

# TRANSLATIONAL BIOENGINEERING (PHD)

This program was approved for students entering the university in the Summer 2025-Spring 2026 catalog year. For more information about catalog year, go to Catalog Year Information (<https://catalog.louisville.edu/undergraduate/university-wide-unit-specific-policies/catalog-year/>).

## Doctor of Philosophy in Translational Bioengineering

Unit: Speed School of Engineering ([https://engineering.louisville.edu/\(GS\)](https://engineering.louisville.edu/(GS)))

Department: Bioengineering (<https://engineering.louisville.edu/academics/departments/bioengineering/>)

Academic Plan Code(s): TBE\_PHD

## Program Information

The Translational Bioengineering PhD program is designed to provide multidisciplinary training in translational bioengineering preparing students to lead research and development in academia, industry and governmental agencies and/or to advance bioengineering technologies through start-up companies as entrepreneurs or within established biomedical companies. The intended audience includes applicants interested in a PhD degree in Bioengineering that have a minimum of a Bachelor's Degree in Engineering from an accredited program, or similar field.

In this program, students will have the opportunity to customize their graduate-level training by selecting one of four concentration areas and one of three tracks. The concentration areas offered include:

- Bioelectronics and Biomedical Devices
- Bioimaging and Biocomputational Modeling
- Biomechanics and Rehabilitation
- Molecular and Tissue Engineering

The three tracks offered are:

- Traditional Bioengineering Research
- Clinical Translational Research
- Entrepreneurship of Bioengineering Technologies

Students who successfully complete the program will demonstrate excellence in designing and conducting research leading to an intellectual contribution to the field; demonstrate in-depth knowledge of their focus area and associated scientific literature; have an understanding of the clinical relevance and ethical implications of their research; have the ability to critically analyze, evaluate and interpret research methods and findings; and have the ability to effectively communicate knowledge of their focus area.

The requirements for the Doctor of Philosophy degree are explained in more detail in the Degree Requirements section (<https://catalog.louisville.edu/graduate/general-policies-procedures-requirements/degree-requirements/>) of this catalog.

Applicants must meet Graduate School admission requirements along with additional program requirements. Applicants must, as a minimum, have completed a Bachelor's Degree in Engineering from an accredited program or a similar field with a 3.25 cumulative GPA to be considered

for admission. Applicants with an undergraduate GPA of 3.0 will be considered for provisional acceptance. The ideal applicant will have completed or be in the process of completing either a Master's (MS or MEng) Degree in Engineering at the time of application.

Applicants must submit:

- A completed graduate application (<https://graduate.louisville.edu/admission/apply/>) for the Graduate School
- An application fee
- Official transcript(s) from each college attended certifying at least a bachelor's degree. All transcripts not in English must be certified as authentic and translated verbatim into English.
- Personal statement (include intended area of study and/or research interest, previous experience related to bioengineering and how the PhD in Translational Bioengineering will allow them to fulfill their career goals as identified by their focus area of interest).
- Resume/CV
- Three letters of recommendation
- Students whose native language is non-English or degree is from a non-US accredited institution are required to submit TOEFL scores (administered by the Educational Testing Service). A minimum TOEFL score of 79 or high on the internet-based test is required. Alternatively, a minimum of 6.5 on the International English Language Testing System will be accepted or Duolingo score of 105
- Optional Graduate Record Exam (GRE)

## Program Requirements

To earn the Doctor of Philosophy in Translational Bioengineering, students are required to successfully complete the following:

- 47 credit hours of course work beyond their bachelor's degree (18 core credit hours, 9 specialty are credit hours, and 20 guided elective credit hours)
- Participate in the Bioengineering Seminar Series (75% attendance rate and one presentation/year as a Doctoral candidate)
- Pass the preliminary examination
- Pass the Dissertation proposal
- Successfully defend a dissertation
- Submit three or more peer-reviewed journal papers representing their original dissertation research

Code	Title	Hours
<b>Required Core Courses</b>		
BE 601	Bioengineering Seminar	1
BE 601	Bioengineering Seminar	1
BE 601	Bioengineering Seminar	1
BE 603	Bioengineering Research Ethics	2
BE 621	Bioinstrumentation	4
BE 654	Advanced Physiology for Engineers	3
BE 695	Bioengineering Research Design & Methods	3
ME 565	Advanced Engineering Mathematics I	3
<b>Minimum Total Hours</b>		<b>18</b>

Students must choose 9 credit hours from one of the following focus areas:

- Molecular & Tissue Engineering (MTE)
- Bioimaging & Biocomputational Modeling (BBM)
- Bioelectrical & Biomedical Devices (BBD)
- Biomechanics & Rehabilitation (BR)

Code	Title	Hours
<b>Focus Area: Molecular &amp; Tissue Engineering (MTE)</b>		
Choose 9 hours from the courses below:		9
BE 553	Nanoscale Bioengineering: Application and Methodology of Nanobiomaterials in Bioengineering	
BE 552	Introduction to Tissue Engineering	
BE 605	Tissue and Molecular Biology Techniques Laboratory	
BE 650	Advanced Biomaterials	
BE 670	Cellular Mechanobiology in Cancer	
BIOC 611	Techniques in Biomolecular Interactions	
BIOC 668	Molecular Biology	
<b>Minimum Total Hours</b>		<b>9</b>

Code	Title	Hours
<b>Focus Area: Bioimaging and Biocomputational Modeling (BBM)</b>		
Choose 9 hours from the courses below:		9
BE 542	Medical Image Computing	
BE 540	Machine Learning in Medicine	
BE 604	Introduction to Artificial Intelligence in Bioengineering	
BE 685	Modeling of Biological Phenomena	
BE 530	Machine Learning in Python	
BE 543	Computer Tools for Medical Image Analysis	
BE 544	Artificial Intelligence Techniques in Digital Pathology	
BE 640	Computational Methods for Medical Image Analysis	
BE 645	Artificial Intelligence and Radiomics	
CSE 622	Simulation and Modeling of Discrete Systems	
CSE 627	Digital Image Processing	
<b>Minimum Total Hours</b>		<b>9</b>

Code	Title	Hours
<b>Focus Area: Bioelectrical &amp; Biomedical Devices (BBD)</b>		
Choose 9 hours from the courses below:		9
BE 524	LabVIEW for Bioengineers	
BE 581	Advanced Computer-Aided Design and Manufacturing for Bioengineers	
BE 522	Biomedical Acoustics	
BE 683	Artificial Organs	
ECE 543	Fundamentals of Microfabrication and MEMS	
BE 611	Cardiovascular Dynamics	

BE 650	Advanced Biomaterials	
<b>Minimum Total Hours</b>		<b>9</b>
Code	Title	Hours
<b>Focus Area: Biomechanics &amp; Rehabilitation (BR)</b>		
Choose 9 hours from the courses below:		9
ME 640	Optimum Design Methods	
BE 630	Biomechanical Computer Modeling and Simulation of Human Movement	
BE 611	Cardiovascular Dynamics	
BE 639	Injury Biomechanics	
BE 658	Rehabilitation Engineering and Assistive Technology	
ME 651	Kinematics and Kinetics of Human Movement	
ME 650	Biofluid Mechanics	
<b>Minimum Total Hours</b>		<b>9</b>

## Specialization Area Guided Electives

Courses in Specialization Area must be unique from those taken to fulfill the Focus Area requirement, and must follow a track listed below. Students must work with their advisor to establish a Plan of Study for Specialization Courses. All Specialization courses must be approved by the student's advisor prior to registration.

## Traditional Bioengineering (T)

18 credit hours from those listed below with a minimum of six (6) credit hours in engineering courses and Teaching Practicum, BE 668 (two (2) credit hours).

## Clinical Translational Bioengineering (C)

12 credit hours from list below designated as ASNB, BIOC, MBIO, OBIO, or PHZB; remaining six (6) credit hours in engineering courses and Clinical Practicum, BE 692 (two (2) credit hours).

## Entrepreneurship of Bioengineering Technologies (E)

12 credit hours from list below designated as ENTR; remaining six (6) credit hours in engineering courses and Teaching Practicum, BE 668 (two (2) credit hours).

Code	Title	Hours
BE 668	Translational Bioengineering teaching Practicum	2
or BE 692	Bioengineering Clinical Rotation	
BE 522	Biomedical Acoustics	
BE 524	LabVIEW for Bioengineers	
BE 530	Machine Learning in Python	
BE 540	Machine Learning in Medicine	
BE 542	Medical Image Computing	
BE 543	Computer Tools for Medical Image Analysis	
BE 544	Artificial Intelligence Techniques in Digital Pathology	
BE 552	Introduction to Tissue Engineering	
BE 553	Nanoscale Bioengineering: Application and Methodology of Nanobiomaterials in Bioengineering	
BE 581	Advanced Computer-Aided Design and Manufacturing for Bioengineers	

BE 604	Introduction to Artificial Intelligence in Bioengineering	MBIO 601	Molecular Microbiology
BE 605	Tissue and Molecular Biology Techniques Laboratory	MBIO 602	Immunology
BE 611	Cardiovascular Dynamics	MBIO 610	Methods and Analysis in the Biomedical Sciences
BE 630	Biomechanical Computer Modeling and Simulation of Human Movement	MBIO 618	Topics in Advanced Microbiology
BE 639	Injury Biomechanics	OBIO 611	Craniofacial Osteology
BE 640	Computational Methods for Medical Image Analysis	OBIO 612	Craniomaxillofacial Diagnostic Imaging
BE 645	Artificial Intelligence and Radiomics	OBIO 617	Advanced Oral Pathology
BE 650	Advanced Biomaterials	PHMS 641	Data Mining I
BE 658	Rehabilitation Engineering and Assistive Technology	PHMS 642	Data Mining II
BE 670	Cellular Mechanobiology in Cancer	PHST 620	Introduction to Statistical Computing
BE 683	Artificial Organs	PHST 661	Probability
BE 685	Modeling of Biological Phenomena	PHST 680	Biostatistical Methods I
ASNB 602	Fundamentals of Neuroscience	PHST 682	Multivariate Statistical Analysis
ASNB 614	Molecular Neuroscience	PHST 684	Categorical Data Analysis
ASNB 617	Seminar on Developmental Neurobiology	PHST 710	Advanced Statistical Computing I
BIOC 645	Advanced Biochemistry I	PHZB 611	Advanced Human Cardiovascular Physiology
BIOC 675	Cancer Biology		
CSE 532	Python and Data Analytics		
CSE 590	Special Topics in Computer Science and Engineering		
CSE 619	Design and Analysis of Computer Algorithms		
CSE 628	Computer Graphics		
CSE 632	Data Mining		
CSE 633	Computer Vision		
CSE 635	Data Mining with Linear Models		
CSE 660	Introduction to Bioinformatics		
CSE 694	Special Topics in Computer Science and Engineering		
ECE 520	Digital Signal Processing		
ECE 521	Digital Signal Processing Laboratory		
ECE 523	Introduction to Biometrics		
ECE 544	Microfabrications/MEMS Laboratory		
ECE 564	Fundamentals of Autonomous Robots		
ECE 565	Fundamentals of Autonomous Robots Lab		
ECE 614	Deep Learning		
ECE 661	Sampled-Data Control Systems		
ECE 662	Introduction to Optimum Control		
ENTR 702	Research Design I		
ENTR 741	Research Design II		
ENTR 724	Strategic Entrepreneurship		
ENTR 745	Entrepreneurship Theory I		
ENTR 746	Entrepreneurship Theory II		
ENTR 747	Corporate Entrepreneurship and Innovation		
ISE 563	Experimental Design in Engineering		
ME 566	Advanced Engineering Mathematics II		
ME 644	Mechatronics		
ME 671	Advanced Fluid Mechanics		
ME 675	Advanced Topics in Mechanical Engineering		