Biomedical Engineering (PhD)

Department of Biomedical, Chemical and Environmental Engineering (Formerly School of Energy, Environment, Biological, and Medical Engineering)

College of Engineering and Applied Science

2014

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I. Program Overview

The UC Biomedical Engineering program (BME) was founded in 2001 as a bridge department between the UC Colleges of Engineering and Medicine. Since the 2010 reorganization of the College of Engineering and Applied Science (CEAS), the BME program has been housed within the Department of Biomedical, Chemical, and Environmental Engineering (formerly the School of Energy, Environmental, Biological, and Medical Engineering), together with the Chemical Engineering and Environmental Engineering programs.

Biomedical Engineering (BME) faculty together developed vision and mission statements when BME was originally created in 2001. The Biomedical Engineering programs mission is to:

(1) Improve the health of the public through excellence in the discovery, dissemination and commercialization of knowledge derived from the application of scientific and engineering principles and methods.
(2) Provide students and other members of the community with the knowledge, skills and practical experience needed to pursue successful careers and assume leadership positions in the biomedical industry, academics and medicine.
(3) Initiate and foster collaboration among University Colleges, Departments and Faculty in biomedical engineering education and research.
(4) Contribute to regional economic growth in the biomedical industry.

These mission statements are consistent with those of the College of Engineering and Applied Sciences and with those of the University, which are listed below.

College of Engineering and Applied Science Mission Statement

The mission of the College of Engineering and Applied Science is to provide:

(1) Excellence in Education—provide a world-class education for our students.
(2) Excellence in knowledge creation and transfer in support of education and community—provide the best education featuring new breakthroughs in science and technology and be able to transfer that knowledge of science technology both to our students and to our local community.
(3) Accessibility—provide a venue where qualified students who want to come, can come; and provide the support necessary to allow them to be successful

University of Cincinnati Mission Statement

(1) The University of Cincinnati serves the people of Ohio, the nation, and the world as a premier, public, urban research university dedicated to undergraduate, graduate, and professional education, experience-based learning, and research.

(2) We are committed to excellence and diversity in our students, faculty, staff, and all of our activities. We provide an inclusive environment where innovation and freedom of intellectual inquiry flourish.
(3) Through scholarship, service, partnerships, and leadership, we create opportunity, develop educated and engaged citizens, enhance the economy and enrich our University, city, state and global community.

BME has made great efforts to leverage the program in support of its vision and mission. Excellent PhD students have been advised by successful primary and secondary faculty having grants funded by numerous agencies (e.g. the National Institutes of Health (NIH) and the National Science Foundation (NSF)). In the classroom, PhD students have been exposed to a broad range of faculty research topics (BME 601 Survey) as well as experimental design, hypothesis generation, and ethics (BME 705 Research Design) and biomedical instrumentation (BME 602 Bioinstrumentation). Focus area courses in medical device innovation, medical imaging, and tissue engineering and regenerative medicine have provided additional breadth and depth prior to dissertation research. BME has recruited MD/PhD students from the Physician Scientist Training Program to work with its primary faculty. Large NIH and NSF grants have supported additional PhD students to complete and publish their dissertation research and present their research at national and international conferences.

II. Program Outcomes

Original Program Learning Outcomes

a. Our graduates will have an advanced understanding of the theory and practice of engineering at the interface of biology and medicine.
b. Our graduates will think innovatively and independently and apply interdisciplinary approaches in their careers.
c. Our graduates will have the skills and experience to pursue successful careers in the industrial, governmental or academic setting.

Proposed Revised Program Learning Outcomes

These Outcomes have been revised in April 2014 to focus on assessment of progress for our current students, rather than attainments of our graduates. These revised Outcomes will be reviewed, revised if necessary, and approved by the BME Graduate Committee and the BME faculty.

Our Biomedical Engineering PhD students will be able to:

a. identify and articulate the status of current research through rigorous and critical literature review, in their chosen discipline of biomedical engineering (medical device innovation, medical imaging, tissue engineering and regenerative medicine, or other related areas).

b. propose and execute a significant, focused research plan that incorporates and extends current theory and practice in their chosen discipline of biomedical engineering.
c. communicate research results through archival journal publications.
d. successfully write and defend a dissertation reporting their research results, demonstrating the significance of their contribution to the field.
e. gain the comprehensive background, skills, and experience necessary to pursue a successful career in their chosen discipline of biomedical engineering.

III. Curriculum/Program Map

Total hours in degree: 90 credit hours
60 credit hours (Post Master's)/Total hours in degree 90
Required courses: Core BME graduate courses
Other requirements: BME focus area courses, general medical sciences courses, mathematics courses, and approved technical electives.
Prior to the start of their first year students are required to attend an orientation program that discusses the topic pertaining to the Biomedical Engineering Graduate Program.
54 credits devoted solely to research; Dissertation required

	Curriculum Mapping Matrix: Linking Program Outcomes to Curriculum																		
Program Learning Outcomes	**Required Courses and Experiences* Identified in P-1**																		
E: Emerging D: Developing A: Achieved	**BME6010**	**BME6011**	**BME6012**	**BME6024**	**BME6030**	**BME6065**	**BME7000**	**BME7001**	**BME7002C**	**BME7003**	**BME7005**	**BME7007**	**BME7012**	**BME7021**	**BME7061**	**BME8064**	**BME8099**	**Qualifying Exam**	**Publications**	**Dissertation Defense**
1 Identify and articulate the status of current research through rigorous and critical literature review, in their chosen discipline of biomedical engineering (medical device innovation, medical imaging, tissue engineering and regenerative medicine, or other related areas).	D	D	D	D	D	D	E	E,D		E		E	D	D	D	D	A	A		A
2 Propose and execute a significant, focused research plan that incorporates and extends current theory and practice in their chosen discipline of biomedical engineering.									E		E D A						E	D		A
3 Communicate research results through archival journal publications.								E D			D						E	E D A	A	A
4 Successfully write and defend a dissertation reporting their research results, demonstrating the significance of their contribution to the field.											E							E D	D	E D A
5 Gain the comprehensive background, skills, and experience necessary to pursue a successful career in their chosen discipline of biomedical engineering.	E	E	E	E	E	E	E	E	E	E	D	D	D	D	D	D	D	E	A	A

* Please note that you are only identifying required courses and experiences that are house with in your academic unit.

IV. Methods/Measures/Evaluation Criteria

Assessment Measures Aligned with Program Outcomes				
Program Outcome	**Assessment Tools Responsible Person, Course(s) and Time frame**	**Course/ Experience**	**Time Line**	**Responsible Person**
Identify and articulate the status of current research through rigorous and critical literature review, in their chosen discipline of biomedical engineering (medical device innovation and entrepreneurship, medical imaging, tissue engineering and regenerative medicine, or other related areas)	Students participate in survey of biomedical engineering research topics. Students will observe and discuss these lectures; review research articles in the areas covered, and make presentations based on their literature reviews.	BME Survey BME 7001 (E,D)	First year, first semester	Course Instructor(s)
Propose and execute a significant, focused research plan that incorporates and extends current theory and practice in their chosen discipline of biomedical engineering.	This course will help students to develop methods and skills necessary to create, develop and execute a successful research career. Methods covered include: formulating and defining ideas, understanding and using appropriate resource management, gathering and assessing data, designing a complete research project and basic writing skills for manuscript preparation and grant writing.	Biomedical Research Design BME 7005 (E,D,A)	First year, second semester	Course Instructor(s)
Communicate research results through archival journal publications	Qualifying exam with a written proposal and oral presentation	Qualifying Exam (E,D,A)	Year two	Committee Chair
Successfully write and defend a dissertation reporting their research results, demonstrating the significance of their contribution to the field	Dissertation committee Meeting summary sheets Dissertation and Defenses	Dissertation preparation (E,D) Dissertation defense (A)	Committee meet yearly from 3rd year onward Last year	Dissertation committee chair
Gain the comprehensive background, skills, and experience necessary to pursue a successful career in their chosen discipline of biomedical engineering	Conference proceeding and/or manuscript submission	Publications	Fourth and the last year	Research advisor

V. Assessment Infrastructure

The program assessment process is jointly administered by the BME Graduate Program Coordinator (PC) and the 4-members of the BME graduate committee (GC). In addition, there will be other helpful resources from College and University if needed.

CEAS administrative support: At CEAS, BME can obtain support from the Academic Director of the Assessment and Continuous Improvement Center (ACIC). The administrative support in the college from ACIC includes the director and the center's members include the department heads and a faculty representative from each department. ACIC provides assistance in the form of consultation, workshops, audits, examples of assessment plans, learning outcomes assessment, development of rubrics and a range of topics related to continuous improvement of programs.

University administrative resource: On the university side we have administrative support from CET&L. They provide assistance by workshops and summer institutes specifically focused on assessment plans every year.

VI. Findings and Use of Findings

At the end of each academic year, the PC and GC get together to review the course content and the BME graduate handbook. The committee along with the student's research advisor (if appropriate) examines how the course content reflects developments in the field as well as what knowledge students should master after concluding it. This review assists the improvement of the course curriculum to meet the requirements and the criteria for the Student Learning Outcomes.

At the end of each semester, the PC and the graduate program director meet to review whether each student has completed minimum benchmarks reflected in the Student Learning Outcomes before proceeding to other courses. The benchmark assessment includes reviews of the students' coursework. These reviews help students successfully fulfill their requirements for coursework and their qualifying examination, so they can advance to successful defense of their dissertation proposal (and thus attainment of doctoral candidacy) in time.

While these annual reviews and meetings allow for small-scale changes of courses, it is anticipated that every 5 years, assessors will conduct a larger-scale analysis of assessment data, with the end goal of identifying (and implementing) any major programmatic changes that may be needed.