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. This 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 nanotechnology, systems biology, biomaterials, cellular engineering, tissue engineering, neuroengineering, 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.

ACTIONS

GRADUATE 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 program(s) you are interested in, apply online (https://grad.wisc.edu/admissions).

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall Deadline</td>
<td>December 1</td>
</tr>
<tr>
<td>Spring Deadline</td>
<td>October 1</td>
</tr>
<tr>
<td>Summer Deadline</td>
<td>December 1</td>
</tr>
<tr>
<td>GRE (Graduate Record Examinations)</td>
<td>Required.</td>
</tr>
<tr>
<td>English Proficiency Test</td>
<td>Every applicant whose native language is not English or whose undergraduate instruction was not in English must provide an English proficiency test score and meet the Graduate School minimum requirements (<a href="https://grad.wisc.edu/apply/requirements/#english-proficiency">https://grad.wisc.edu/apply/requirements/#english-proficiency</a>).</td>
</tr>
<tr>
<td>Other Test(s) (e.g., GMAT, MCAT)</td>
<td>The MCAT may be accepted as an alternate to the GRE.</td>
</tr>
</tbody>
</table>

Letters of Recommendation Required

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 application is judged on the basis of:

- Official academic transcripts
- Graduate Record Examinations (http://www.ets.org/gre) (GRE) scores or Medical College Admission Test (MCAT) scores for the general test
- Test of English as a Foreign Language (http://www.ets.org/toefl) (TOEFL) examination for international students
- Three letters of recommendation
- Statement of purpose (https://grad.wisc.edu/apply/prepare)
- Resume (for Ph.D. applicants only)

All applicants must satisfy requirements that are set forth by the Graduate School (https://grad.wisc.edu). Students admitted to the program may be required to make up deficiency course requirements.

To apply to the BME program, complete applications (https://grad.wisc.edu/apply), including supportive materials, must be submitted as described below and received by the following deadline dates:

- Fall 2019 Semester—December 1 (Ph.D.), January 1 (MS)
  *Starting Fall 2020 Semester—December 1 (MS and Ph.D.)
- Spring Semester—October 1 (MS and Ph.D.)
- Summer 2019 Session—December 1 (Ph.D.), January 1 (MS)
  *Starting Summer 2019 Session—December 1 (MS and Ph.D.)

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.

OFFICIAL ACADEMIC TRANSCRIPT

Electronically submit one copy of your official transcript of all undergraduate and previous graduate work along with your online application to 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 you have questions, please contact bmegradadmission@engr.wisc.edu.

GRADUATE RECORD EXAMINATION (GRE)

Applicants should request ETS to send their official GRE scores by using institution code 1846 and department code 1603.

MCAT scores may be substituted for GRE. Domestic applicants who choose to substitute MCAT scores for the GRE should send their MCAT score report to bmegradadmission@engr.wisc.edu.

TEST OF ENGLISH AS A FOREIGN LANGUAGE (TOEFL)

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. Depending on your score,
you may need to register for any recommended English as a Second Language (ESL) courses in the first semester you are enrolled.

Any international applicant who will hold a teaching assistantship (TA), and whose native language is not English must take the SPOK test (https://esl.wisc.edu/ta-training/speak) when arriving on campus.

THREE LETTERS OF RECOMMENDATIONS
These letters are required from people who can accurately judge the applicant’s academic or research performance. Letters of recommendation are submitted electronically to graduate programs through the online application. Applicants should not send any more than three letters (if more than three are sent, only the first three will be considered). See the Graduate School for FAQs (https://grad.wisc.edu/apply) regarding letters of recommendation.

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/apply/prepare)).

RESUME (FOR PH.D. APPLICATIONS ONLY)
Include your resume ONLY if applying for the Ph.D. program.

APPLICATION FEE
Submission must be accompanied by the one-time application fee. 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/apply/fee-grant).

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 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>Mode of Instruction</th>
<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>
<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.
- **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>Requirements</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>60 credits</td>
</tr>
<tr>
<td>Credit</td>
<td>Requirement</td>
</tr>
</tbody>
</table>
Biomedical Engineering, Ph.D.

Minimum Residence Credit Requirement

Minimum Graduate Coursework Requirement

Overall Graduate GPA Requirement

Other Grade Requirements

Assessments and Examinations

Language Requirements

Doctoral Minor/Breadth Requirements

Biomedical Engineering, Ph.D.

M.S. Requirements

To receive a Ph.D., students must first complete the requirements for an M.S. 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 B M E 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.

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.

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.

**Code** | **Title** | **Credits**
---|---|---
ZOOLOGY 570 | Cell Biology | 2-3
ZOOLOGY/ BIOCHEM/ PHMCOL-M 630 | Cellular Signal Transduction Mechanisms | 1-3
CRB 650 | Molecular and Cellular Organogenesis | 1-3
ONCOLOGY 401 | Introduction to Experimental Oncology | 1-3

**Data Analysis Requirement (1-3 Credits)**

- B M I/STAT 541 Introduction to Biostatistics
- COMP SCI 765 Data Visualization

**Systems & Synthetic Biology Requirement (6 Credits)**

- B M E/PHM SCI 430 Biological Interactions with Materials
- B M E/CBE 510 Introduction to Tissue Engineering
- B M E 511 Tissue Engineering Laboratory
- B M E/CBE 520 Stem Cell Bioengineering
- B M E 545 Engineering Extracellular Matrices
- B M E 550 Introduction to Biological and Medical Microsystems
### Biomedical Engineering, Ph.D.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>B M E 601</td>
<td>Special Topics in Biomedical Engineering</td>
<td></td>
</tr>
<tr>
<td>CBE 540</td>
<td>Polymer Science and Technology</td>
<td></td>
</tr>
<tr>
<td>M S &amp; E 521</td>
<td>Advanced Polymeric Materials</td>
<td></td>
</tr>
</tbody>
</table>

**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

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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.

### 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**

<table>
<thead>
<tr>
<th>Mathematics Requirement (0-3 Credits)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 443</td>
</tr>
</tbody>
</table>

**Biology Requirement (3 Credits)**

<table>
<thead>
<tr>
<th>ZOOLOGY 570</th>
<th>Cell Biology</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANAT&amp;PHY 335</td>
<td>Physiology</td>
</tr>
</tbody>
</table>

**Imaging Requirement (9 Credits)**

<table>
<thead>
<tr>
<th>B M E/MED PHYS 530</th>
<th>Medical Imaging Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>B M E/MED PHYS 573</td>
<td>Medical Image Science: Mathematical and Conceptual Foundations</td>
</tr>
<tr>
<td>B M E/MED PHYS 574</td>
<td>Imaging in Medicine: Applications</td>
</tr>
<tr>
<td>B M E/MED PHYS 578</td>
<td>Non-Ionizing Diagnostic Imaging</td>
</tr>
<tr>
<td>B M E 601</td>
<td>Special Topics in Biomedical Engineering</td>
</tr>
<tr>
<td>B M E/CHEM/MED PHYS 650</td>
<td>Biological Optical Microscopy</td>
</tr>
<tr>
<td>MED PHYS/ B M E 710</td>
<td>Advances in Medical Magnetic Resonance</td>
</tr>
</tbody>
</table>

**Elective Requirement (6-11 Credits)**

To provide breadth, at least 6 credits of electives must be chosen from courses that are not listed above.

**Total Credits**: 18-23

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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.

### 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**

<table>
<thead>
<tr>
<th>Mathematics Requirement (3 Credits)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 443</td>
</tr>
<tr>
<td>MATH 519</td>
</tr>
<tr>
<td>MATH 619</td>
</tr>
</tbody>
</table>

**Biomechanics of Solids & Fluids Requirement (>9 Credits)**

| B M E/M 415 | Biomechanics of Human Movement |
| B M E/M 505 | Biofluidics |
| B M E/M 603 | Topics in Bio-Medical Engineering (Finite Elements for Biomechanics) |
| B M E/M 615 | Tissue Mechanics |
| M E 601 | Special Topics in Mechanical Engineering (Orthopedic Biomechanics: Design of Implants) |

**Biosciences (3-6 Credits)**

| ANATOMY 622 | Human Anatomy-Physical Therapy, Occupational Therapy |
| KINES 350 | Introduction to Exercise Psychology |
| KINES 531 | Neural Control of Movement |
| KINES 773 | Cardiorespiratory Adaptations 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 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 |
B M E/ANATOMY/ Microscopy of Life
MED PHYS/
PHMCO-I-M/
PHYSICS/
RADIOL 619
M E/STAT 424 Statistical Experimental Design

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>0-3</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>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></td>
</tr>
</tbody>
</table>

#### Mathematics Requirement (3 Credits)

#### Biology Requirement (3 Credits)

- B M E 515: Therapeutic Medical Devices
- B M E 601: Special Topics in Biomedical Engineering (Physics for BME Students)
- ZOOLOGY 570: Cell Biology

#### Data Analysis (3 Credits)

- COMP SCI 368: Learning a Programming Language
- COMP SCI 368: Learning a Programming Language
- COMP SCI 368: Learning a Programming Language
- Biostatistics & Medical Informatics Course (B M I)

#### Elective Requirement (9-11 Credits)

- To provide breadth, 6 credits of electives must be from courses that are not listed above; examples of possible courses are listed below:
- B M E: Imaging in Medicine: Applications
- MED PHYS 574: Introduction to Biological and Medical Microsystems
- E C E 630: All of Signal Processing

#### 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)

#### Ethical and Regulatory Issues in Clinical Investigation

- MED HIST 545: Ethical and Regulatory Issues in Clinical Investigation
- MED PHYS 701: Ethics and the responsible conduct of research and practice of Medical Physics

#### 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 630: Systems Neuroscience
- NTP/NEURODPT 735: Neurobiology of Disease

#### Neuroengineering Track

Neuroengineering is the convergence of neuroscience, computation, device development, and mathematics to improve human health. Neuroengineering brings together state-of-the-art technologies for the development of devices and algorithms to assist those with neural disorders. It is also used to reverse engineer living neural systems via new algorithms, technologies and robotics. Students pursing this track are involved in all of these endeavors so as the next generation of engineers, they will transcend the traditional boundaries of neuroscience, technology, engineering and mathematics.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 443</td>
<td>Applied Linear Algebra (OR previous undergraduate course)</td>
<td></td>
</tr>
<tr>
<td>MED HIST 545</td>
<td>Ethical and Regulatory Issues in Clinical Investigation</td>
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</tr>
<tr>
<td>MED PHYS 701</td>
<td>Ethics and the responsible conduct of research and practice of Medical Physics</td>
<td></td>
</tr>
<tr>
<td>COMP SCI 368</td>
<td>Learning a Programming Language</td>
<td></td>
</tr>
<tr>
<td>COMP SCI/B M I 567</td>
<td>Medical Image Analysis</td>
<td></td>
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<tr>
<td>COMP SCI 766</td>
<td>Computer Vision</td>
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</tr>
<tr>
<td>COMP SCI/B M I 767</td>
<td>Computational Methods for Medical Image Analysis</td>
<td></td>
</tr>
<tr>
<td>E C E/B M E 462</td>
<td>Medical Instrumentation</td>
<td></td>
</tr>
<tr>
<td>E C E/B M E 463</td>
<td>Computers in Medicine</td>
<td></td>
</tr>
<tr>
<td>E C E/COMP SCI/ I SY E 524</td>
<td>Introduction to Optimization</td>
<td></td>
</tr>
<tr>
<td>E C E/COMP SCI/ M E 539</td>
<td>Image Processing</td>
<td></td>
</tr>
<tr>
<td>E C E/COMP SCI/ NEURODPT 610</td>
<td>Introduction to Artificial Neural Network and Fuzzy Systems</td>
<td></td>
</tr>
<tr>
<td>MED PHYS/ NTP 651</td>
<td>Methods for Neuroimaging Research</td>
<td></td>
</tr>
<tr>
<td>PSYCH 610</td>
<td>Statistical Analysis of Psychological Experiments</td>
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</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): 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).

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>B M E 545</td>
<td>Engineering Extracellular Matrices</td>
<td></td>
</tr>
<tr>
<td>B M E 550</td>
<td>Introduction to Biological and Medical Microsystems</td>
<td></td>
</tr>
<tr>
<td>B M E/ANATOMY/MED PHYS/PHMCOL-M/PHYSICS/RADIOL 619</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Credits</td>
<td>22-26</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.

**GRADUATE SCHOOL POLICIES**

The Graduate School's Academic Policies and Procedures (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) 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 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:

- assess current skills, interests, and strengths;
- 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
- Kristyn Masters
- Beth Meyerand
- William Murphy
- Darryl Thelen

ASSISTANT PROFESSORS
- Randolph Ashton
- Aviad Hai
• Melissa Kinney
• Megan McClean
• Jeremy Rogers
• Krishanu Saha
• Colleen Witzenburg

ASSOCIATE PROFESSORS
• Christopher Brace
• Pamela Kreeger
• Wan-ju Li
• Kip Ludwig
• Melissa Skala

FACULTY ASSOCIATES
• Amit Nimunkar
• John Puccinelli
• Tracy Jane Puccinelli
• Darilis Suarez-Gonzalez
• Aaron Suminski
• Mitchell Tyler

EMERITUS
• Ed Bersu
• Willis Tompkins
• John Webster