**BIOMEDICAL ENGINEERING, PH.D.**

Biomedical engineering is the application of engineering tools for solving problems in biology and medicine. It is an engineering discipline that is practiced by professionals trained primarily as engineers, who specialize in medical and biological applications. The area of study combines fundamentals of the biomedical sciences with advanced engineering methods of analysis and design, and brings together these two fields in order to contribute to the design of new medical instruments and devices, apply engineering principles for understanding and repairing the human body and other biological systems, and use engineering tools for decision making and cost containment.

The interdisciplinary degree program offers a course of graduate study leading to the master of science or the doctor of philosophy degrees in biomedical engineering. The Department of Biomedical Engineering should be of interest to students who wish to practice engineering or engage in research in an engineering specialization in medicine and biology. An individualized course of study is planned with a faculty advisor. Biomedical engineering faculty and affiliated faculty come from the various colleges and professional schools throughout the university. They specialize in biomedical engineering areas as diverse as biomechanics, bioinstrumentation, biomedical imaging and biophotonics, micro and nano technology, systems biology, biomaterials, cellular engineering, tissue engineering, bioengineering, and rehabilitation and human performance. A list of biomedical engineering faculty, affiliated faculty, and their respective areas of specialization is available from the department website.

**ADMISSIONS**

Applicants should have a bachelor's degree in engineering (biomedical, chemical, electrical, industrial, mechanical, etc.) or science (biology, biochemistry, chemistry, genetics, immunology, physics, etc.). Each applicant is judged on the basis of:

- official academic transcripts
- Graduate Record Examinations (GRE) (http://www.ets.org/gre) scores or Medical College Admission Test (MCAT) scores for the general test
- TOEFL (http://www.toefl.org) examination for international students
- three letters of recommendation
- a statement of purpose (https://grad.wisc.edu/prospective/prepare/statement)
- a resume (for Ph.D. applicants only)

Students admitted to the program may be required to make up deficiency course requirements. In addition, all applicants must satisfy requirements that are set forth by the Graduate School (http://www.wisc.edu/grad).

**APPLICATION DEADLINES & FEE**

Complete applications (including supportive materials) must be submitted as described below and received by the below dates. Submission must be accompanied by the one-time application fee of $75; it is non-refundable and can be paid by credit card (Master Card or Visa) or Debit/ATM. By state law, this fee can only be waived or deferred through the conditions outlined here by the Graduate School (https://grad.wisc.edu/admissions/feegrants):

- Fall Semester—December 1 (Ph.D.), January 1 (MS)
- Spring Semester—October 1 (both M.S & Ph.D. programs)
- Summer Session 1—December 1 (Ph.D.), January 1 (M.S)

1 Please note that summer admissions are generally limited to continuing BME students at UW–Madison or applicants who have research assistantships already arranged with UW faculty.

**APPLICATION MATERIALS**

To apply to the BME program, applicants should complete the Graduate School's online application (https://grad.wisc.edu/apply) with the following materials:

**Official Academic Transcripts**

Electronically submit one copy of your official transcript of all undergraduate and previous graduate work along with your online application with the Graduate School. Unofficial copies of transcripts will be accepted for review but official copies are required for admitted students. Please do not send transcripts or any other application materials to the Graduate School or the BME department. If questions, please contact bme (bmegradadmission@engr.wisc.edu).

**Graduate Record Examination (GRE) and Test of English as a Foreign Language (TOEFL) Scores**

- **GRE Scores**
  - The GRE General Test is required for admission of applicants; exemption is only possible for the following:
    - domestic applicants who choose to substitute MCAT scores for the GRE (send MCAT score report to BME graduate admissions email: bmegradadmission@engr.wisc.edu)

Students should request ETS to forward GRE scores by using institution code 1846 and department code 1603.

- **TOEFL Scores**
  - The TOEFL is required for international students unless a degree from a U.S. educational institution is held; scores should be forwarded using institution code 1846 and department code 69. An applicant whose TOEFL (paper-based) test score is below 580; TOEFL computer based test (CBT) score below 237; (TOEFL internet based iBT) test score below 92; IELTS score below 7; or MELAB below 82 must take an English assessment test upon arrival if accepted to the program. The student may also need to register for an English as a Second Language (ESL) course in the first semester that they are enrolled.
  - Any international applicant who will hold a teaching assistantship (TA) and whose native language is not English must take the SPEAK (https://esl.wisc.edu/ita-training/speak) test when arriving on campus.

**Three Letters of Recommendation**

These letters are required from people who can accurately judge the applicant's academic or research performance. Letters of
opportunity in lower-level courses, such as calculus, chemistry, and physics. Often, funding matches with specific faculty occur during the Visit Wisconsin Weekend in the spring.

**ADMITTED WITHOUT FUNDING**

If you are admitted without funding, please know that you will be considered by BME faculty for potential support. You are also encouraged to contact faculty in BME (http://www.engr.wisc.edu/bme/faculty) whose research is of particular interest. Please wait to hear from us about your admission without aid before contacting faculty for support. You may also apply to BME specific TA positions after being admitted or other TA positions on campus.

**REQUIREMENTS**

**MINIMUM GRADUATE SCHOOL REQUIREMENTS**

Review the Graduate School minimum academic progress and degree requirements (http://guide.wisc.edu/graduate/#policiesandrequirementstext), in addition to the program requirements listed below.

**MAJOR REQUIREMENTS**

**MODE OF INSTRUCTION**

<table>
<thead>
<tr>
<th>Face to Face</th>
<th>Evening/Weekend</th>
<th>Online</th>
<th>Hybrid</th>
<th>Accelerated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

**Mode of Instruction Definitions**

**Evening/Weekend:** These programs are offered in an evening and/or weekend format to accommodate working schedules. Enjoy the advantages of on-campus courses and personal connections, while keeping your day job. For more information about the meeting schedule of a specific program, contact the program.

**Online:** These programs are offered primarily online. Many available online programs can be completed almost entirely online with all online programs offering at least 50 percent or more of the program work online. Some online programs have an on-campus component that is often designed to accommodate working schedules. Take advantage of the convenience of online learning while participating in a rich, interactive learning environment. For more information about the online nature of a specific program, contact the program.

**Hybrid:** These programs have innovative curricula that combine on-campus and online formats. Most hybrid programs are completed on-campus with a partial or completely online semester. For more information about the hybrid schedule of a specific program, contact the program.

**Accelerated:** These on-campus programs are offered in an accelerated format that allows you to complete your program in a condensed time-frame. Enjoy the advantages of on-campus courses with minimal disruption to your career. For more information about the accelerated nature of a specific program, contact the program.

**CURRICULAR REQUIREMENTS**

<table>
<thead>
<tr>
<th>Minimum Credit Requirement</th>
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</thead>
<tbody>
<tr>
<td>Minimum 60 credits</td>
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<tr>
<td>Minimum 32 credits</td>
</tr>
</tbody>
</table>

**FUNDING**

**GRADUATE SCHOOL RESOURCES**

Resources to help you afford graduate study might include assistantships, fellowships, traineeships, and financial aid. Further funding information (https://grad.wisc.edu/funding) is available from the Graduate School. Be sure to check with your program for individual policies and processes related to funding.

**PROGRAM RESOURCES**

It is our experience that nearly all doctoral students in the BME department obtain funding, but there are no guarantees. A limited number receive fellowships. A few students enrolled in M.S. coursework program are self-funded.

Research assistantships are available from individual faculty based on their research funding and awarded when grants are funded and after applications for BME admission are accepted. Sometimes there are project assistantships, teaching assistantships, and traineeships also available. A few students enrolled in M.S. coursework program are self-funded.

**ADMITTED WITH FUNDING**

We have a limited number of university or departmental fellowships to offer each year. In addition, there are research assistantships that are offered to grad applicants from individual faculty members. Teaching assistantships (TA) are possible through specific departments with more opportunity in lower-level courses, such as calculus, chemistry, and

**Graded School Admissions**

Graduate admissions is a two-step process between academic degree programs and the Graduate School. Applicants must meet requirements of both the program(s) and the Graduate School. Once you have researched the graduate program(s) you are interested in, apply online (https://grad.wisc.edu/admissions).

**Statement of Purpose**

In this document, applicants should explain why they want to pursue further education in BME and discuss which UW faculty members they would be interested in doing research with during their graduate study (see the Graduate School for more advice on how to structure a personal statement (https://grad.wisc.edu/prospective/prepare/statement)).

**Resume (for Ph.D. applicants only)**

ONLY if applying for the PhD program.

**Application fee**—online through the application, it is nonrefundable and can be paid by credit card (Master Card or Visa), Debit/ATM. By state law, this fee can only be waived or deferred through the conditions outlined here by the Graduate School (https://grad.wisc.edu/admissions/fee waivers).
Minimum Graduate Coursework Requirement

Half of degree coursework (30 credits out of 60 total credits) must be completed graduate-level coursework; courses with the Graduate Level Coursework attribute are identified and searchable in the university's Course Guide.

Overall Graduate GPA Requirement

3.00 GPA required.

Other Grade Requirements

The Graduate School requires an average grade of B or better in all coursework (300 or above, not including research credits) taken as a graduate student unless conditions for probationary status require higher grades. Grades of Incomplete are considered to be unsatisfactory if they are not removed during the next enrolled semester.

Assessments and Examinations

Candidates are required to pass a comprehensive qualifying examination and preliminary examination.

Doctoral Minor/Breadth Requirements

Breadth is provided via interdisciplinary training (minor requirement waived): The central aim of biomedical engineers is to unravel gaps in biological knowledge through the use of engineering principles. Thus, the doctoral program is inherently interdisciplinary. Prior to obtaining a Ph.D. warrant, students will prepare a summary of their effort in interdisciplinary coursework and training. The purpose of the summary will be to document the effort to meet the spirit of the minor requirement. The summary must be approved by the student's thesis committee and filed with the department. Students may elect to pursue a doctoral minor.

Language Requirements

No language requirements.

Ph.D. Requirements

In addition to the M.S. requirements listed above, Ph.D. students must complete an additional 30 credits of Ph.D. study. These 30 credits must include completion of one the following six Ph.D. tracks:

**Biomaterials & Tissue Engineering Track**

Biomaterials and tissue engineering employ a diverse range of approaches to develop methods to diagnose and treat diseases, create living tissue environments that may be used to restore the function of a damaged organ, and uncover biological mechanisms related to tissue development and disease. Graduate students trained in biomaterials and tissue engineering are expected to gain a detailed understanding of cellular and molecular biology, materials science, and engineering methods relevant to their research focus.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOM 511</td>
<td>Introduction to Biostatistics</td>
<td>1-3</td>
</tr>
<tr>
<td>BIOM 545</td>
<td>Engineering Extracellular Matrices</td>
<td>6</td>
</tr>
<tr>
<td>BIOM 550</td>
<td>Introduction to Biological and Medical Microsystems</td>
<td>6</td>
</tr>
<tr>
<td>BIOM 551</td>
<td>Tissue Engineering Laboratory</td>
<td>3-6</td>
</tr>
<tr>
<td>BIOM 510</td>
<td>Introduction to Tissue Engineering</td>
<td>3-6</td>
</tr>
<tr>
<td>BIOM 511</td>
<td>Tissue Engineering Laboratory</td>
<td>3-6</td>
</tr>
<tr>
<td>BIOM 510</td>
<td>Introduction to Tissue Engineering</td>
<td>3-6</td>
</tr>
<tr>
<td>BIOM 550</td>
<td>Introduction to Biological and Medical Microsystems</td>
<td>6</td>
</tr>
<tr>
<td>BIOM 560</td>
<td>Special Topics in Biomedical Engineering</td>
<td>3-6</td>
</tr>
<tr>
<td>BIOM 545</td>
<td>Polymer Science and Technology</td>
<td>3-6</td>
</tr>
<tr>
<td>BIOM 521</td>
<td>Advanced Polymeric Materials</td>
<td>3-6</td>
</tr>
<tr>
<td>BIOM 521</td>
<td>Advanced Polymeric Materials</td>
<td>3-6</td>
</tr>
</tbody>
</table>

Specific course selection is very flexible and draws upon a variety of courses. The required coursework is designed to complement each student's interests and background in biomedical engineering and meet the spirit of a BME degree; deviations from the requirements should be discussed with the associate chair of graduate advising and will be decided on a case-by-case basis.

**M.S. Requirements**

To receive a Ph.D., students must first complete the requirements for an M.S. degree in biomedical engineering (http://guide.wisc.edu/graduate/biomedical-engineering/biomedical-engineering-ms/#requirementstext):

- Completion of a Degree Program Plan (found on the BME website [https://www.engr.wisc.edu/department/bme/academics/graduate]) or through the graduate student coordinator:
  - During their first semester of coursework, students must complete and have their advisor approve a Degree Program Plan, which will be stored in their secure BOX folder. This form will be useful for students to reflect upon at the end of their program when they complete their Final Warrant Request Form.
  - Two semesters of BME 701 Seminar in Biomedical Engineering
  - At least one course in bioscience (such as ANAT&PHY 335 Physiology or 3 a cell biology course; if not from a bioscience or BME background)
  - At least 12 credits of engineering courses, 400-level or above
  - At least 15 credits in one area of specialization, 400-level or above (any program)

- At least 15 credits that are graduate level (700 or above or from the approved list)
- Optional, but recommended: 3-6 credits of independent study project experience or master's thesis research in the student's area of specialization (a maximum of 6 credits can be applied to the MS although students may take more). These credits may count towards your area of specialization.

**Biological Interactions with Materials**

BME 430

**Biological Interactions with Materials**

BME/CBE 511

**Cell Biology**

ZOLOGY 570

**Cellular Signal Transduction**

ZOLOGY/BIOMED 630

**Cellular and Molecular Biology**

CRB 650

**Molecular and Cellular Organogenesis**

ONCOLOGY 401

**Introduction to Oncology**

Data Analysis Requirement (1-3 Credits)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOM 541</td>
<td>Introduction to Biostatistics</td>
<td>1-3</td>
</tr>
<tr>
<td>COMP SCI 765</td>
<td>Data Visualization</td>
<td>1-3</td>
</tr>
</tbody>
</table>

**Advanced Polymeric Materials**

BME 521

**Engineering Extracellular Matrices**

BME 545

**Introduction to Biological and Medical Microsystems**

BME 550

**Introduction to Tissue Engineering**

BME/CBE 510

**Mechanisms**

BME 511

**Stem Cell Bioengineering**

BME/CBE 520

**Special Topics in Biomedical Engineering**

BME 560

**Polymer Science and Technology**

CBE 540

**Advanced Polymeric Materials**

M S & E 521
Elective Requirement (9-11 Credits) To provide breadth, at least 9 credits of electives must be chosen from courses that are not listed above.

Total Credits 18-23

These tracks are internal to the program and represent different pathways a student can follow to earn this degree. Track names do not appear in the Graduate School admissions application, and they will not appear on the transcript.

Biomedical Imaging & Optics Track
Biomedical imaging and optics research develops and utilizes new experimental and computational tools to characterize tissue structure across multiple size scales. A particular focus is on human health, especially with respect to achieving superior diagnostic/prognostic tools for a spectrum of diseased states. Graduate students trained in this track are expected to gain a detailed understanding of mathematics, biology and engineering both optical and/or physical methods relevant to their research focus.

Code Title Credits
Mathematics Requirement (0-3 Credits)
MATH 443 Applied Linear Algebra (OR previous undergraduate course with grade B- or better) 0-3

Biology Requirement (3 Credits)
ZOOLOGY 570 Cell Biology 3
ANAT&PHY 335 Physiology

Imaging Requirement (9 Credits)
B M E/ MED PHYS 530 Medical Imaging Systems
B M E/ MED PHYS 573 Medical Image Science: Mathematical and Conceptual Foundations
B M E/ MED PHYS 574 Imagine in Medicine: Applications
B M E/ MED PHYS 578 Non-Ionizing Diagnostic Imaging
B M E 601 Special Topics in Biomedical Engineering
B M E/CHEM/ MED PHYS 650 Biological Optical Microscopy
MED PHYS/ B M E 710 Advances in Medical Magnetic Resonance
B M E/M E 530 Medical Imaging Systems
B M E/M E 603 Topics in Bio-Medical Engineering (Finite Elements for Biomechanics)
B M E/M E 615 Tissue Mechanics
M E 601 Special Topics in Mechanical Engineering (Orthopedic Biomechanics: Design of Implants)

Elective Requirement (6-11 Credits) To provide breadth, at least 6 credits of electives must be chosen from courses that are not listed above.

Data Analysis
B M I/STAT 541 Introduction to Biostatistics
COMP SCI 368 Learning a Programming Language

Computational Methods
E M A 405 Practicum in Finite Elements
E M A 605 Introduction to Finite Elements
M E 460 Applied Thermal / Structural Finite Element Analysis

Solid & Fluid Mechanics
E M A 622 Mechanics of Continua
E M A 630 Viscoelastic Solids
E M A 700 Theory of Elasticity
M E 563 Intermediate Fluid Dynamics
M E/M A 570 Experimental Mechanics
M E 573 Computational Fluid Dynamics

Other
B M E/E C E 462 Medical Instrumentation
B M E/MED PHYS 530 Medical Imaging Systems

Total Credits 18-26

These tracks are internal to the program and represent different pathways a student can follow to earn this degree. Track names do not appear in the Graduate School admissions application, and they will not appear on the transcript.

Biomechanics Track
Biomechanics utilizes experimental and computational tools to analyze and develop novel biomechanical systems. Graduate students trained in biomechanics are expected to gain a detailed understanding of mathematics, biology and engineering methods relevant to their research focus.

Code Title Credits
Mathematics Requirement (3 Credits)
MATH 443 Applied Linear Algebra 3
MATH 519 Ordinary Differential Equations
MATH 619 Analysis of Partial Differential Equations

Biomechanics of Solids & Fluids Requirement (>9 Credits) 9+
B M E/M E 415 Biomechanics of Human Movement
B M E 505 Biofluidics
B M E/M E 603 Topics in Bio-Medical Engineering (Finite Elements for Biomechanics)
B M E/M E 615 Tissue Mechanics
M E 601 Special Topics in Mechanical Engineering (Orthopedic Biomechanics: Design of Implants)

Biosciences (3-6 Credits) 3-6
ANATOMY 622 Human Anatomy-Physical Therapy, Occupational Therapy
KINES 350 Introduction to Exercise Psychology
KINES 531 Neural Control of Movement
KINES/ PHYSIOL 773 Cardiorespiratory Adaptions to Environment and Exercise
ANAT&PHY 335 Physiology
ANAT&PHY 435 Fundamentals of Human Physiology
ZOOLOGY 570 Cell Biology

Elective Requirement (6 Credits) To provide breadth, electives must be courses that are not listed above; some recommendations are below.

Data Analysis
B M I/STAT 541 Introduction to Biostatistics
COMP SCI 368 Learning a Programming Language

Computational Methods
E M A 405 Practicum in Finite Elements
E M A 605 Introduction to Finite Elements
M E 460 Applied Thermal / Structural Finite Element Analysis

Solid & Fluid Mechanics
E M A 622 Mechanics of Continua
E M A 630 Viscoelastic Solids
E M A 700 Theory of Elasticity
M E 563 Intermediate Fluid Dynamics
M E/M A 570 Experimental Mechanics
M E 573 Computational Fluid Dynamics

Other
B M E/E C E 462 Medical Instrumentation
B M E/MED PHYS 530 Medical Imaging Systems
These tracks are internal to the program and represent different pathways a student can follow to earn this degree. Track names do not appear in the Graduate School admissions application, and they will not appear on the transcript.

Medical & Microdevices Track

Medical and microdevices involve the use of electronic and computational tools to develop devices used in diagnosis and treatment of disease ranging from the systemic to the cellular and molecular levels.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 443</td>
<td>Applied Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>MATH 519</td>
<td>Ordinary Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>MATH 619</td>
<td>Analysis of Partial Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>B M E 601</td>
<td>Special Topics in Biomedical Engineering (Physiology for BME Students)</td>
<td>3</td>
</tr>
<tr>
<td>ZOOLOGY 570</td>
<td>Cell Biology</td>
<td>3</td>
</tr>
</tbody>
</table>

Engineering Requirement (12 Credits)

- B M E 515 Therapeutic Medical Devices
- B M E 601 Special Topics in Biomedical Engineering (BioMEMs)
- B M E 601 Special Topics in Biomedical Engineering (Special Topics in Neuroinstrumentation)
- B M E/E C E 763 Projects in Computers in Medicine
- E C E/B M E 462 Medical Instrumentation
- E C E/B M E 463 Computers in Medicine
- E C E/COMP SCI/I SY E 524 Introduction to Optimization
- E C E/COMP SCI 533 Image Processing
- E C E/COMP SCI/M E 539 Introduction to Artificial Neural Networks
- MED PHYS/ NTP 651 Methods for Neuroimaging Research

Neurobiology Requirement (6 Credits)

- B M E/CBE 520 Stem Cell Bioengineering
- KINES 721 Neural Basis for Movement
- KINES 861 Principles of Motor Control and Learning
- NTP/ NEURODPT 610 Cellular and Molecular Neuroscience
- NTP/NEURODPT/PSYCH 611 Systems Neuroscience
- NTP/ NEURODPT 630 Neuronal Mechanisms for Sensation and Memory in Cerebral Cortex
- NTP/NEUROL 735 Neurobiology of Disease
<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSYCH 610</td>
<td>Statistical Analysis of Psychological Experiments</td>
<td></td>
</tr>
<tr>
<td>PSYCH/ NEURODPT/ NTP 611</td>
<td>Systems Neuroscience</td>
<td></td>
</tr>
<tr>
<td>PSYCH 733</td>
<td>Perceptual and Cognitive Sciences</td>
<td></td>
</tr>
<tr>
<td>ZOOLOGY 625</td>
<td>Development of the Nervous System</td>
<td></td>
</tr>
</tbody>
</table>

1 These tracks are internal to the program and represent different pathways a student can follow to earn this degree. Track names do not appear in the Graduate School admissions application, and they will not appear on the transcript.

**Systems & Synthetic Biology Track**

Systems and synthetic biology utilizes experimental and computational tools in an iterative fashion to analyze and regulate biological systems.

**Students interested in earning a doctoral minor in Quantitative Biology** ([http://guide.wisc.edu/graduate/biomedical-engineering/quantitative-biology-doctoral-minor](http://guide.wisc.edu/graduate/biomedical-engineering/quantitative-biology-doctoral-minor)) enrollment in B M E 601 Special Topics in Biomedical Engineering (Methods in Quantitative Biology) is a requirement. Additionally, students will need to take one additional 3-credit course in quantitative science, biology, or integrated biology/quantitative science from the approved list of courses in the doctoral minor (this course counts toward the elective credits for this track).

**Code | Title | Credits**
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Mathematics Requirement (3 Credits)</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>CBE 660</td>
<td>Intermediate Problems in Chemical Engineering</td>
<td></td>
</tr>
<tr>
<td>MATH 443</td>
<td>Applied Linear Algebra</td>
<td></td>
</tr>
<tr>
<td>MATH 519</td>
<td>Ordinary Differential Equations</td>
<td></td>
</tr>
<tr>
<td>MATH 619</td>
<td>Analysis of Partial Differential Equations</td>
<td></td>
</tr>
<tr>
<td>Biology Requirement (3 Credits)</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>BIOCHEM 501</td>
<td>Introduction to Biochemistry</td>
<td></td>
</tr>
<tr>
<td>ZOOLOGY 570</td>
<td>Cell Biology</td>
<td></td>
</tr>
<tr>
<td>ZOOLOGY/ BIOCHEM/ PHMCOL-M 630</td>
<td>Cellular Signal Transduction, Mechanisms</td>
<td></td>
</tr>
<tr>
<td>Data Analysis Requirement (1-3 Credits)</td>
<td></td>
<td>1-3</td>
</tr>
<tr>
<td>B M E 601</td>
<td>Special Topics in Biomedical Engineering (Matlab Skills)</td>
<td></td>
</tr>
<tr>
<td>B M I/STAT 541</td>
<td>Introduction to Biostatistics</td>
<td></td>
</tr>
<tr>
<td>COMP SCI 368</td>
<td>Learning a Programming Language</td>
<td></td>
</tr>
<tr>
<td>Systems &amp; Synthetic Biology Requirement (6 Credits)</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>B M E 556</td>
<td>Systems Biology: Mammalian Signaling Networks</td>
<td></td>
</tr>
<tr>
<td>CBE/B M E 560</td>
<td>Biochemical Engineering</td>
<td></td>
</tr>
<tr>
<td>CBE 781</td>
<td>Biological Engineering: Molecules, Cells &amp; Systems</td>
<td></td>
</tr>
<tr>
<td>CBE/B M E 782</td>
<td>Modeling Biological Systems</td>
<td></td>
</tr>
<tr>
<td>Electives Requirement (9-11 Credits)</td>
<td>To meet the requirement of 12 credits of engineering courses, 3-6 credits of electives must be engineering coursework. To provide breadth, 6 credits of electives must be from courses that are not listed above. Suggested courses include the below list</td>
<td>9-11</td>
</tr>
</tbody>
</table>

**GRADUATE SCHOOL POLICIES**

The Graduate School's Academic Policies and Procedures ([https://grad.wisc.edu/acadpolicy](https://grad.wisc.edu/acadpolicy)) provide essential information regarding general university policies. Program authority to set degree policies beyond the minimum required by the Graduate School lies with the degree program faculty. Policies set by the academic degree program can be found below.

**MAJOR-SPECIFIC POLICIES**

**GRADUATE PROGRAM HANDBOOK**

The Graduate Program Handbook ([https://www.engr.wisc.edu/app/uploads/2016/01/bme_grad_handbook_2017-2.pdf](https://www.engr.wisc.edu/app/uploads/2016/01/bme_grad_handbook_2017-2.pdf)) is the repository for all of the program's policies and requirements.

**PRIOR COURSEWORK**

**Graduate Work from Other Institutions**

The Graduate School's minimum credit requirement for graduation can ONLY be satisfied with graduate-level courses taken as a graduate student at UW–Madison. The minimum credit requirement is 32 credits for Ph.D. students. The BME department will allow the student to use up to 6 credits of graduate course work from another institution toward his/her degree requirements. See the graduate student coordinator for more information.

**UW–Madison Undergraduate**

Fulfillment of Minimum Graduate Degree Credit Requirement with prior UW–Madison undergraduate coursework is allowed up to 6 credits numbered 700 or above in engineering-degree-granting programs or from the approved list. Coursework earned five or more years prior to admission to a Ph.D. degree is not allowed to satisfy requirements. Prior coursework from the UW–Madison undergraduate career may not count toward the minimum graduate residence credit requirement.

**UW–Madison University Special**

A maximum of 15 credits from the UW–Madison University Special student career may count toward program requirements. Minimum graduate resident credits requirement and minimum graduate degree credit requirement: allowed
Biomedical Engineering, Ph.D.

up to 15 credits numbered 300 or above. Minimum graduate coursework (50%) requirement: allowed up to 15 credits numbered 700 or above. Coursework earned five or more years prior to admission to a Ph.D. program is not allowed to satisfy requirements.

**PROBATION**

The Graduate School regularly reviews the record of any student who earned grades of BC, C, D, F, or Incomplete in a graduate course (300 or above), or grade of U in research credits. This review could result in academic probation with a hold on future enrollment or in being suspended from the Graduate School.

1. Good standing (progressing according to standards; any funding guarantee remains in place).
2. Probation (not progressing according to standards but permitted to enroll; loss of funding guarantee; specific plan with dates and deadlines in place in regard to removal of probationary status).
3. Unsatisfactory progress (not progressing according to standards; not permitted to enroll, dismissal, leave of absence or change of advisor or program).

**ADVISOR / COMMITTEE**

Every BME graduate student must have a faculty advisor. A faculty advisor provides the graduate student with academic guidance in their course program and research oversight in their thesis, project, or engineering report. Graduate students should always seek advice from their advisor and other faculty in their interest area prior to enrolling for courses.

**CREDITS PER TERM ALLOWED**

15 credits

**TIME CONSTRAINTS**

Students typically complete their degree within seven years of entering the program.

Within two years of entering their program, students are required to pass a comprehensive qualifying examination.

Within one year of after completion of their qualifying examination, students are required to prepare for a preliminary examination.

**OTHER**

n/a

**PROFESSIONAL DEVELOPMENT**

**GRADUATE SCHOOL RESOURCES**

Take advantage of the Graduate School’s professional development resources (https://grad.wisc.edu/pd) to build skills, thrive academically, and launch your career.

**PROGRAM RESOURCES**

**THE INDIVIDUAL DEVELOPMENT PLAN (IDP)**

An Individual Development Plan (IDP) (https://grad.wisc.edu/pd/idp) helps graduate students and postdoctoral researchers:

- make a plan for developing skills to meet academic and professional goals; and
- communicate with supervisors, advisors, and mentors about evolving goals and related skills.

The IDP is a document to be revisited again and again, to update and refine as goals change and/or come into focus, and to record progress and accomplishments.

The university recommends IDPs for all postdoctoral researchers and graduate students, and requires IDPs for all postdoctoral researchers and graduate students supported by National Institutes of Health (NIH) funding. See the Graduate School for more information and IDP resources (https://grad.wisc.edu/pd/idp).

**ENGINEERING CAREER SERVICES**

The Engineering Career Services (https://ecs.wisc.edu) staff offers assistance to students searching or preparing for internships, co-ops, and jobs with well-recognized organizations.

**THE WRITING CENTER**

The Writing Center (https://writing.wisc.edu) is a campus-wide organization that provides free of charge, face-to-face and online consultations for students writing papers, reports, resumes, and applications.

**LEARNING OUTCOMES**

1. Demonstrate an ability to synthesize knowledge from a subset of the biological and physical sciences.
2. Conduct original research.
3. Demonstrate an ability to create new knowledge and communicate it to their peers.
4. Foster ethical and professional conduct.

**PEOPLE**

**FACULTY:**

See also BME Faculty Directory (https://directory.engr.wisc.edu/bme/faculty)

**PROFESSORS:**

- Justin Williams (Chair)
- David Beebe
- Walter Block
- Paul Campagnola
- Naomi Chesler
- Shaoqin (Sarah) Gong
- Jan Huisken
- Beth Meyerand
- William Murphy
- Darryl Thelen
- Ray Vanderby
ASSISTANT PROFESSORS:
- Randolph Ashton
- Megan McClean
- Jeremy Rogers
- Krishanu Saha

ASSOCIATE PROFESSORS:
- Christopher Brace
- Pamela Kreeger
- Wan-ju Li
- Melissa Skala

FACULTY ASSOCIATES
- Amit Nimunkar
- John Puccinelli
- Tracy Jane Puccinelli
- Aaron Suminski
- Joseph Towles
- Mitchell Tyler

EMERITUS
- Ed Bersu
- Willis Tompkins
- John Webster