

Doctor of Philosophy in Bioengineering

Bioengineering Program

The bioengineering program prepares students to become leading researchers, educators, and entrepreneurs. The program provides knowledge breadth in engineering and the biological sciences and knowledge depth in the student's area of research interest. The program offers the Master of Science and Doctor of Philosophy degrees in bioengineering and the M.D./Ph.D. combined degree in conjunction with the KU School of Medicine (<http://medicine.kumc.edu/>). Students have access to innovative research and educational facilities on KU's Lawrence and KU Medical Center campuses. The student selects from 6 tracks:

1. Bioimaging
2. Computational Bioengineering
3. Biomaterials & Tissue Engineering
4. Biomechanics & Neural Engineering
5. Biomedical Product Design & Development
6. Biomolecular Engineering

The student, in consultation with his or her advisor and advisory committee, develops a Plan of Study (<https://gradplan.engr.ku.edu/accounts/login/?next=/>) and a research program to satisfy degree requirements.

The program's goals are:

1. To give students an in-depth understanding of mathematics, engineering principles, physics, chemistry, physiology, and modern biology;
2. To train students to apply basic sciences to biological problems using engineering principles;
3. To train students to do bioengineering research and solve problems related to the design and development of diagnostic and therapeutic technologies that improve human health; and
4. To train students to apply bioengineering research to commercially viable technologies.

Bioengineering research projects typically focus on 1 of 2 broad categories:

1. The development of fundamental scientific knowledge and
2. The development and application of materials, devices, and systems with the goal of improving biological processes, systems, and health care.

Bioengineering students are often involved in measurements, analysis, modeling, computations, design, and development. The program prepares students for careers in industry, academia, health care settings, or government.

Financial Aid

Once admitted, students become eligible for financial aid. Graduate students in the bioengineering program are most often supported through research assistantships, teaching assistantships, or fellowships (e.g., the Madison and Lila Self Fellowship). Research assistantships are arranged by the student and faculty advisor with assistance from the Bioengineering

Director if needed. Teaching assistantships are assigned by the Bioengineering Director. Highly qualified applicants are considered for additional support and fellowships. For more information about external and other KU funding options, please visit <https://graduate.ku.edu/funding> (<https://graduate.ku.edu/funding/>).

Admission to the Bioengineering Graduate Program

All applicants are expected to have an undergraduate grade point average of 3.0 or higher on a 4.0 scale. The appropriate academic preparation includes both general and track prerequisites. General prerequisites include calculus I and II, differential equations, linear algebra, general physics I and II, chemistry, and biology. Track prerequisites depend on the student's track of study. More complete details about academic preparation can be found on the program's website (<http://bio.engr.ku.edu/>).

Applicants normally have a B.S. and/or an M.S. degree in an engineering discipline, physical sciences, the life sciences, or a closely related field. Depending on their preparation, students may be required to take additional courses that may or may not count toward the graduate degree.

A student may enter the Bioengineering Program before meeting all the prerequisites if approved by the Admissions Committee. This student must plan to complete the prerequisites in addition to the graduate degree requirements and consultation with the program is required to determine which courses satisfy these requirements. Course credits from prerequisites generally do not apply toward the graduate degree and must be completed with a grade of B or higher.

A highly qualified applicant may apply for admission directly into the Ph.D. program after completing the B.S. degree. Generally, a student who does not have an undergraduate degree in an engineering discipline must complete the M.S. before entering the Ph.D. program. A strong applicant should have outstanding academic credentials, some formal research experience, research interests that fit one of the tracks of study, and a strong potential for advanced study.

Submit your graduate application online (<https://gradapply.ku.edu/apply/>).

Application Information & Deadlines

In order to receive full consideration, a complete application package should be submitted by the following deadlines:

Fall Admission: December 1

Spring Admission: October 1

APPLICATION MATERIALS INCLUDE:

1. **Official Transcripts**
 - a. One official transcript from each degree granting institution that the student has attended is **REQUIRED** for admission. If courses from another university or junior college appear on the degree granting institution's transcript, we do not need transcripts from the other university or junior college. A scanned copy of the official transcript IS acceptable but it MUST be an official copy. Printouts from student portals or websites will **NOT** be accepted. A final degree conferred transcript sent directly from the degree granting university will be required before the second semester of enrollment should the applicant be admitted and enroll in a program at KU.
2. **Letters of Recommendation**

- a. Request 3 letters of recommendation from individuals who can speak to your academic and research preparedness. Obtain the correct e-mail addresses of your recommenders and explain that he/she will be sent an e-mailed request with instructions on how to complete the required Recommendation Form and how to upload their letter to your application electronically.

3. **A Statement of Your Academic Objectives (you attach to on-line application)**

- a. Your statement is a very important part of your application. Please write a 1-2 page essay describing your academic and career objectives as they relate to bioengineering. It should indicate how and why you have decided to pursue graduate studies in your chosen field. **Please discuss the particular areas of focus within the track(s) you wish to study and why you feel KU specifically is a good fit for your particular interests and goals.** If you are interested in the research of particular KU faculty members, please discuss it. You may also include relevant information about your academic background, research experience, leadership skills, related work and/or volunteer experiences that you feel have prepared you for graduate study.

This statement of objectives will be read and used by faculty in the track to evaluate your academic, research and leadership potential as well as to select graduate teaching and/or research assistants. It also plays a role in determining scholarship/fellowship nominations. Please make sure that it is of high quality and demonstrates your readiness for graduate level study and research at KU.

4. **Your Curriculum Vitae (CV) or Resume (you attach to on-line application)**

5. **English Proficiency Scores (if English is NOT your native language)**

- a. TOEFL, iBT (or IELTS) Scores (sent to us directly from the testing agency).
 - i. **The institution code for the University of Kansas is 6871.**
 - ii. **The program/department code is 1603.**
 - iii. **The department code is 69 for iBT.**

b. **NOTES:**

- i. For REGULAR admission: All section scores must be at least 20 on the internet-based and computer based TOEFL, or at least 53 on the paper based test.
- ii. Admittance will NOT be granted if you do not meet the above standard of English Proficiency. Due to a change in policy, we are no longer able to issue an I-20 for these instances.
- iii. To qualify for a GTA offer, you must score at least a 24 on the SPEAKING portion of the iBT and/or score a 50 on the SPEAK test (administered at KU after you arrive).
- iv. For more information regarding English Proficiency Requirements (<http://graduate.ku.edu/english-proficiency-requirements/>), see the graduate studies website.

6. **Proof of Financial Support (International Applicants ONLY)**

- a. Obtain the proper Financial Documentation. Scan the document and save it as a pdf file. **KEEP THE PAPER COPIES. Be prepared to send the paper copies to the program office at the address below if requested!** Although the financial statement is not required for making admission decisions, the U.S. Department of State mandates that evidence of financial resources, such as an official bank statement, be provided in order to issue an I-20 and student visa. It should have the name of the student on the account, not the parent's name or any other name. See

the following link (<https://iss.ku.edu/proof-finances/>) for more information.

Funding

Scholarships/Fellowships - The Bioengineering graduate admissions committee nominates applicants for University and School of Engineering scholarships and fellowships based on academic merit and other selection criteria, as specified by the fellowship selection committees.

Graduate Teaching Assistantships (GTAs) - Teaching Assistantships are available and are awarded competitively based on academic qualifications. You do not need a separate application to be considered.

Graduate Research Assistantships (GRAs) - Students work with their potential academic advisor/mentor to obtain a funded position on a research project at the time of matriculation or within the first year. It is NOT required for prospective students to have KU faculty pledge a GRA position prior to your admission.

Visit Us

The graduate program staff are happy to work with all prospective students in determining the fit between the student and the program. We feel that visiting our campus in Lawrence is a very important step. In order to facilitate your visit to KU, there are two main options:

The first, and most preferred, option entails simply applying for admission to the program. All prospective students are welcome to attend our Open House in October or mid-March. Eligible admitted students may be invited to participate in Campus Visit Days in February (prior to the fall semester of your intended matriculation). These organized campus visit opportunities will allow you to gather a great deal of first-hand information which we hope will help you in making a final decision about whether to attend KU.

The second option is making arrangements to visit us on your own, outside of organized events. With early notification, we will do our best to work with you to provide information and schedule appointments with faculty when possible. Please contact us if you feel that this is the best option for you.

Contact Information

Please contact the Graduate Program Coordinator at bioe@ku.edu or (785) 864-5258 to schedule a visit or with questions about the bioengineering application process.

Ph.D. Degree Requirements

In addition to general rules and regulations, the student must meet the program's Ph.D. requirements. Requirements for the Ph.D. include coursework, a doctoral qualifying examination, research skills and residence requirement, a comprehensive examination, a dissertation, and a final oral examination.

In the first semester, the student selects a track of study, an advisor, and an advisory committee. The advisory committee guides the student's development through the Plan of Study (<https://gradplan.engr.ku.edu/accounts/login/?next=/>) in the chosen track, participates in the comprehensive and final examination, and helps the student select a topic for research leading to the dissertation. Should the student's interests change, the advisory committee membership may be changed accordingly, with the approval of the program's Graduate Studies Director. The student's advisory committee consists of a minimum of 5 graduate

faculty members and is chaired by the student's advisor. A more detailed description is available on the program's website (<http://bio.engr.ku.edu/>).

Course Requirements

The Ph.D. program requires a minimum of 60 credit hours* beyond the B.S. to meet degree requirements.

- Core Courses (6 hours)
- Track Courses (30-36 hours) Students must complete the number of hours, including the depth and breadth courses, required in the chosen track (see the program's website (<http://bio.engr.ku.edu/>) for track requirements).
- Research (18-24 hours)

*No more than 9 credits may be taken at the 500-600 level.

Plan of Study

Students are expected to complete a Plan of Study before beginning the second semester of graduate study. To complete a Plan of Study, a student should have identified a research advisor and dissertation committee. Students should work with their research advisors to identify an appropriate list of courses that fulfill degree requirements and support the student's educational and research objectives. A Plan of Study can be completed online (<https://gradplan.engr.ku.edu/accounts/login/?next=/>). The advisor, committee members, and graduate studies director must approve the Plan of Study. The Plan of Study can be modified later, if needed, with approval of the advisor, committee members, and Graduate Studies Director. Students are required to complete their PhD degree within 8 years from initial enrollment in the program, but typically finish within 4-5 years. A timeline is available here (<https://bioengr.ku.edu/sites/bioengr/files/documents/Docs/forms%20and%20docs/PhD%20Timeline.pdf>).

Qualifying Examination

Each doctoral student must pass the doctoral qualifying examination, normally taken at the end of the first year of graduate study. The written and oral examination measures the student's ability to comprehend and communicate technical literature in the chosen track of study. The qualifying examination may be taken twice in a student's graduate career. A more detailed description of the examination is available on the program's website (<http://bio.engr.ku.edu/>).

Research Skills and Responsible Scholarship

In addition to passing the qualifying examination, the doctoral student is required to demonstrate proficiency in research skills and responsible scholarship. The research skill requirement is fulfilled through successful completion of BIOE 800, Bioengineering Colloquium. The responsible scholarship requirement is fulfilled through successful completion of BIOE 801, Responsible Conduct of Research in Engineering or PHCH 817, Pharmaceutical Chemistry - Responsible Research Conduct.

Residence Requirement

Doctoral students must spend a minimum of 2 semesters, which may include the summer session, involved in full-time academic or professional pursuits beyond the baccalaureate degree in graduate study at KU. This may include an appointment for teaching or research and requires that the student be enrolled in a minimum of 6 credit hours a semester. More information can be found in the general doctoral degree requirements of the graduate catalog.

Comprehensive Examination

The comprehensive exam should be taken no later than the end of the Fall semester of the third year for graduate students. The exam consists of a written and oral component that is a grant-style proposal of work to be conducted towards the student's dissertation research. The exam evaluates the student's ability to write an original research proposal, design experiments, and interpret results in a sound and critical manner.

The final outcome is intended to establish the scope of the student's dissertation research. The examining committee consists of the student's Doctoral Dissertation Committee which is chaired or co-chaired by their research advisor. A more detailed description can be found on the program's website (<http://bio.engr.ku.edu/forms-documents/>). Passing the examination advances the student to doctoral candidacy.

Dissertation and Final Examination

The doctoral candidate is expected to conduct original research, prepare a written dissertation detailing the results, and defend the dissertation in a final oral examination. The research is expected to be of sufficient quality to permit publication in reputable scientific journals. The final oral examination is scheduled when the advisory committee agrees that the research is complete.

M.D./Ph.D. Combined Degree Requirements

The Bioengineering Graduate Program offers the combined M.D./Ph.D. (<http://www.kumc.edu/md-phd-program.html>) degrees, in conjunction with the School of Medicine (<http://www.kumc.edu/school-of-medicine.html>), for the student who wishes to combine a focus on medicine with interests in bioengineering research. The requirements for the Ph.D. component of the M.D./Ph.D. program are the same as for the Ph.D. program. The student applies to the M.D./Ph.D. through the KU Medical Center and not to the Bioengineering program directly. Completion of the M.D./Ph.D. degrees is expected to take approximately 7 years. The M.D./Ph.D. student is encouraged to defend the dissertation before clinical rotations. Scholarships are available for both the M.D. and Ph.D. components of the program.