STEPHENVSON SCHOOL OF BIOMEDICAL ENGINEERING

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General Information
The Peggy and Charles Stephenson School of Biomedical Engineering ties together OU’s Gallogly College of Engineering, the OU Health Sciences Center, Oklahoma Medical Research Foundation, the OU College of Arts and Sciences, the Price College of Business and the regional bioscience industry, offering an unprecedented level of health care collaboration and discovery in Oklahoma.

The successful and highly multidisciplinary graduate program was established after a Whitaker Foundation grant in the late 1990s, and the undergraduate program was launched in Fall 2016. SBME will be housed in Gallogly Hall, a new building currently under construction in the engineering quad that will be completed in 2019. The excellent team of faculty are focused on translational discoveries in healthcare areas including cancer, brain injury and disease, and musculoskeletal medicine.

Biomedical engineers enhance the quality of life through transformative research that provides solutions to complex medical challenges. From developing imaging tools that reduce the amount of patient exposure to radiation, developing quantitative imaging biomarkers for evaluating treatment responses of ovarian cancer or delivering photo thermal therapy using single-walled carbon nanotubes combined to treat cancers more effectively, biomedical engineers are making an impact—one life at a time.

Core focus areas include
- biomechanics
- molecular, cellular and tissue engineering
- biomedical micro- and nano-technology
- bioimaging; biotransport and neural engineering

Programs & Facilities
Institute for Biomedical Engineering, Science and Technology

The University of Oklahoma Institute for Biomedical Engineering, Science and Technology (IBEST) spans research and education activities in bioscience and biomedical engineering on the Norman and Oklahoma City campuses. Students may select either a degree objective from traditional areas of engineering with a biomedical engineering option or an interdisciplinary degree program in biomedical engineering. Individuals with exceptional academic records may choose to pursue the M.D.-Ph.D. in conjunction with the OU Medical School.

Diversity & Inclusion
The Stephenson School of Biomedical Engineering nurtures a culture of diversity and inclusion, and offers resources for our faculty, staff, and students.

Gallogly Hall
Gallogly Hall, situated on the Engineering Quad between Felgar Hall and the ExxonMobil Lawrence G. Rawl Engineering Practice Facility, will provide Stephenson School of Biomedical Engineering students and faculty with world-class biomedical engineering facilities to learn, study and research. The 70,000 square-foot facility is scheduled to be completed Fall 2019.

Undergraduate
Bachelor of Science in Biomedical Engineering

The Bachelor of Science in Biomedical Engineering focuses on current and strategic future strengths of our faculty members: Bioimaging, Biotransport, Neural Engineering, Biomechanics, Molecular, Cellular and Tissue Engineering, and Biomedical Micro-/Nano-Technology. Courses are intended to build on previous engineering and life science courses to truly integrate engineering with biology and medicine. They are also pathways to advanced biomedical engineering courses and research, allowing students the flexibility to individualize their curriculum to meet their career objectives. Our bachelor’s degree graduates will have a strong foundation in biomedical engineering with opportunities for focus within areas of the field. In addition to engineering principles, the program is built on a solid foundation of the basic sciences (chemistry, physics and biology) and mathematics.

Undergraduate students and prospective students interested in biomedical engineering or bioengineering can also follow the pre-med option available in the Schools of Aerospace and Mechanical Engineering (AME) or Industrial and Systems Engineering (ISE), or either the pre-med/biomedical engineering option or biotechnology option available in the School of Chemical, Biological and Materials Engineering (CBME). These curricula provide a solid foundation in engineering and the biosciences that can be supplemented with elective courses and undergraduate research opportunities available from the University of Oklahoma Biomedical Engineering Center.

Bachelor of Science in Biomedical Engineering/Master of Science

The Accelerated B.S./M.S. degree program may be of interest to some students. Among the courses offered are introduction to biomedical engineering, biochemical engineering, bioinstrumentation, neural engineering, biotransport, medical imaging, biomaterials, biomechanics, cellular and tissue engineering, and biosensors.

PROGRAM EDUCATIONAL OBJECTIVES FOR BME B.S. GRADUATES TO ATTAIN WITHIN A FEW YEARS OF GRADUATION:

1. Successful career advancement: Graduates will be advancing in their careers in the healthcare industry or in related technical professions, or continuing their education in professional school (e.g., medicine, dentistry, law, business) or graduate school.
2. Technical ability: Graduates will be utilizing their skills as engineers to apply a creative approach to problem solving in their chosen career path.
3. Positive contributors to society: Graduates will be effective team members and communicators who infuse global perspective,
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 Biomedical engineering Program. More application information and application forms are available on the website.

DOCTOR OF PHILOSOPHY
A student with a B.S. degree can enter the Biomedical Engineering doctoral 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.

M.D./Ph.D. COMBINED PROGRAM
Students completing this program will receive two degrees: M.D. and Ph.D. in Bioengineering. The M.D. program satisfies requirements for both degrees including completion of the clinical, advisory conference, general exam, written dissertation and oral defense components. Individuals pursing the M.D./Ph.D. program would be prepared to practice and teach medicine in a research setting and/or conduct biomedical research that requires a combination of expertise in medicine and bioengineering.

Admission to the program requires a B.S. degree in engineering from an accredited program. In exceptional cases, students with degrees in other technical areas may be admitted upon addressing deficiencies identified by the M.D./Ph.D. Advisory Committee and the Graduate Program Coordinator of the Bioengineering Program. Admission means acceptance by the University of Oklahoma College of Medicine (includes sitting for the MCAT, the AMCAS report, etc.) the Graduate College of the University of Oklahoma-Norman, the Bioengineering Program of OUBC, and the M.D./Ph.D. Advisory Committee. The GRE is not required, but may be submitted with the application. The minimum GPA (4.0 scale) for the Bioengineering Program is 3.50 and the minimum GPA for the College of Medicine is 3.0.

Additional information about degree options and application forms are available from the OUBC web pages or the OUBC office. Information about the OU Medical School at the Health Sciences Center in Oklahoma City can be found at their web pages.

Courses
BME 2333 Biomedical Engineering Fundamentals 3 Credit Hours
Prerequisite: Majors only; MATH 1914 or 1823; MATH 2924 or 2423; CHEM 1315; CHEM 1415; and PHYS 2514 all with a grade of B or better. Introduction to material, energy, charge, and momentum balances in biological systems. Steady state and transient conservation equations for mass, energy, charge, and momentum will be derived and applied using basic mathematical principles, physical laws, stoichiometry, and thermodynamic properties. (F)
BME 2433  Signals and Systems for Biomedical Engineering  3 Credit Hours
Prerequisite: BME 2333; completion or concurrent enrollment in ENGR 2431; course is not open to freshmen. Students learn circuits and linear systems concepts necessary for analysis and design of biomedical systems. Theory is motivated by examples from biomedical engineering. Topics covered include electrical circuit fundamentals, operational amplifiers, frequency response, electrical transients, impulse response, transfer functions, and convolution, all motivated by circuit and biomedical examples. Elements of continuous time domain-frequency domain analytical techniques are developed. (Sp)

BME 3111  Bioimaging Lab  1 Credit Hour
Prerequisite: ISE 3293; completion or concurrent enrollment in BME 3113; majors only. Hands-on lab that teaches students technical skills associated with bioimaging. Lab components include hypothesis testing and analysis, computer simulation, lab safety and instrument training, and technical communication. (F, Sp)

BME 3113  Bioimaging  3 Credit Hours
Prerequisite: BME 2333; BME 2433; PHYS 2524 and MATH 3113. Introduction to medical imaging techniques such as x-ray, computed tomography, magnetic resonance, and ultrasound. (F, Sp)

BME 3121  Biotransport Lab  1 Credit Hour
Prerequisite: ISE 3293; completion or concurrent enrollment in BME 3123; majors only. Hands-on lab that teaches students technical skills associated with biotransport. Lab components include hypothesis testing and analysis, computer simulation, lab safety and instrument training, and technical communication. (F, Sp)

BME 3123  Biotransport  3 Credit Hours
Prerequisite: BME 2333; PHYS 2524 and MATH 3113. Covers key transport concepts in biomedical engineering. Emphasis is put on mass and momentum transport with applications related to biology, medical science and biotechnology. (F, Sp)

BME 3131  Bioelectricity Lab  1 Credit Hour
Prerequisite: ISE 3293; completion or concurrent enrollment in BME 3133; majors only. Hands-on lab that teaches students technical skills associated with electrobiology. Lab components include hypothesis testing and analysis, computer simulation, lab safety and instrument training, and technical communication. (F, Sp)

BME 3133  Bioelectricity  3 Credit Hours
Prerequisite: BME 2333; 2433; PHYS 2524 and MATH 3113. The electrophysiology of excitable cells from a quantitative perspective. Topics include the ionic basis of action potentials, quantitative models for nerve and muscle including the Hodgkin-Huxley equations, impulse propagation, synaptic dynamics, source-field relationships, and an introduction to functional electrical stimulation. (F, Sp)

BME 3141  Biomechanics Lab  1 Credit Hour
Prerequisite: ISE 3293; completion or concurrent enrollment in BME 3143; majors only. Hands-on lab that teaches students technical skills associated with biomechanics. Lab components include hypothesis testing and analysis, computer simulation, lab safety and instrument training, and technical communication. (F, Sp)

BME 3143  Biomechanics  3 Credit Hours
Prerequisite: BME 2333; PHYS 2524 and MATH 3113. Analysis of human motion, evaluation of tissue solid mechanics, and identification of principal planes and stresses. (F, Sp)

BME 3151  Molecular, Cellular and Tissue Engineering Lab  1 Credit Hour
Prerequisite: ISE 3293; completion or concurrent enrollment in BME 3153; majors only. Hands-on lab that teaches students technical skills associated with molecular, cell, and tissue engineering. Lab components include hypothesis testing and analysis, computer simulation, lab safety and instrument training, and technical communication. (F, Sp)

BME 3153  Molecular, Cellular and Tissue Engineering  3 Credit Hours
Prerequisite: BME 2333, MATH 3113 and BIOL 1124. Application of engineering methods to study, measure, repair, or replace biological functions at the molecular, cellular, or tissue-level length scales. (F, Sp)

BME 3161  Biomedical Micro-/Nano-Technology Lab  1 Credit Hour
Prerequisite: ISE 3293; completion or concurrent enrollment in BME 3163; majors only. Hands-on lab that teaches students technical skills associated with BME micro/nanotechnology. Lab components include hypothesis testing and analysis, computer simulation, lab safety and instrument training, and technical communication. (F, Sp)

BME 3163  Biomedical Micro-/Nano-Technology  3 Credit Hours
Prerequisite: BME 2333; PHYS 2524; MATH 3113; majors only. Introduction to micro/nanotechnology in biomedical settings, including micro/nanotechnologies used to investigate biological systems, physiological responses to nanotherapeutics, and first principles of microfluidics and microfabrication. (F, Sp)

BME 3233  Biomaterials  3 Credit Hours
Prerequisite: PHYS 2524; majors only and junior or senior standing in the Gallogly College of Engineering, or permission of instructor. Introduction to materials used in biomedical environment, the design and use of implantable materials, such as metals, polyethylene, ceramics, and composites, biocompatibility, test methods, and tissue growth on biomaterials. (F)

BME 3440  Mentored Research Experience  3 Credit Hours
0 to 3 hours. Prerequisites: ENGL 1113 or equivalent, and permission of instructor. May be repeated; maximum credit 12 hours. For the inquisitive student to apply the scholarly processes of the discipline to a research or creative project under the mentorship of a faculty member. Student and instructor should complete an Undergraduate Research & Creative Projects (URCP) Mentoring Agreement and file it with the URCP office. For not for honors credit. (F, Sp, Su)

BME 3533  Biomedical Instrumentation  3 Credit Hours
Prerequisite: BME 2433. Measurement and analysis of biopotentials and biomedical transducer characteristics; electrical safety applications of FET's; integrated circuits, operational amplifiers for signal processing and computer interfacing; signal analysis and display on the laboratory minicomputer. (Sp)

BME 3722  Numerical Methods in Biomedical Engineering  2 Credit Hours
Prerequisite: C S 1213, MATH 3113 and BME 2333; majors only. Introduces principles and techniques of numerical analysis of biomedical engineering problems. Covers numerical methods of integration, differentiation, interpolation, curve fitting, data analysis, sampling and estimation, error analysis, analysis of ordinary differential equations, numerical modeling of biomedical engineering systems, symbolic computation, and scientific visualization. (F)

BME 3980  Honors Research  1-3 Credit Hours
1 to 3 hours. Prerequisite: admission to Honors Program. May be repeated; maximum credit 6 hours. Selected students work with individual faculty members on research problems in biomedical engineering. (F, Sp, Su)
BME 4281  Engineering Co-Op Program  1 Credit Hour
(Crosslisted with AME, C S, CEES, CH E, ECE, IS and EPHY 4281)
Prerequisite: Departmental permission and junior standing. May be
repeated; maximum credit 6 hours. The Co-Op program provides students
an opportunity to enhance their education via career exploration in
related professional work experiences. Course assignments help
students articulate their experiences by completing journals; mid-term
paper; final paper and/or final presentation. Faculty receive an evaluation
from the student's Co-op supervisor who monitors performance. Faculty
collaborate with the Co-Op supervisor to ensure student success. (F, Sp,
Su)

BME 4713  Biomedical Engineering Design I  3 Credit Hours
Prerequisite: BME 3533; Senior standing in the BS in BME curriculum.
Structured methodologies for designing systems or to interface with
living systems. Creative design, analysis, selection, development, and
fabrication of biomedical components and systems. (F)

BME 4823  Biomedical Engineering Design II  3 Credit Hours
Prerequisite: BME 4713. Development of team projects in biomedical
engineering with emphasis on prototype development and quantitative
analysis, and written and oral reporting of the outcome. Capstone. (Sp)

BME 4970  Special Topics/Seminar  1-3 Credit Hours
1 to 3 hours. Prerequisite: Senior standing or permission of instructor.
May be repeated; maximum credit nine hours. Special topics or seminar
course for content not currently offered in regularly scheduled courses.
May include library and/or laboratory research and field projects. (Irreg.)

BME 5023  Bioengineering Principles  3 Credit Hours
(Crosslisted with AME 5203 and CH E 5203) Prerequisite: MATH 3113
and PHYS 2524. Principles of bioengineering for the areas of the
biomechanics of solids and fluids, mass transfer, biomaterials, electrical
networks, imaging, and ionizing radiation as they apply to the human
body. (F)

BME 5213  Biomechanics I  3 Credit Hours
(Crosslisted with AME 5213) Prerequisite: AME 3143 and AME 3153 or
permission of instructor. Introduction to physiological systems with
emphasis on structure and function of tissues and organs; application
of continuum mechanics to understanding of tissue and organ behavior
at microscopic and macroscopic levels; viscoelastic behavior at
microscopic and macroscopic levels; viscoelastic and solid biomaterials.
(F)

BME 5223  Biomechanics II  3 Credit Hours
Prerequisite: AME 3143 and AME 3153 or permission of instructor.
Biofluid mechanics; non-Newtonian behavior of blood and body fluids;
basic mechanical properties of muscle, bone, cartilage, and other living
tissues; application of continuum mechanics to circulation; growth and
change of living organs in response to stress and strain. (Sp)

BME 5233  Biomaterials  3 Credit Hours
(Crosslisted with AME 5233) Prerequisite: graduate standing and
permission of instructor. Introduction to materials used in biomedical
environment, the design and use of implantable materials (such as
metals, polyethylene, ceramics, composites), biocompatibility, test
methods, and tissue growth on biomaterials. (Sp)

BME 5243  Biochemical Engineering  3 Credit Hours
(Crosslisted with CH E 5243) Prerequisite: CH E 3123 or permission
of instructor. Current bioprocesses for reaction and separation
with emphasis on fundamental principles of chemical engineering,
biochemistry, and microbiology. (Sp)

BME 5293  Transport in Biological Systems  3 Credit Hours
(Crosslisted with AME 5293 and CH E 5293) Prerequisite: CH E 3123
or permission of instructor. Theoretical and practical aspects of
transport phenomena in living organisms and biomedical technologies.
Applications include hemorheology, drug delivery, extracorporeal
circulation and artificial organs. (Irreg.)

BME 5363  Optical Engineering  3 Credit Hours
(Crosslisted with ECE 5363) Prerequisite: ECE 3793. Underlying theory
and design of optical systems. Interference, diffraction and coherence
phenomena will be examined as a basis for studying the limits of
optical system performance. Other topics include a detailed study of
polarization, the interaction of light with various media and geometrical
optics. (Sp)

BME 5373  Tissue Engineering  3 Credit Hours
(Crosslisted with CH E) Prerequisite: graduate standing or permission
of instructor. Examines the background and recent advances in the science
of combining multiple cell types with an appropriate support to provide a
construct that can replace or support damaged tissue. (Irreg.)

BME 5393  Introduction to Computer-Aided Tissue
Engineering  3 Credit Hours
Prerequisite: graduate standing or permission of instructor. Designed
for graduate and senior undergraduate students in Engineering majors.
Describes advanced computer-aided technology for medical implant
design and tissue engineering applications. Topics include reverse
engineering, biomodeling and layered manufacturing. Course content is
delivered through lecture- and laboratory-based hands-on training. (Sp)

BME 5563  Cellular Aspects in Tissue Regeneration  3 Credit Hours
Prerequisite: graduate standing or permission of instruct. Introduce
novel technological advancements utilizing cells in tissue regeneration.
Issues covered in class include adult and embryonic stem cells, cell
differentiation, cell culture, transplantation of engineered tissues and
cells, ethical and FDA considerations. (Irreg.)

BME 5703  Biology for Engineers  3 Credit Hours
Prerequisite: graduate standing or permission of instructor. Provides
engineering students with an understanding of key biological concepts,
where the interface between biology and engineering is broadened.
Introduces engineers to the biological science by an integrated approach.
(Irreg.)

BME 5723  Biosensors  3 Credit Hours
Prerequisite: graduate standing or permission of instructor. Introduction
to the fundamental principles of biosensors within the medical field.
Topics covered include electrochemical sensing potentiometric and
amperometric biosensors, fiberoptic biosensors, immobilization of
biorecognition molecules (enzymes, antibodies, receptor proteins),
semiconductor electrodes and ion-selective electrodes. (Irreg.)

BME 5853  Biomedical Signals and Systems  3 Credit Hours
(Crosslisted with ECE 5853) Prerequisites: ECE 3723 and ECE 3793,
or equivalent course in electrical circuits and signal processing, or
permission of instructor. Comprehensive coverage of topics related to
signals in humans. Emphasis on using engineering tools to interpret
signals and underlying physiological principles. Focus on emerging
engineering technologies, physiological knowledge and clinical
application. (Sp)
BME 5960  Directed Readings  1-3 Credit Hours
1 to 3 hours. Prerequisite: graduate standing or permission of department. May be repeated; maximum credit six hours. Directed readings and/or literature reviews under the direction of a faculty member. (Irreg.)

BME 5970  Special Topics/Seminar  1-3 Credit Hours
1 to 3 hours. Prerequisite: Graduate standing or permission of instructor. May be repeated; maximum credit nine hours. Special topics or seminar course for content not currently offered in regularly scheduled courses. May include library and/or laboratory research and field projects. (Irreg.)

BME 5980  Research for Master's Thesis  1-6 Credit Hours
1 to 6 hours. Prerequisite: graduate standing or permission by instructor. May be repeated; maximum credit toward degree six hours. (F, Sp, Su)

BME 5990  Independent Study  1-3 Credit Hours
1 to 3 hours. Prerequisite: graduate standing or permission by instructor. May be repeated; maximum credit six hours. Contracted independent study for a topic not currently offered in regularly scheduled courses. Independent study may include library and/or laboratory research and field projects. (Irreg.)

BME 6213  Optical Information Processing  3 Credit Hours
(Crosslisted with ECE 6213) Prerequisite: ECE 5213 and ECE 5353. Application of Fourier transforms, linear systems, and diffraction theory to the analysis of optical systems. Emphasis is on the use of optical systems for information processing, including image enhancement, pattern recognition, data processing, optical switching, and computing. (F)

BME 6960  Directed Readings  1-3 Credit Hours
1 to 3 hours. Prerequisite: graduate standing or permission of instructor. May be repeated; maximum credit six hours. Directed readings and/or literature review under the direction of a faculty member. (Irreg.)

BME 6970  Advanced Topics in Bioengineering  1-6 Credit Hours
1 to 6 hours. Prerequisite: graduate standing or instructor permission. May be repeated with change of topic; maximum credit towards degree six hours. Selected topics of current faculty research interest at the PhD level not covered by regularly scheduled courses. (Irreg.)

BME 6980  Research for Doctoral Dissertation  1-16 Credit Hours
1 to 16 hours. Prerequisite: graduate standing or permission of instructor. May be repeated. (F, Sp, Su)

BME 6990  Independent Study  1-3 Credit Hours
1 to 3 hours. Prerequisite: graduate standing and permission of instructor. May be repeated; maximum credit nine hours. Contracted independent study for a topic not currently offered in regularly scheduled courses. Independent study may include library and/or laboratory research and field projects. (Irreg.)

Faculty

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<thead>
<tr>
<th>Last Name</th>
<th>First/Middle Name</th>
<th>Middle init.</th>
<th>OU Service start</th>
<th>Title(s), date(s) appointed</th>
<th>Degrees Earned, Schools, Dates Completed</th>
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<tr>
<td>Acar</td>
<td>Handan</td>
<td></td>
<td>2017</td>
<td>ASSISTANT PROFESSOR OF BIOMEDICAL ENGINEERING, 2017; STEPHENSON PROFESSOR IN BIOMEDICAL ENGINEERING 2017</td>
<td>PhD, Bilkent Univ, 2013</td>
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<tr>
<td>Detamore</td>
<td>Michael</td>
<td>S</td>
<td>2016</td>
<td>STEPHENSON CHAIR, 2016; PROFESSOR OF BIOMEDICAL ENGINEERING, 2016</td>
<td>PhD, Rice Univ, 2004; BS, Univ of Colorado, 2000</td>
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<tr>
<td>Tang</td>
<td>Qinggong</td>
<td></td>
<td>2018</td>
<td>ASSISTANT PROFESSOR OF BIOMEDICAL ENGINEERING, 2018</td>
<td>PhD, Univ of Maryland</td>
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<tr>
<td>Wilhelm</td>
<td>Stefan</td>
<td></td>
<td>2017</td>
<td>STEPHENSON PROFESSOR IN BIOMEDICAL ENGINEERING, 2017; ASSISTANT PROFESSOR OF BIOMEDICAL ENGINEERING, 2017</td>
<td>PhD, Univ of Regensburg 2014; MS, Univ of Regensburg, 2010; BS, Univ of Regensburg, 2006</td>
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<tr>
<td>Yuan</td>
<td>Han</td>
<td></td>
<td>2015</td>
<td>ASSISTANT PROFESSOR OF BIOMEDICAL ENGINEERING, 2015</td>
<td>PhD, Univ of Minnesota, 2010; BS, Tsinghua Univ, 2005</td>
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