Students must complete 6 credit hours of combined science electives

EBME 406 ***(3 credit hours)***: *Polymers in Medicine*

This course covers the important fundamentals and applications of polymers in medicine, and consists of three major components: (i) the blood and soft-tissue reactions to polymer implants; (ii) the structure, characterization and modification of biomedical polymers; and (iii) the application of polymers in a broad range of cardiovascular and extravascular devices. The chemical and physical characteristics of biomedical polymers and the properties required to meet the needs of the intended biological function will be presented. Clinical evaluation, including recent advances and current problems associated with different polymer implants.

EBME 411 ***(3 credit hours)***: *Underpinnings of the Extracellular Matrix*

This class presents the fundamentals of collagenous tissues in a combined lecture/seminar format. Details at the molecular, fibrillar and whole tissue levels are presented. Applications ranging from how to obtain collagen molecules, to synthesizing gels for use in tissue engineering, to design and creation of collagen based materials for replacement and/or augmentation of several tissues are presented. A series of guest lectures by researchers currently using and/or developing collagen based materials are presented. Throughout the course, students choose articles of interest, present them to the class, and participate in discussions surrounding these presentations. The course concludes with a series of in-class presentations by the students who pick a specific application of interest to them and then demonstrate how the fundamentals presented in the first portion of the class play out in their application. While not required, it is recommended that students have an undergraduate course in biomaterials, two semesters of undergraduate biology, and organic chemistry.

EBME 426 ***(3 credit hours)****: Nanomedicine*

Principles of the design and application of nanomedicine, including nanosized drug delivery systems, protein delivery systems, gene delivery systems and imaging probes. Methods for bioconjugation and surface modifications. Structure property relationships of nanosized biomaterials. In vivo and intracellular transport, pharmacokinetics, biodistribution, drug release kinetics, and biocompatibility of

various nanosized therapeutics and diagnostics. Theranostics, image-guided drug delivery and therapy.

EBME 440 ***(3 credit hours)***: *Translational Research for Biomedical Engineers*

Translational Research (TR) in the Biomedical Engineering context means translating laboratory discoveries or developments into improved health care. Topics and activities include: Interdisciplinary teamwork and communication; Research ethics and human subjects protection; Regulation and oversight of human subjects and animal research; Clinical validation study design and biostatistics; Intellectual property, technology transfer and commercialization; Physician shadowing; Attending Grand Rounds and Morbidity-Mortality conferences; Preparing IRB and IACUC protocols; Final integrative project.

EBME 451 ***(3 credit hours)***: *Molecular and Cellular Physiology*

This course covers cellular and molecular basics for graduate students with little or no prior biology background. The emphasis of EBME 451 is on the molecular and cellular mechanisms underlying physiological processes. Structure-function relationship will be addressed throughout the course. The primary goal of the course is to develop understanding of the principles of the physiological processes at molecular and cellular level and to promote independent thinking and ability to solve unfamiliar problems. This course is no longer a core course of the Biomedical Engineering graduate curriculum but serves as a fundamentals course to prepare students for the graduate cellular and molecular physiology core.

EBME 473 ***(3 credit hours)***: *Fundamentals of Clinical Information Systems*

Technology has played a significant role in the evolution of medical science and treatment. While we often think about progress in terms of the practical application of, say, imaging to the diagnosis and monitoring of disease, technology is increasingly expected to improve the organization and delivery of healthcare services, too. Information technology plays a key role in the transformation of administrative support systems (finance and administration), clinical information systems (information to support patient care), and decision support systems (managerial decision-making). This introductory graduate course provides the student with the opportunity to gain insight and situational experience with clinical

information systems (CIS). Often considered synonymous with electronic medical records, the "art" of CIS more fundamentally examines the effective use of data and information technology to assist in the migration away from paper-based systems and improve organizational performance. In this course we examine clinical information systems in the context of (A) operational and strategic information needs, (B) information technology and analytic tools for workflow design, and (C) subsequent implementation of clinical information systems in patient care. Legal and ethical issues are explored. The student learns the process of "plan, design, implement" through hands-on applications to select CIS problems, while at the same time gaining insights and understanding of the impacts placed on patients and health care providers. Offered as EBME 473, IIME 473 and SYBB 421.

Review all course descriptions via the CWRU General Bulletin