Doctor of Philosophy in Bioengineering

Bioengineering Graduate Programs
The bioengineering graduate 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. Bioinformatics
3. Biomaterials and tissue engineering
4. Biomechanics and neural engineering
5. Biomedical product design and 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 graduate 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 Academic Director if needed. Teaching assistantships are arranged by the Bioengineering Academic Director. Highly qualified applicants are considered for additional support and fellowships. For more information about external and other KU funding options, please visit http://www.engr.ku.edu/prospective/graduate/scholarships.html.

Admission to the Bioengineering Graduate Program
Ph.D. applicants are expected to have an undergraduate grade point average of 3.5 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. Students with a degree in an engineering discipline outside of bioengineering may be required to take additional courses (e.g., in the life sciences). Students with a degree from outside engineering may be required to take additional courses (e.g., in the physical sciences, mathematics, and engineering). These additional courses generally do not count toward the graduate degree.

A highly qualified applicant (with a grade-point average higher than 3.75) 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 student may enter the bioengineering graduate program before meeting all the prerequisites if approved by the Graduate Studies Committee. This student must plan to complete the prerequisites during the program in addition to the degree requirements. Consultation with the academic director is required to determine which courses satisfy these requirements. Course credits from prerequisites generally do not apply toward the graduate degree; they must be completed with a grade of B or higher.

The application deadline for fall admission is December 15th and the deadline for spring admission is September 30th. A complete application should include: completed online application, application fee payment, transcripts of all college-level work, 3 letters of recommendation, a letter of intent or statement of purpose, and scores from the Graduate Record Examination (verbal, quantitative, and analytical). 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.

Unless the applicant's native language is English or the applicant has received a baccalaureate degree or higher from an accredited U.S. institution of higher education, he or she must meet the program's standard for the Test of English as a Foreign Language (TOEFL). Applicants for graduate teaching assistantships must obtain satisfactory scores on the Test of Spoken English (SPEAK).

Submit your graduate application online (http://www.graduate.ku.edu).

Application Instructions
General Information

Admissions to the Bioengineering Graduate Program is granted to domestic and international students who have a superior record of achievement in their previous studies and show strong potential to succeed in study and research at the graduate level.

Applicants normally have a Bachelors of Science degree or a Masters of Science degree in an engineering discipline, physical sciences (e.g. Chemistry, Physics, etc.), the life sciences (e.g. Biology, Biochemistry, etc.), or a closely related field.

Highly qualified undergraduate students may apply for admission directly into our Ph.D. program after completing their B.S. degree. Students who do not have an undergraduate degree in an Engineering discipline will generally be admitted to the MS degree.

Application Deadlines

In order to receive full consideration for fellowships and other awards, a complete application package should be submitted by the following deadlines:

- Fall Admission: December 15 (all applicants)
- Spring Admission: September 30 (all applicants)

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 to 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 is happy to work with all prospective students in determining the fit between the student and the program. In order to determine this, 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 early November and some highly qualified admitted students may be invited to participate in Visitation Days in late February or early March (prior to the fall semester of your intended matriculation). These organized visitation opportunities will allow you time 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 Bioengineering Program Assistant, bioe@ku.edu or (785) 864-5258, to schedule a visit or with questions about the bioengineering application process.

The University of Kansas
Bioengineering Graduate Program
Eaton Hall
1520 W. 15th Street, Room 1
Lawrence, KS 66045-7605

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).

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 (http://www.engr.ku.edu/graduate/steps.html).

**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.

**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**
Doctoral students must take the comprehensive examination after passing the qualifying examination, completing the research skills requirement, residency requirement, responsible scholarship requirement, and at least ¼ of the course work required in the Plan of Study. The examining committee for the comprehensive examination is generally the student’s doctoral advisory committee. Before the examination, the student must submit in writing to the committee a detailed NIH or NSF-style research proposal for a possible Ph.D. dissertation project. Any modifications to the format should be approved by the student’s doctoral advisory committee. The comprehensive examination evaluates the student’s ability to write an original research proposal, design experiments, and interpret results in a sound and critical manner. A more detailed description of the examination is available on the program’s website (http://bio.engr.ku.edu). 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. degrees, in conjunction with the School of Medicine (http://medicine.kumc.edu), 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. 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.