STEPHENSON 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, Health Sciences Center, College of Arts and Sciences, Price College of Business, the Oklahoma Medical Research Foundation, 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 the fall of 2016. SBME is housed in Gallogly Hall, completed in the fall of 2019, which is located in the engineering quad.

The faculty of the OU Stephenson School of Biomedical Engineering (SBME) focus on the development of new and improved materials and technologies for the diagnosis and treatment for a wide variety of healthcare needs. While SBME has two strategic research clusters – Immunoengineering and Neuroengineering, the SBME faculty have a variety of research specialties in the following areas:

- Peptide-based materials and applications in biomedical engineering
- Nano-engineered sensing and treatment
- Scholarship of teaching & learning and clinical biomechanics
- Local ablation-based immunotherapy for metastatic cancers
- Neuro-immuno-engineering immunotherapies for neurological diseases
- Computational neuroimaging and neuroengineering
- Regenerative medicine
- Engineering education and single particle elemental analysis
- Multi-omics analysis for cancer therapy and vaccine development
- Engineering education and biomimetic therapeutics/cell-instructive materials
- Biomedical imaging for diagnostics and imaging-guided therapeutics
- Biomaterials
- Nanomaterials
- Brain and psychological networks
- Neuroimaging and neuromodulation

Mission Statement

The mission of the Stephenson School of Biomedical Engineering is to educate the next generation of biomedical engineers and to create new technologies that advance human health.

Biomedical Engineering

Biomedical engineers enhance the quality of life through transformative research that provides solutions to complex medical challenges. From developing immunoengineering approaches for treatment of metastatic cancers, nanotechnologies for drug delivery, neuroimaging and neuromodulation for brain research, to developing multimodality biomedical imaging for diagnostics and imaging-guided therapeutics, biomedical engineers are making an impact – one life at a time.

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.

Faculty from the lead departments – School of Sustainable Chemical, Biological and Materials Engineering, School of Aerospace and Mechanical Engineering, School of Electrical and Computer Engineering, and School of Computer Science – work with bioscientists and biomedical engineers from OU's College of Arts and Sciences in Norman and OU Health Sciences Center and Oklahoma Medical Research Foundation in Oklahoma City.

Facilities

In the fall of 2019, Gallogly Hall opened its doors. This 70,000-square-foot building offers lab space for biomedical engineering research and training programs.

The Bachelor of Science in Biomedical Engineering is accredited by the Engineering Accreditation Commission (EAC) of ABET*, under the General Criteria and the Bioengineering and Biomedical and Similarly Named Engineering Programs Program Criteria.*

Bachelor of Science *, under the General Criteria and the Bioengineering and Biomedical and Similarly Named Engineering Programs Program Criteria.*

The Bachelor of Science in Biomedical Engineering focuses on the 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-medical/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 biosciences that can be supplemented with elective courses and undergraduate research opportunities available from the University of Oklahoma Biomedical Engineering Center.

Bachelor of Science/Master of Science

The Accelerated B.S./M.S. degree program in Biomedical Engineering 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 are advancing in their careers, either in technical roles in the healthcare/life sciences industry, or continuing their education in professional school (e.g., medicine, dentistry, law, business) or graduate school.
2. **Positive contributors to society:** Graduates are solving healthcare problems with the goal of benefiting the quality of life for people of varied communities, infusing creative, technically competent, evidence-based, and global perspectives.
3. **Interdisciplinary team contributors:** Graduates are communicating effectively, valuing the views and contributions of interdisciplinary team members, and contributing to team success.

The Bachelor of Science in Biomedical Engineering is accredited by the Engineering Accreditation Commission (EAC) of ABET*, under the General Criteria and the Bioengineering and Biomedical and Similarly Named Engineering Programs Program Criteria.*

BME B.S. Students are Assessed for the Following Outcomes:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Accelerated Dual B.S. / M.S.

BS in Biomedical Engineering / MS in Biomedical Engineering (A108/ F109 Q062)

Students completing this program will receive two degrees: a B.S. and an M.S. in Biomedical Engineering. This program is accelerated because students may share 12 hours of credit that apply to both their undergraduate and graduate degrees. Students should apply for this program option by March 1 of their junior year. Please contact Nicole Palmeter (npalmeter@ou.edu) for the application materials to apply.

Master of Science

The Biomedical Engineering, Master of Science degree program can be readily completed in two years. A thesis is required.

Application Information

In addition to meeting the general requirements of the Graduate College, 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 master's student will continue to follow the general procedures of the Graduate College as well as the procedures of the Biomedical Engineering Program. More application information and application forms are available on the SBME website.

Doctor of Philosophy

The Ph.D. degree in Biomedical Engineering requires ninety post-baccalaureate hours. A student with a B.S. degree can enter the Biomedical Engineering, Doctor of Philosophy degree program directly; the student does not have to complete the M.S. thesis as part of the Ph.D. degree. A student with an M.S. degree can enter the Ph.D. program directly. At the end of the program, the student will demonstrate excellence in scholarly research by authoring and successfully defending a Ph.D. Dissertation.

During the Ph.D. program, the student is required to take a general examination in accordance 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). While here, the doctoral student will continue to follow the general procedures of the Graduate College as well as the procedures of the Biomedical Engineering Program. More application information and application forms are available on the SBME website.

Doctor of Medicine / Doctor of Philosophy in Biomedical Engineering

Students completing this program will receive two degrees: M.D. and Ph.D. in Biomedical Engineering. The M.D. program satisfies the requirements for both degrees including completion of the clinical, advisory conference, general exam, written dissertation, and oral defense components. Individuals pursuing this degree will 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 biomedical engineering.

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 Stephenson School of Biomedical Engineering, 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 Biomedical Engineering Program and the College of Medicine is 3.0.

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

Courses

BME 1421 Introduction to Biomedical Engineering 1 Credit Hour
Prerequisite: Freshman Standing. This course serves as an introduction to and overview of biomedical engineering. Course content serves to provide appreciation for the breadth of the biomedical engineering field and to guide first year students in making curriculum, major, and career choices. (F, Sp)

BME 2333 Biomedical Engineering Fundamentals 3 Credit Hours
Prerequisite: Course is not open to freshmen; Majors only; MATH 1823 or 1914; MATH 2423 or 2924; CHEM 1315 or 1335; CHEM 1415 or 1435; and PHYS 2514, and BME 1421 or permission of instructor. 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; ECE 2723 or concurrent enrollment; 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 2970 Special Topics/Seminar 1-3 Credit Hours
1 to 3 hours. Prerequisite: 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 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 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 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 3143 Biomechanics 3 Credit Hours
Prerequisite: BME 2333, PHYS 2524, and MATH 3113. Analysis of human motion, evaluation of tissue solid mechanics, and use of momentum balance in fluid mechanics. (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 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 3171 Biomedical Engineering Lab 1 1 Credit Hour
Prerequisite: Junior standing; ISE 3293 or departmental permission; BME 3143 or concurrent enrollment; majors only. Hands-on lab that teaches students technical skills associated with BME biomechanics, and also includes topics such as bioelectricity and bioimaging. Lab components include hypothesis testing and analysis, computer simulation, lab safety and instrument training, and technical communication. (F)

BME 3181 Biomedical Engineering Lab 2 1 Credit Hour
Prerequisite: Junior standing; BME 3171; BME 3123 or concurrent enrollment, and BME 4813 or concurrent enrollment; majors only. Hands-on lab that teaches students technical skills associated with biotransport and quantitative physiology, and includes topics such as molecular, cellular & tissue engineering, bioimaging, and micro/nanotechnology. Lab components include hypothesis testing and analysis, computer simulation, lab safety and instrument training, and technical communication. (Sp)

BME 3233 Biomaterials 3 Credit Hours
Prerequisite: BIOL 1124, BME 2333, PHYS 2524, and BME 3143; majors only; 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 3243 Biomechanics of Human Movement 3 Credit Hours
Prerequisite: BME 3143. This course introduces advanced undergraduate students to musculoskeletal biomechanics and the quantitative analysis of human movement. Topics covered will include rigid-body kinematics, dynamics, motion capture, external force measurement, electromyography, and mechanical properties of muscles and tendons. (Sp)

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. Not for honors credit. (F, Sp, Su)

BME 3531 Bioinstrumentation Lab 1 Credit Hour
Prerequisite: BME 2433, corequisite BME 3533; Majors only. Fundamental circuit elements and concepts include resistance, capacitance, inductance, op-amps, impedance, voltage, current, power, and frequency. Fundamental analog measurement concepts include adequate bandwidth and amplitude and phase linearity. Examples of medical measurements and devices are included for the fundamental circuit and measurement concepts covered above. Introduction of laboratory instruments used to simulate measurements of and direct measure physiological events. (F)

BME 3533 Biomedical Instrumentation 3 Credit Hours
Prerequisite: Majors only; BME 2433 and ECE 2723. 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: Majors only; C S 1213, MATH 3113, and BME 2333. Introduces principles and techniques of numerical analysis of biomedical engineering problems using software packages. Covers numerical methods of interpolation, curve fitting, solving linear systems, analysis of ordinary and partial differential equations, numerical modeling of biomedical engineering systems, symbolic computation, and scientific visualization. (F)

BME 3723 Numerical Methods in Biomedical Engineering 3 Credit Hours
Prerequisite: Majors only; CS 1213; MATH 3113; and BME 2333. Introduces principles and techniques of numerical analysis of biomedical engineering problems using software packages. Covers numerical methods of interpolation, curve fitting, solving linear systems, analysis of ordinary and partial equations, numerical modeling of biomedical engineering systems, symbolic computation, and scientific visualization. (F)

BME 3960 Honors Reading 1-3 Credit Hours
1 to 3 hours. Prerequisite: admission to Honors Program. May be repeated; maximum credit six hours. Consists of topics designated by the instructor in keeping with the student's major program. Covers materials not usually presented in the regular courses. (F, Sp, Su)

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 4013 Introduction to Medical Device Design 3 Credit Hours
(Slashlisted with BME 5013; Crosslisted with AME 4013) Prerequisite: Junior standing or permission of instructor. Introduction to medical device design with emphasis on the entire procedure of developing a medical device from identifying the unmet medical need to product launching. Topics include marketing and technology survey, concept development, the biocompatible material, device prototype, bench test, in vitro/in vivo test, clinical trial and FDA regulation. No student may earn credit for both 4013 and 5013. (Sp)

BME 4050 Design Projects in Biomedical Engineering 3 Credit Hours
0 to 3 hours. Prerequisite: Permission of Instructor. May be repeated; maximum credit 6 hours. This course is designed for students who are participating in design and project based experiences. This course is different from mentored research in that the student is expected to have completed a functioning prototype or design solution by the end of the experience. Credit hours may vary, based on the size, scope, and expectations of the project. (F, Sp)

BME 4093 Applied Biomechanics - Ear Mechanics 3 Credit Hours
(Slashlisted with BME 5093; Crosslisted with AME 4093) Prerequisite: Junior Standing; PHYS 2514; MATH 1823 or 1914; MATH 2423 or 2924; and CHEM 1315 all with a minimum grade of C or better. The course curriculum starts with a review of some basic solid mechanics and fluid mechanics. Then the course will review the applications of mechanics in different biosystems or organs. Finally, this course will cover how to apply mechanics on ear tissue mechanical measurements, ear modeling and ear implant design. No student may earn credit for both 4093 and 5093. (F)

BME 4243 Biochemical Engineering 3 Credit Hours
(Slashlisted with BME 5243; Crosslisted with CH E 4243) Prerequisite: CH E 3113 or permission of instructor. Current bioprocesses for reaction and separation with emphasis on fundamental principles of biochemical engineering, biochemistry, and microbiology. No student may earn credit for both 4243 and 5243. (Sp)

BME 4281 Engineering Co-Op Program 1 Credit Hour
(Crosslisted with AME, C S, CEES, CH E, ECE, ISE 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 4373 Tissue Engineering 3 Credit Hours
(Slashlisted with BME 5373; Crosslisted with CH E 4373) Prerequisite: senior 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. No student may earn credit for both 4373 and 5373. (Irreg.)

BME 4423 Genetic Engineering and Biotechnology 3 Credit Hours
(Slashlisted with BME 5423; Crosslisted with CH E 4423) Prerequisite: permission of instructor for upper-class undergraduates. The course will cover state-of-the-art technologies of manipulating and controlling genes, genomes and cellular pathways with a goal of engineering human (stem) cells and microbes for health, environmental and industrial applications. No student may earn credit for both 4423 and 5423. (F)

BME 4533 Neural Engineering 3 Credit Hours
(Slashlisted with BME 5533) Prerequisite: BME 3113 or BME 3133 or concurrent enrollment, or instructor permission. Principles and technologies of applying engineering to neuroscience, including areas as neural tissue engineering, models of neural function, neural interface and neuromodulation technology. Examples of neural engineering systems focus on brain-controlled interface and prosthetic systems currently in development or produced commercially, neurofeedback and brain stimulation systems for treating disorders such as depression. MATLAB(R) programming is required. No student may earn credit for both 4533 and 5533. (F)

BME 4713 Biomedical Engineering Design I 3 Credit Hours
Prerequisite: BME 3533 or concurrent enrollment; 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 G4813 Quantitative Physiology 3 Credit Hours
Prerequisite: BME 3722, junior standing, and majors only. Introduces students to the mathematical and numerical techniques used to develop, solve, and analyze quantitative models of physiology systems. (Sp)

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) [V].

BME 4873 Network Modeling and Analysis of Complex Systems 3 Credit Hours
(Slashlisted with BME 5873) Prerequisite: BME 3722 or permission of instructor. In this course, we will cover the key concepts and methodologies for studying the structure and dynamics of complex biological systems such as protein, genetic, and neural networks. No student may earn credit for both 4873 and 5873. (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 4980 Senior Thesis 1-3 Credit Hours
1 to 3 hours. Prerequisite: Senior standing, BME 3440 or BME 3980, and permission of instructor. The Senior Thesis is an option for seniors who are especially interested in research and/or intending to continue on to a PhD program. Students who have completed the first semester (fall of their senior year) and have satisfactorily passed the fall semester report will enroll in this course for the Spring of their senior year only. (Sp)

BME 5013 Introduction to Medical Device Design 3 Credit Hours
(Slashlisted with BME 4013; Crosslisted with AME 5013) Prerequisite: Graduate standing or permission of instructor. Introduction to medical device design with emphasis on the entire procedure of developing a medical device, from identifying the unmet medical need to product launching. Topics include marketing and technology survey, concept development, the biocompatible material, device prototype, bench test, in vitro/in vivo test, clinical trial, and FDA regulation. No student may earn credit for both 4013 and 5013. (Sp)

BME 5093 Applied Biomechanics - Ear Mechanics 3 Credit Hours
(Slashlisted with BME 4093; Crosslisted with AME 5093) Prerequisite: Graduate Standing. The course curriculum starts with a review of some basic solid mechanics and fluid mechanics. Then the course will review the applications of mechanics in different biosystems or organs. Finally, this course will cover how to apply mechanics on ear tissue mechanical measurements, ear modeling and ear implant design. No student may earn credit for both 4093 and 5093. (F)

BME 5113 Special Topics in Cancer 3 Credit Hours
Prerequisite: Graduate standing and permission of instructor. Students will develop an appreciation of the tools available at hand to dissect the molecular mechanisms controlling cancer development such that they can take this knowledge to the bench to develop their own graduate research. (Sp)

BME 5123 Biophotonics Imaging Microscopy 3 Credit Hours
Prerequisite: Graduate standing; BME 2333; BME 2433; PHYS 2524 and MATH 3113; or instructor permission. Optical imaging, spectroscopy, and microscopy have become indispensable tools in modern biomedical research. This course will cover the principles and instrumentation of various biomedical optical techniques, including fluorescence and Raman spectroscopy, confocal and multi-photon microscopy, optical coherence tomography, and diffuse optical tomography. Biomedical applications, particularly on cancer and brain research, will also be discussed. (F)

BME 5133 Therapeutic Biophotonics 3 Credit Hours
Prerequisite: Graduate standing, BME 4813 or permission of the instructor. This course will introduce the effects of photothermal, photochemical, photomechanical, photoimmunological, and photomodulational interactions. Applications of biophotonics in treatment of cancer and other diseases in basic, translational, and clinical studies will be discussed. Modern multiomics technologies, such as spatial and/or single cell transcriptomics for analysis of phototherapy induced biological effects will also be discussed. (Sp)

BME 5143 Biosensor: Fundamentals and Applications 3 Credit Hours
Prerequisite: Graduate standing or Permission of Instructor. Healthcare, precision medicine, and self-monitoring of health all depend on biosensors. The goal of the course is to provide students a thorough introduction to the topic of biosensors as well as a quantitative and in-depth understanding of device design and performance evaluation. (Sp)

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 5233 Biomaterials 3 Credit Hours
Prerequisite: Graduate standing, BME 3233, 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
(Slashlisted with BME 4243; Crosslisted with CH E 5243) Prerequisite: CH E 5971; graduate standing or instructor permission. Current bioprocesses for reaction and separation with emphasis on fundamental principles of biochemical engineering, biochemistry, and microbiology. No student may earn credit for both 4243 and 5243. (Sp)

BME 5283 ImmunoEngineering 3 Credit Hours
Prerequisite: Graduate standing or permission of instructor. The immune system plays a big role to maintain the homeostasis in our body. It provides the first reaction to external stresses, such as pathogens, biomaterials and implants, and cancer. Dysregulations in immune system can cause autoimmune diseases or determine our fate when we are exposed to external diseases. (Sp)

BME 5293 Transport in Biological Systems 3 Credit Hours
(Crosslisted with CH E 5293) Prerequisite: Chemical Engineering Graduate standing or permission of instructor; CH E 5971. 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
(Slashlisted with BME 4373; Crosslisted with CH E 5373) Prerequisite: CH E 5971; graduate standing, admission into Gallogly College of Engineering 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. No student may earn credit for both 4373 and 5373. (Irreg.)

BME 5413 Nanomedicine 3 Credit Hours
Prerequisite: BME 3163 and permission of instructor. Introduction to nanomaterials used in preclinical and clinical stages; the design, application, and evaluation of nanomaterials to diagnose and treat diseases, including cancer. (Sp)

BME 5423 Genetic Engineering and Biotechnology 3 Credit Hours
(Slashlisted with BME 4423; Crosslisted with CH E 5423) Prerequisite: Graduate standing in CBME or SBME, or permission of instructor. The course will cover state-of-the-art technologies of manipulating and controlling genes, genomes and cellular pathways with a goal of engineering human (stem) cells and microbes for health, environmental and industrial applications. No student may earn credit for both 4423 and 5423. (F)

BME 5443 Neural System and Rehabilitation Engineering 3 Credit Hours
Prerequisite: Graduate standing or permission of instructor. Advanced knowledge of neural control of movement, musculoskeletal system, and movement impairment and disability will be discussed. Topics include the frontiers of rehabilitation engineering, including assistive technologies, brain-computer interfaces, non-invasive brain stimulation, regenerative rehabilitation, and machine learning in rehabilitation. The students will learn writing skills for NIH/AHA aims page for research projects in the field of rehabilitation (Sp)

BME 5453 Polymer Science and Engineering 3 Credit Hours
(Crosslisted with CH E 5453) Prerequisite: Chemical Engineering Graduate standing or permission of instructor; CH E 5971. This course will be focused on the synthesis, characterization, processing, and properties of state-of-the-art polymeric and multicomponent polymeric materials. Students should come into the course with a background knowledge of polymers such as that found in an Engineering Materials and/or Organic Chemistry Course. (Sp)

BME 5533 Neural Engineering 3 Credit Hours
(Slashlisted with BME 4533) Prerequisite: Graduate standing or permission of instructor. Principles and technologies of applying engineering to neuroscience, including neural tissue engineering, models of neural function, neural interface, and neuromodulation technology. Examples of neural engineering systems focus on brain-controlled interface and prosthetic systems currently in development or produced commercially, and neurofeedback and brain stimulation systems for treating disorders such as depression. MATLAB(R) programming is required. No student may earn credit for both 4533 and 5533. (F)

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 5863 Bioinstrumentation 3 Credit Hours
(Crosslisted with ECE 5863) Prerequisite: ECE 4213 or permission of the instructor. A comprehensive coverage of topics related to principles, applications, and design of medical instruments widely used in hospitals and clinical researches. Emphasis is placed on general design concepts, discussions on a great variety of medical devices, and medical device safety issues. Materials cover different levels and various aspects of human systems, such as heart, brain, circulation, respiration. (F, Sp)

BME 5873 Network Modeling and Analysis of Complex Systems 3 Credit Hours
(Slashlisted with BME 4873) Prerequisite: graduate standing or permission of instructor. In this course, we will cover the key concepts and methodologies for studying the structure and dynamics of complex biological systems such as protein, genetic, and neural networks. No student may earn credit for both 4873 and 5873. (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 sic 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 5971 Seminar in Biomedical Engineering Research 1 Credit Hour
Prerequisite: Graduate standing and BME majors only; May be repeated with change of content; maximum credit 6 hours. The department will invite speakers and the graduate students to present their ongoing research. Students will learn the frontiers in biomedical engineering and relevant fields and will have the opportunity for discussion with leading scientists. Students will also be encouraged to present their own research work and get feedback from faculty and peers. (F, Sp)

BME 5973 Special Topics in Electrical and Computer Engineering 3 Credit Hours
(Crosslisted with ECE 5973) Prerequisite: Graduate standing and permission of instructor. May be repeated with change of content; maximum credit 12 hours. Selected topics of current research interest not covered by regularly scheduled coursework. (F, Sp, Su)

BME 5980 Research for Master's Thesis 2-6 Credit Hours
2 to 6 hours. Prerequisite: graduate standing or permission by instructor. May be repeated; maximum credit toward degree six hours. Directed research culminating in the completion of the master's thesis. (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 with change of subject matter; 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
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 2-16 Credit Hours
2 to 16 hours. Prerequisite: Graduate standing and permission of instructor; may be repeated. Directed research culminating in the completion of the doctoral dissertation. (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

Last Name	First/Middle Name	Middle init.	OU Service start	Title(s), date(s) appointed	Degrees Earned, Schools, Dates Completed
Acar	Handan		2017	ASSISTANT PROFESSOR OF BIOMEDICAL ENGINEERING, 2017; STEPHENSON PROFESSOR IN BIOMEDICAL ENGINEERING 2017	PhD, Bilkent University, 2013; MS, Ankara University, 2008; BS/MA, Gazi University, 2006
Breen	Sarah		2021	ASSOCIATE PROFESSOR OF BIOMEDICAL ENGINEERING, 2021	PhD, University of Limerick, 2012; BS, University of Limerick, 2008
Chen	Wei	R	2020	INTERIM DIRECTOR, PROFESSOR OF BIOMEDICAL ENGINEERING, 2020; STEPHENSON PROFESSOR IN BIOMEDICAL ENGINEERING 2020	PhD, University of Oregon, 1988; MS, University of Oregon, 1984; BS, Shandong University, 1982
Clegg	John		2021	ASSISTANT PROFESSOR OF BIOMEDICAL ENGINEERING, 2021	PhD, University of Texas, 2019; MA, University of Texas, 2018; MS, University of Texas, 2016; BS, University of South Carolina, 2014
Detamore	Michael	S	2016	FOUNDING DIRECTOR, 2016; STEPHENSON CHAIR, 2016; PROFESSOR OF BIOMEDICAL ENGINEERING, 2016	PhD, Rice University, 2004; BS, University of Colorado, 2000
Ding	Lei		2007	PROFESSOR OF BIOMEDICAL ENGINEERING, 2018; DIRECTOR OF INSTITUTE FOR BIOMEDCIAL ENGINEERING, SCIENCE, AND TECHNOLOGY (IBEST), 2016	PhD, University of Minnesota, 2007; BE, Zhejiang University, 2000
Frickenstein	Alex		2023	ASSISTANT PROFESSOR, 2023	PhD, University of Oklahoma, 2023; BS Colorado State University, 2019
Liu	Kaili		2023	RESEARCH ASSISTANT PROFESSOR OF BIOMEDICAL ENGINEERING, 2023	PhD, Chinese Academy of Sciences, 2011; BS, Nanjing Agricultural University, 2005
Rouf	Tahrima Binte		2022	VISITING ASSISTANT PROFESSOR OF BIOMEDICAL ENGINEERING, 2022	PhD, Purdue University, 2019; BS Bangladesh University of Engineering and Technology, 2012
Scott	Rebecca		2021	ASSISTANT PROFESSOR OF BIOMEDICAL ENGINEERING, 2021	PhD, Purdue University, 2014; BS, Saint Louis University, 2010
Tang	Qinggong		2018	ASSISTANT PROFESSOR OF BIOMEDICAL ENGINEERING, 2018	PhD, University of Maryland, 2017; BP, Huazhong University of Science and Technology, 2012
Townsend	Jakob		2023	RESEARCH ASSISTANT PROFESSOR OF BIOMEDICAL ENGINEERING, 2023	PhD, University of Oklahoma, 2017; BS, Oregon State University, 2014
Wilhelm	Stefan		2017	ASSOCIATE PROFESSOR OF BIOMEDICAL ENGINEERING, 2017; STEPHENSON PROFESSOR IN BIOMEDICAL ENGINEERING, 2017	PhD, University of Regensburg 2014; MS, University of Regensburg, 2010; BS, University of Regensburg, 2006
Yuan	Han		2015	ASSOCIATE PROFESSOR OF BIOMEDICAL ENGINEERING, 2015	PhD, University of Minnesota, 2010; BS, Tsinghua University, 2005

Zamani Esfahlani	Farnaz	2023	ASSISTANT PROFESSOR OF BIOMEDICAL ENGINEERING, 2023	PhD, State University of New York at Binghamton, 2018; MS, State University of New York at Binghamton, 2015; BA, University of Tabriz, 2012