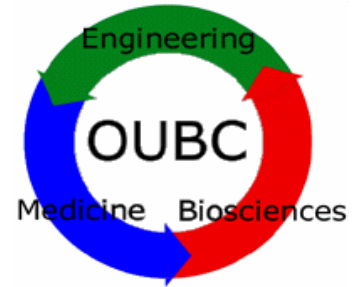


# The University of Oklahoma OU BIOENGINEERING CENTER

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## GRADUATE DEGREE PROGRAMS IN BIOENGINEERING

### MASTER OF SCIENCE IN BIOENGINEERING DOCTOR OF PHILOSOPHY IN BIOENGINEERING

Bioengineering is the use of engineering principles and technology to solve problems in medicine and biology. The goal of bioengineering research is to understand living systems and develop new and improved devices and products for medicine and biology. The principle objective of the graduate degrees in bioengineering is to provide a focused educational program in biomedical engineering for students seeking careers in industry, medicine, business and other fields related to biotechnology.

OU has a rich research history in biomedical engineering based on the collaborative activities of professors on the Norman and Health Sciences Center campuses beginning nearly a quarter of a century ago with early research toward an artificial liver and pioneering work in the use of thermography for mammograms. Research has more recently led to important work in the areas of blood substitutes, electrocardiology, implantable devices, software development, and tissue engineering. Officially established as a degree program in 2003, the interdisciplinary degrees in bioengineering are designed to increase the knowledge of biological systems and to detect and treat disease through the use of engineering principles and techniques and draws faculty resources from the Schools of Aerospace and Mechanical Engineering, Chemical, Biological and Materials Engineering, and Electrical and Computer Engineering and the University of Oklahoma Health Sciences Center.

Research in bioengineering advances the health of the nation and provides technology that has contributed to the development of novel devices, drugs and systems. Based on a history of collaboration between professors on the Norman and Health Sciences Center campuses, the OU College of Engineering received a special opportunity grant in 1999 from the Whitaker Foundation to establish the University of Oklahoma Bioengineering Center (OUBC) and create a graduate program. Eight new faculty members were added to the three Schools to expand research and teaching in bioengineering specialties.

The faculty of the OU Bioengineering Center are involved in a diverse array of research projects that aim to increase our understanding of the human body and that develop new and improved methods of diagnosis and treatment for a wide variety of disorders. Several faculty members are developing devices that can be implanted into the body to improve hearing or that will sense the level of sugar in the blood of diabetic patients. Another type of implantable device that is being developed here is tissue engineered blood vessels for cardiac bypass surgery as well as bone tissue for reconstructive surgery. Additional projects examine how implanted devices can be physically connected to the central nervous system. Some faculty are investigating the basic biochemical properties of various types of blood cells and how the functions of these cells are altered by the fluid mechanical environment found in the blood. Other

faculty members are developing novel drug delivery strategies for giving clot busting drugs to patients suffering from heart attack. Finally, some of the faculty are pioneering new methods to analyze images from x-ray and magnetic resonance imaging scans to detect cancer and other pathological conditions.

Any student with an undergraduate degree in engineering from an accredited school may be admitted as a student in full standing. It is recommended that students entering the program have taken at least one college biology course and one college organic chemistry course. A student with an undergraduate degree in the sciences may be admitted on the condition that specified undergraduate engineering and/or mathematics courses will have to be taken for completion of the degree program, which will depend on the background of each individual student. While here, the Masters and Doctoral students will continue to follow the general procedures of the Graduate College for their level of degree as well as the procedures of the Bioengineering Program.

## MASTER OF SCIENCE

The M.S. degree program requires thirty semester hours and can normally be completed in two years. A thesis is required. Course work requirements for the Master of Science degree in Bioengineering are the following:

Bioengineering Principles	3 hours
Three elective courses in bioengineering (graduate credit, see list below)	9 hours
Two elective courses in the life sciences (graduate credit, chosen from the list below of approved life science courses)	6 hours
Two elective courses in engineering, science, or math (graduate credit)	6 hours
M.S. Research Thesis course	<u>6 hours</u>
TOTAL	30 hours

## DOCTOR OF PHILOSOPHY

The Ph.D. degree in Bioengineering requires ninety post-baccalaureate hours, which include the courses required for the M.S. degree in Bioengineering and a minimum of nine additional hours of graduate level courses. Research credits make up the balance of the ninety hours. Three hours of this course work must be in the life sciences (graduate credit, chosen from the list below of approved life science courses), and the other six hours can be selected from engineering, science, or math courses (graduate credit) in consultation with the student's research supervisor. A student with a B.S. degree can enter the Ph.D. program directly; the student does not have to complete the M.S. thesis as part of the Ph.D. degree. At the end of the program, the student will demonstrate excellence in scholarly research by authoring and successfully defending a Ph.D. dissertation. Outstanding students may also want to apply for the M.D./Ph.D. program offered in conjunction with the OU Medical School in Oklahoma City (<http://w3.ouhsc.edu/mdphd/>).

During the Ph.D. program, the student is required to take a general examination in accord with Graduate College requirements. For students entering with a B.S. degree, the general examination must be taken as soon as possible after the student has completed three semesters (not including the summer semester). For students entering with an M.S. degree, the general examination must be taken as soon as possible after the student has completed one semester (not including the summer semester).

### Courses and Electives in the Bioengineering Program

#### Bioengineering Courses

AME G5213	-	Biomechanics I (Biosolids)
AME G5223	-	Biomechanics II (Biofluids)
AME G5233	-	Biomaterials
AME G5253	-	Implantable Devices
AME G5710	-	Topics in Solid Mech. - Neural Engineering
AME/CH E G5203	-	Bioengineering Principles

AME/CH E G5293	-	Transport in Biological Systems
CH E G5243	-	Biochemical Engineering
CH E G5373	-	Tissue Engineering
CH E G5480	-	Special Topics - Biosensors
CH E G5480	-	Special Topics – Cellular Aspects of Tissue Regeneration
ECE G4973	-	Special Topics - Engineering Principles of the Body
ECE G4990	-	Special Studies – Res. & Design Experience in Bioengineering
ECE G5823	-	Bioinstrumentation
ECE G5843	-	Medical Imaging Systems
ECE G5973	-	Special Topics - Computational Bioengineering
ECE G6813	-	Advanced Topics in Biomedical Engineering

**Life Science Courses:**

CHEM G3653	-	Introduction to Biochemistry
CHEM G5753	-	Principles of Biochemistry I
CHEM G5853	-	Principles of Biochemistry II
CHEM G6721	-	Seminar—Biochemistry
CHEM G6813	-	Introduction to Biochemical Methods
CHEM G6823	-	Protein, Nucleic Acids, & Gene Expression
CHEM G6833	-	Structure & Function of Membranes & Hormones
CHEM G6843	-	Enzyme Mechanisms & Metabolic Regulation
CHEM G6853	-	Protein Structure & Function
HSS G5823	-	Exercise Physiology
HSS G5833	-	Advanced Exercise Physiology Laboratory
HSS G5843	-	Biomechanics
HSS G5863	-	Physiology of Aging
MBIO G3932	-	Instrumental Methods in Biology
MBIO G3942	-	Instrumental Methods Laboratory
MBIO G4833	-	Basic Immunology
MBIO G5620	-	Investigations in Microbiology
MBIO G5812	-	Applications of Molecular Biology Laboratory
MBIO G5822	-	Applications of Molecular Biology
MBIO G5833	-	Industrial & Applied Microbiology
MBIO G5843	-	Introduction to Molecular Biology
MBIO G5893	-	Genetics and Plasmids & Bacterial Viruses
MBIO G5971	-	Seminar in Microbiology
ZOO G3101	-	Principles of Physiology Lab
ZOO G3103	-	Principles of Physiology
ZOO G3333	-	Genetics
ZOO G3342	-	Genetics Laboratory
ZOO G4123	-	Vertebrate Physiology
ZOO G4853	-	Neurobiology of Memory
ZOO G4913	-	Quantitative Biology
ZOO G5153	-	Endocrine Physiology
ZOO G5203	-	Mechanisms of Development
ZOO G5293	-	Cytology Ultrastructure
ZOO G5343	-	Developmental Genetics
ZOO G5364	-	Transmission Electron Microscopy
ZOO G5374	-	Scanning Electron Microscopy
ZOO G6012	-	Professional Aspects of Biology