

# Bioengineering PhD

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## COLLEGE OF ENGINEERING

Learn more about the Doctor of Philosophy in Bioengineering.

## About the Program

The PhD in Bioengineering addresses the needs of an aging population that is likely to require more medical care and to take advantage of the advances in and benefits of biomedical engineering. Employment of biomedical engineers is projected to grow 6 percent from 2020 to 2030, as fast as average for all occupations. The Bioengineering PhD program is designed to educate and train doctoral-level bioengineers to work in academic, medical or industrial settings.

**Time Limit for Degree Completion:** 7 years

**Campus Location:** Main, Health Sciences Center

**Full-Time/Part-Time Status:** Students are able to complete the didactic portion of the PhD degree program through classes offered after 4:30 p.m.

**Interdisciplinary Study:** Bioengineering research is highly interdisciplinary and draws on collaboration with members of the faculty and students within all departments of the College of Engineering; other departments on Main campus, including Biology and Chemistry; and other schools and colleges at Temple University, such as the Kornberg School of Dentistry, Lewis Katz School of Medicine, and School of Pharmacy.

**Areas of Specialization:** While the Bioengineering PhD is inherently interdisciplinary, the student is admitted to the program and then conducts doctoral research within an area of specialization. These include:

- Biomaterials
- Imaging and optical spectroscopy
- Injury biomechanics
- Neuroengineering
- Neuromechanics of locomotion
- Regenerative tissue engineering
- Stem and cancer cell engineering
- Targeted drug delivery

In the first term, the student and the Bioengineering (BIO) Graduate Program Director jointly initiate a Plan of Study. This form lists all required courses and the program requirement sequence for the student to follow. The Plan of Study is used to track the student's progress, with an annual annotation and update as the student completes various benchmarks in the PhD program.

**Job Prospects:** The program is primarily intended for individuals who wish to pursue careers in industry, government and academia in a highly creative environment. The program is dedicated to producing engineers who will contribute to advancements in biotechnology.

**Non-Matriculated Student Policy:** Up to 9 credits of graduate Engineering coursework may be taken at Temple University on a non-matriculated basis and subsequently applied to the PhD degree upon admission. If the applicant's undergraduate GPA was less than 3.0, a GPA of 3.25 or better is required on this non-matriculated graduate coursework to receive an admissions exception. Consequently, the BIO Graduate Program Director may encourage those with an undergraduate GPA less than 3.0 to take their first three graduate courses prior to making formal application to the PhD program. (See the relevant Graduate School policies on special admission procedures for non-matriculated students: 02.23.11.03 and 02.24.19.)

**Financing Opportunities:** Applicants for full-time study in the Bioengineering PhD program are automatically considered for financial aid. Three forms of financial aid are awarded to PhD students on a competitive basis:

1. Teaching Assistantship (TA): TA awards are made solely by the Department and require the awardee to work 20 hours per week in support of the Department's undergraduate programs. The TA is compensated with a 9-month stipend, a basic health-insurance plan, and 9 credits per term of tuition remission.
2. Research Assistantship (RA): Individual faculty confer RA awards, using their research funds, upon students who appear well-qualified to carry out the research. Typically, this faculty member becomes the RA's doctoral advisor. The RA normally works up to 20 hours per week and is compensated with a stipend, basic health insurance, and tuition remission.
3. Fellowships: Fellowships are awarded by the University in a competitive process that is open to all PhD applicants. The BIO Graduate Program Director nominates exceptional PhD applicants for a University Fellowship. Fellows receive 9 to 12 months of stipend, depending on the award; basic health insurance; and 12 credits of tuition remission each Fall and Spring term. Fellows of the University have no work obligations with respect to either the Department, the College, or the University.

Because financial aid is awarded on a competitive basis, applicants are urged to complete the application as early as possible.

## Admission Requirements and Deadlines

### Application Deadline:

*Fall:*

- December 15 (Fellowship Consideration)
- January 15 (Final Fellowship/Early Assistantship Consideration)
- March 1 (Final Admissions)

*Spring:* November 1

Applications are processed on a continual basis. Ordinarily, the applicant is informed of an admissions decision within 4 to 6 weeks of receipt of all supporting application documents.

*APPLY ONLINE to this graduate program.*

**Review tuition and financial assistant deadlines to ensure financial aid consideration for the intended term of study.**

Both admissions and financial aid award decisions originate in the Bioengineering Department within the College of Engineering. Applicants who plan to matriculate full-time are automatically considered for financial aid awards so no separate application for financial aid is required.

### Letters of Reference:

*Number Required:* 3

*From Whom:* Letters of recommendation should be obtained from college or research faculty who are familiar with the applicant's competency. If the applicant has an established career in engineering, one of the letters should be provided by the applicant's immediate supervisor. Any applicant who has been out of school long enough that relevant academic reference letters appear impractical should provide recommendations by the applicant's previous or current immediate supervisor(s)

**Coursework Required for Admission Consideration:** Students not adequately prepared for advanced courses may be required to take a number of prerequisites. The Bioengineering Department identifies the needed coursework on a case-by-case basis.

**Master's Degree in Discipline/Related Discipline:** A master's degree is not required, but preferred.

**Bachelor's Degree in Discipline/Related Discipline:** A bachelor's degree is required.

University regulations stipulate that the applicant must have earned a 3.0 grade-point average on a 4.0 scale in their undergraduate studies, but admission exceptions are made for a variety of circumstances. (See Graduate School Policy 02.23.11.03.) The BIO Graduate Program Director helps the applicant navigate the admission possibilities and assists in the assessment of their overall educational qualifications with respect to the departmental requirements for the PhD program.

Official transcripts from all institutions of higher education attended, whether or not a degree was awarded, must be submitted. International applicants submit official transcripts or official NACES-accredited evaluation documentation that validates completion and conferral of a degree, diploma and/or certificate. All applicants must ensure transcripts and/or NACES-accredited documentation are sent directly from the institution(s) or NACES-accredited evaluation agency via email to gradengr@temple.edu or to the Temple University College of Engineering, 1947 N. 12th Street, Philadelphia, PA 19122-6077.

**Statement of Goals:** Describe your relevant technical experiences, career goals, and specific research interests in one to two pages.

### Standardized Test Scores:

GRE: Required. Scores that are not more than 5 years in advance of the application date are sent by Educational Testing Service (ETS) to test code 2945. (See Graduate School Policy 02.23.12.) Applicants who require a waiver of the GRE should consult the BIO Graduate Program Director concerning the mechanics and consequences of obtaining an exception.

Applicants who earned their baccalaureate degree from an institution where the language of instruction was other than English, with the exception of those who subsequently earned a master's degree at a U.S. institution, must ensure official scores are reported directly by the testing agency for a standardized test of English and meet one of these minimums:

- TOEFL iBT: 79
- IELTS Academic: 6.5
- PTE Academic: 53
- Duolingo: 110

**Resume:** Current resume required.

**Advanced Standing:** Both transfer credit for courses taken at another institution while matriculated at Temple and/or advanced standing credit for courses taken within the 5-year period prior to matriculating at Temple may be applied toward the PhD-level didactic coursework requirement. Written approval is required from the student's doctoral advisor, the College's Associate Dean for Graduate Study, and the Graduate School. (See Graduate School Policy 02.24.21.) Up to six credits of advanced standing for courses taken within the 5-year period prior to matriculating at Temple may be used to satisfy the master's-level didactic coursework requirement. Approval of the BIO Graduate Program Director is required. The courses must be equivalent to courses offered at Temple in the student's area of study and research, and the grades must be "B" or better.

## Program Requirements

### General Program Requirements:

*Number of Credits Required Beyond the Bachelor's:* 60, including 45 credits of graduate-level didactic coursework and 15 research credits, including preliminary PhD examination and dissertation research

*Number of Credits Required Beyond the Master's:* 30, including 15 credits of graduate-level didactic coursework and 15 research credits, including preliminary PhD examination and dissertation research

*Required Courses:*

### Post-Baccalaureate (for students WITHOUT a master's degree in Bioengineering)

Code	Title	Credit Hours
<b>Core Courses</b>		
BIOE 5600	Bioengineering Graduate Seminar <sup>1</sup>	0
ENGR 5011	Engineering Mathematics I	3
<b>Specialty Courses</b>		
Select three from the following:		9
BIOL 5312	Biostatistics	
BIOE 5719	Introduction to Bioengineering	
BIOE 5721	Cell Biology for Engineers	
BIOE 5737	Systems Physiology for Engineers	
<b>Technical Electives</b> <sup>2</sup>		<b>33</b>
<b>Research Courses</b> <sup>3</sup>		<b>15</b>
BIOE 9991	Directed Research (1-9 credits)	
BIOE 9994	BioEngineering Preliminary Examination Preparation (1-2 credits)	
BIOE 9998	Bioengineering Pre-Dissertation Research (1 credit minimum)	
BIOE 9999	BioEngineering Dissertation Research (2 credits minimum)	
<b>Total Credit Hours</b>		<b>60</b>

<sup>1</sup> BIOE 5600 Bioengineering Graduate Seminar is required to be taken each academic term while completing the degree.

<sup>2</sup> Coursework is typically selected by the student's Doctoral Advisory Committee. It may include up to 6 credits of CEE 9182 Independent Study I and/or CEE 9282 Independent Study II. Two Independent Study courses are permitted for students requiring 60 credits for a PhD.

<sup>3</sup> Students who wish to take graduate coursework outside the College of Engineering in one of Temple University's other schools or colleges need to obtain the appropriate written approvals on their Plan of Study form.

<sup>4</sup> Sample distribution of the 15 credits associated with PhD examinations and dissertation research is shown, although the actual distribution of credits can vary across courses depending on the student's particular needs. Completion of the required 15 credits includes a minimum of 1 credit but no more than 2 credits of BIOE 9994, a minimum of 1 credit of BIOE 9998, and a minimum of 2 credits of BIOE 9999, with the further stipulation that the minimum number of credits taken in BIOE 9994, BIOE 9998 and BIOE 9999 combined is 6.

### Post-Master's (for students WITH a master's degree in Bioengineering)

Code	Title	Credit Hours
<b>Core Courses</b>		
BIOE 5600	Bioengineering Graduate Seminar <sup>1</sup>	0
ENGR 5011	Engineering Mathematics I	3
<b>Specialty Courses</b>		

Select three from the following:

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BIOL 5312	Biostatistics
BIOE 5719	Introduction to Bioengineering
BIOE 5721	Cell Biology for Engineers
BIOE 5737	Systems Physiology for Engineers

**Technical Electives <sup>2</sup>** **3**
**Research Courses <sup>3</sup>** **15**

BIOE 9991	Directed Research (1-9 credits)
BIOE 9994	BioEngineering Preliminary Examination Preparation (1-2 credits)
BIOE 9998	Bioengineering Pre-Dissertation Research (1 credit minimum)
BIOE 9999	BioEngineering Dissertation Research (2 credits minimum)

**Total Credit Hours** **30**
<sup>1</sup> BIOE 5600 Bioengineering Graduate Seminar is required to be taken each academic term while completing the degree.

<sup>2</sup> Coursework is typically selected by the student's Doctoral Advisory Committee. It may include up to 3 credits of CEE 9182 Independent Study I. Only one Independent Study course is permitted for students requiring 30 credits for a PhD.

<sup>3</sup> Students who wish to take graduate coursework outside the College of Engineering in one of Temple University's other schools or colleges need to obtain the appropriate written approvals on their Plan of Study form.

<sup>4</sup> Sample distribution of the 15 credits associated with PhD examinations and dissertation research is shown, although the actual distribution of credits can vary across courses depending on the student's particular needs. Completion of the required 15 credits includes a minimum of 1 credit but no more than 2 credits of BIOE 9994, a minimum of 1 credit of BIOE 9998, and a minimum of 2 credits of BIOE 9999, with the further stipulation that the minimum number of credits taken in BIOE 9994, BIOE 9998 and BIOE 9999 combined is 6.

### Culminating Events:

#### *Formation of the Doctoral Advisory Committee:*

Selection of a research advisor and formation of a Doctoral Advisory Committee constitute the first steps toward achieving a PhD. Selection of a doctoral advisor depends on the student's level of preparation upon entering the PhD program. The Doctoral Advisory Committee selects the required coursework and guides the progress of the student's dissertation research:

- Students entering the PhD program with a master's degree, i.e., those who must complete 30 credits to earn the degree, form their Doctoral Advisory Committee before the end of their second regular term of study.
- Students entering the program with a bachelor's degree, i.e., those who must complete 60 credits to earn the PhD degree, generally complete most of their coursework before forming their Doctoral Advisory Committee by the end of their fourth regular term in the program.

See Graduate School Policy 02.28.11 for clarification on the composition of the Doctoral Advisory Committee.

#### *Preliminary Examination:*

All students generally complete their didactic coursework prior to taking the preliminary examination. (See Graduate School Policy 02.27.11.) Students in the 30-credit cohort ordinarily take the exam in their third or fourth term. Students in the 60-credit cohort typically take the exam no later than the eighth regular term. Students should register for one credit of BIOE 9994 BioEngineering Preliminary Examination Preparation in the term when the exam will be taken.

The preliminary exam tests both the student's core knowledge in Bioengineering and their capacity to synthesize and interpret research communications. The student coordinates the scheduling of the preliminary exam with the BIO Graduate Program Director. The BIO Graduate Program Director supervises the specific form, content and frequency of the Bioengineering preliminary exam. A maximum of two opportunities to pass the preliminary exam are available to the student. In each term when the exam is attempted, the student registers for one credit of BIOE 9994. Students are dismissed upon the second failure.

#### *Dissertation Proposal:*

After passing the preliminary exam, the student must develop a written research proposal and present it in an open College seminar. The student must schedule the proposal ten business days prior to the presentation seminar and post an announcement. Immediately following the seminar, the Doctoral Advisory Committee will question the student about the details and strategy of their proposed research.

Approval is granted for the proposed dissertation research when the "Dissertation Proposal Transmittal for Elevation to Candidacy" form (found in TUportal under the Tools tab within "University Forms") has been signed off by the entire Doctoral Advisory Committee. After the dissertation proposal has been accepted by the Doctoral Advisory Committee and the Graduate School has received the form, the student is considered to be a doctoral candidate. (See Graduate School Policy 02.28.12 for more information.)

#### *Research Credits:*

Students carry out research throughout their studies and register for the corresponding research credits while in the PhD program. However, the type of research credits that a student registers for depends on the student's progress in the program:

- Prior to passing the preliminary exam, credit hours associated with the student's research should be registered under BIOE 9991 Directed Research.
- After the preliminary exam is passed, but before elevation to candidacy, credit hours associated with the student's research should be registered under BIOE 9998 Bioengineering Pre-Dissertation Research.
- After elevation to candidacy, the student's research credits should be registered under BIOE 9999 BioEngineering Dissertation Research. Students are required to register for at least three credits of BIOE 9999 following their elevation to candidacy. (See Graduate School Policy 02.28.15.)

#### *Publications:*

Paper writing and presentation at a conference are considered integral to the student's training. Also, peer review, in part, offers an indication of the quality and novelty of the student's research. All doctoral students must publish at least two technical papers in refereed journals or refereed conferences. The papers must be based on the student's dissertation research with the student as the first author.

#### *Dissertation:*

The dissertation defense is an open University seminar in which the student presents the concepts and results of their research.

The student must coordinate the formation of the Dissertation Examining Committee in the term that they intend to defend their dissertation. This committee consists of the original Doctoral Advisory Committee plus one additional "external" member who is not faculty in the College of Engineering. If the external examiner is not a member of Temple University's Graduate Faculty, the person must be approved by the Graduate School at least four weeks prior to the dissertation defense.

The dissertation defense is to take place during a regular academic term (i.e., not scheduled during study days, final exams, or the breaks between terms). If the student is to graduate in the same term as the dissertation defense is held, then the defense should take place at least 30 days prior to the end of the term to allow for document revisions.

Three weeks prior to the defense, the members of the committee elect a Chair of the Dissertation Examining Committee. The Chair cannot be the student's doctoral advisor. The Associate Dean of Research and Graduate Studies must approve the selection. The Chair is identified to the Graduate School in the student's official request for permission to schedule the defense. (See Graduate School Policy 02.28.15.) The Chair's role includes coordination of the proceedings of the defense and completion of all relevant College and Graduate School forms concerning the defense.

The dissertation document should be prepared in a format compliant with University standards. (See Graduate School Policy 02.28.18.) A copy of the completed dissertation must be provided to the committee at least three weeks before the date of the dissertation defense. Note that any Graduate Faculty may request a copy of the dissertation in advance of the defense and may participate in the defense.

A minimum of two weeks prior to the defense, a public announcement of the defense must be posted. Prior to posting, this announcement must be approved in writing by the Graduate School. (See Graduate School Policy 02.28.16.)

Immediately following the presentation, the Dissertation Examining Committee closely examines the student's performance and their research. External attendees may participate in this closed portion of the defense with the permission of the Dissertation Examining Committee Chair. However, only members of the Dissertation Examining Committee may actually vote on the decision to accept the dissertation as prepared, accept the dissertation with revisions, or not accept the dissertation. If the dissertation is accepted with revisions, a revised copy of the dissertation must be submitted and approved by the Committee within 30 days of the original defense date.

## **Contacts**

### **Program Web Address:**

<https://www.temple.edu/academics/degree-programs/bioengineering-phd-en-bioe-phd>

### **Department Information:**

College of Engineering  
ATTN: BIO Programs  
1947 N. 12th Street  
Philadelphia, PA 19122-6077  
[gradengr@temple.edu](mailto:gradengr@temple.edu)  
215-204-7800

### **Submission Address for Application Materials:**

<https://apply.temple.edu/ENGINEERING/Account/Login>

### **Department Contacts:**

*Admissions:*

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