Genetics (Graduate Faculty Executive Committee Representative)

Review Process

1. The committee met on April 12, 2017 to review the program materials. At this meeting, the committee identified a set of questions to be asked during the visits to the department.
2. The committee members visited the BME program on April 13, 2017. There were three meetings on this day. The first meeting was with Professor Paul Campagnola (Associate Chair for Graduate Advising) and Pamela Peterson (Graduate Program Coordinator). The second meeting was with all the four Assistant Professors in the program (Assistant Professors Kris Saha, Randy Ashton, Meghan McClean, and Jeremy Rogers). The third meeting was with a group of 10 doctoral students; the students were in different stages of the program, ranging from first-year to sixth-year.
3. The committee members also visited the BME program on April 27, 2017. There were two meetings on this day. The first meeting was with five BME MS program students. The second meeting with Professor Justin Williams (chair of the BME department).

Overview of the Program

The Master of Science (MS) degree in Biomedical Engineering has been offered in this campus since the mid-1970s. The doctoral degree (PhD) in Biomedical Engineering was established in 1999. Both programs are administered through the Biomedical Engineering (BME) department in the College of Engineering.

The core faculty for the BME programs come from the BME department. The BME department has 19 tenure-track faculty and 67 affiliate faculty. Although the affiliate faculty may supervise graduate students in the program, most of the graduate students in the program have the BME tenure-track faculty members as their primary advisor. The BME department was established only 18 years ago; in fact, across UW-Madison was among the first few institutions to establish a BME department. BME PhD program's national ranking has fluctuated between 20 and 24 in the past 7 years. The BME program is first among the public institutions in research expenditures per FTE and third among the public Universities in total research expenditures. The BME department recently completed a strategic planning process to identify their areas of excellence and the areas

in which they can increase their visibility, which in turn, they hope will result in improved USNWR ranking.

The BME PhD program matriculates about 10 students each year. Most of these students are direct admit into a faculty member's laboratory. There is one NIH training grant led by a faculty member (Professor Justin Williams) in the BME department. Almost all BME faculty are trainers in NIH training grants at UW-Madison. The BME program takes advantage of some of these training grants to offer flexibility to incoming graduate students. However, the faculty feel that BME program loses out in recruiting many top students due to the lack of financial resources to offer flexibility/rotation to graduate students in the first year.

Most of the students in the BME MS program were undergraduates at UW-Madison. Many of them are BME undergraduates who opt to stay for an additional year to complete the MS program. Many of these students also receive financial support in the form of TAships, either in the lower level BME undergraduate courses or in courses such as Physiology (Phys 335).

The BME department recently got approval for a PhD minor in Quantitative Biology. The minor will only begin in Fall 2017. It was not part of this program review.

BME Program Strengths

1. Faculty are excellent and appear to be highly involved with students and degree programs
2. PhD students appear to be very satisfied with the program.
3. Highly visible publications in top journals indicate strong research program
4. Student post-degree placement is satisfactory
5. Degree is highly tailored to match student interests
6. Research program is highly interdisciplinary and provides students with exposure to multiple disciplines
7. Although the graduate students' laboratories are in different buildings (Engineering Centers Building (ECB), Wisconsin Institute for Medical Research (WIMR), and Wisconsin Institute for Discovery (WID)), the Ph.D. students seemed to feel a sense of community. There is a graduate seminar which brings these students together on a regular basis. The graduate student association also does a good job of organizing social events to maintain a community among the doctoral students.
8. The program has a clear set of learning goals and an assessment plan for both programs.
9. The PhD program is successful in recruiting domestic minority students (24% of the domestic students are minority, with 16% targeted minority). The program also has a good gender balance (60% males, 40% females), especially in comparison to other engineering programs.
10. The MS program is also successful in recruiting domestic minority students 41% of the domestic students are minority, with 29% targeted minority). The program

also has a good gender balance (65% males, 35% females), especially in comparison to other engineering programs.

11. The committee met a few MS program students. These students felt that the MS program added considerable value to their undergraduate degree. Because of the MS program, these students felt that they were more marketable for industrial positions.

BME Program Concerns

1. Not much communication from department regarding changes being planned to graduate program, e.g., planned changes to qualifying exams. The communication is sparse both to Assistant Professors and to graduate students.
2. Program is highly dependent on real-time faculty advising and personalized examinations, which may be challenging as program grows and faculty turnover.
3. Most official TA positions are awarded to MS students who completed the same course as an undergraduate at UW-Madison. Teaching opportunities for interested PhD students are limited and reliant on their primary mentor's teaching responsibilities.
4. The lack of formal program structure introduces challenges for new students to design and navigate their graduate course and examinations. This is particularly difficult for students of new faculty and further exaggerated by the distribution of labs across campus (see below).
5. Research facilities are in different locations on campus. Although not a weakness per se, it creates communication challenges.
6. The BME undergraduate program has a large number of students. The resulting large undergraduate teaching load, makes it difficult for faculty to offer specialized courses for graduate students.
7. The MS program students expressed dissatisfaction with Engineering Career Services (ECS). As per these students, many of the companies who recruit through ECS do not understand the value-add provided by the BME degree as compared to other engineering degrees such as Electrical Engineering, Computer Engineering, and Mechanical Engineering. As a result, the MS program students are not keen on using ECS services to find job opportunities. Instead, they rely on faculty advisors to help in identifying career opportunities. The students were optimistic about their career opportunities.

Recommendations

1. Have a periodic newsletter to communicate better with students and faculty. The newsletter can highlight faculty and student accomplishments, as well as draw attention to upcoming opportunities for professional development.
2. Investigate whether creating graduate tracks will help provide the missing structure.
3. Graduate students (at least the 10 who met with the committee) were satisfied with the structure of qualifying examinations. The program, on the other hand, is considering a revision of the qualifying examination procedure. The program

faculty should seek feedback from the graduate students regarding the qualifying examination as part of their process to revise the format.

4. Work with the College of Engineering to improve potential employers understanding of the scope and quality of BME student training. The scope and value-add provided by the BME training should be also be part of the messaging from Engineering Career Services to increase the career opportunities for BME students.
5. Consider alternate mechanisms to meet the different advising needs of PhD and MS students
6. Seek ways to ensure that junior faculty have the opportunity to offer specialized graduate level courses as part of their departmental teaching responsibility.
7. The limited resources for graduate fellowships is not likely to change dramatically in the next few years. To provide rotational opportunities to PhD students, the BME faculty may want to lead efforts to get one or two NIH training grants in the targeted areas of excellence.