Marnix E. Heersink Institute for Biomedical Innovation Graduate Programs

The Heersink Institute offers graduate certificate and masters degree programs to meet the needs of innovation and digital-minded clinicians, leaders and scholars.

Certificate Programs

Digital Healthcare Certificate

Artificial Intelligence in Medicine

Translation of Biomedical Innovation to Clinical Practice

BMEM-Biomedical Engineering Courses

BMEM 601. Biomedical Innovation and Clinical Translation I. 3 Hours.
This lecture and team-based project focused course will provide a detailed overview of the device design process and focus on important issues to be considered for successful translation of preliminary designs into viable clinical products. This course will include a final team-based project focused on a providing a biomedical device for a hypothetical problem selected by the group.

BMEM 602. Biomedical Innovation and Clinical Translation II. 3 Hours.
This lecture and team-based project will be a continuation of BME-M 601. The business and commercialization aspects of a marketable design will be explored. This course will focus on the important business issues to be considered for successful translation of preliminary designs into viable clinical products. This course will include a final team-based presentation (with an accompanying report) to obtain funding from investors.

BMEM 603. Regulatory, Legal and Ethical Perspectives. 3 Hours.
This lecture and team-based project will be a continuation of BME-M 602. The regulatory, legal, and ethical aspects of a marketable design will be explored; specifically how this will modify the final marketable design. This course will include a final team-based oral and written presentation (accompanying report) to include information necessary for an FDA submission as well as an updated commercialization plan to give to investors.

BMEM 610. Design and Regulation of Stem Cell and Tissue Engineered Products. 3 Hours.
The overall objective of this course is to provide a broad introduction to regenerative and therapeutic strategies enabled using stem cells and tissue engineering. This course will provide an overview of the different types of stem cells, discuss their potential for regenerative medicine and cellular therapeutics, introduce basic concepts in tissue engineering, and discuss regulatory and ethical issues associated with the use of stem cells and tissue-engineered products.

BMEM 611. Biomedical Device Design. 3 Hours.
This design course focuses on the development of solutions to clinical problems that require the use of implants and medical devices. Topics covered include a detailed overview of the design process of implants and biomedical devices including the role of stress analysis in the design process; anatomic fit, shape and size of implants; selection of bio-materials; instrumentation for surgical implantation procedures; pre-clinical testing for safety and efficacy, risk assessment evaluation of clinical performance and design of clinical trials.

BMEM 612. Lab-on-a-chip and Point-of-Care Diagnostic Technologies. 3 Hours.
This course will introduce lab-on-a-chip (LOC) technologies used for point-of-care (POC) diagnostics. Specifically, this course will detail design considerations, fabrication techniques, current advances in sensing and detection, data acquisition and analysis, and quality control. This course will also provide an overview of regulatory challenges associated with the development and approval of these technologies for use in patients. Finally, this course will provide examples of point-of-care technologies classified based on clinical use and clinical setting.

BMEM 613. Implantable Devices and Biomaterials. 3 Hours.
The overall objective of this course is to provide a comprehensive review of tissue-material interactions to guide the design on biomedical devices for in-vivo transplantation. Specific topics will include an overview of commonly used bio-materials, their interactions with blood and the immune system and strategies to prevent unwanted tissue responses and promote beneficial responses.

BMEM 614. Wearable Device Technologies. 3 Hours.
The overall objective of this course is to provide a comprehensive overview of currently used wearable devices, provide a basic understanding of the current technologies, their advantages for continuous patient monitoring and current limitations. This course will also provide a broad overview of potential new markets and opportunities for wearable devices over the next decade.

BMEM 615. Design and Use of Tissue Chips, Organ Chips & Microphysiological Systems. 3 Hours.
The overall objective of this course is to provide a an introduction to human tissue chips and microphysiological systems that are poised to replace animal based drug testing with human in-vitro model based approaches. This course will outline the basics of tissue chips and complex microphysiological systems, provide an overview of current state of the field, outline limitations and challenges and discuss potential opportunities for disease modeling, drug discovery and drug toxicity testing.

BMEM 616. Direct Reprogramming 101. 3 Hours.
Dysfunction or degradation of cells in our body leads to devastating human disorders. The discovery of direct reprogramming opens the avenue to (re)generate the desired cell types for both research purposes and disease treatment. This course will cover the history and biological basis of direct reprogramming, outline direct reprogramming achieved in different cell types, and their implications in answering basic biomedical questions and treating human diseases. We will also overview the current state of the field and discuss the obstacles and potential opportunities to be applied with other bioengineering technologies.

BMEM 617. Pain Management. 3 Hours.
The overall objective of this course is to provide a an introduction to human disease with pain. Pain management is an aspect of medicine and health care involving relief of pain in various dimensions, from acute and simple to chronic and challenging. Effective pain management does not always mean total eradication of all pain. Rather, it often means achieving adequate quality of life in the presence of pain, through any combination of lessening the pain and/or better understanding it and being able to live happily despite it.

HCI-Healthcare Innovation Courses

HCI 611. Foundations of Artificial Intelligence in Medicine. 3 Hours.
This course introduces students to the fundamentals needed for implementing Artificial Intelligence (AI) in clinical settings. Introduction to AI, Introduction to Healthcare System and Clinical data and Introduction to tools and techniques used in AI.

HCI 612. Applications of Artificial Intelligence in Medicine. 3 Hours.
This course introduces students to Applications of AI in medicine, Machine Learning- Applications of AI to EHR data, Deep Learning- Applications of AI to Medical Imaging data, and Natural Language Processing- Applications of AI to Clinical Documentation.
Prerequisites: HCI 611 [Min Grade: C](Can be taken Concurrently) or HCI 611 [Min Grade: C](Can be taken Concurrently)

HCI 613. Leadership and Ethics for Artificial Intelligence in Medicine. 3 Hours.
This course introduces students to leadership, ethical and strategic skills, responsible AI, AI strategy, people, organization, and implementation of AI in medicine.
Prerequisites: HCI 611 [Min Grade: C](Can be taken Concurrently) or HCI 611 [Min Grade: C](Can be taken Concurrently)

HCI 614. Integration of Artificial Intelligence into Clinical Workflow. 3 Hours.
This course introduces students to strategies and processes for integrating AI into existing clinical workflows. Using AI for Medical Diagnosis, Using AI for Medical Prognosis, and Using AI for Medical Treatment.
Prerequisites: HCI 611 [Min Grade: C](Can be taken Concurrently) or HCI 611 [Min Grade: C](Can be taken Concurrently)

HCI 641. Foundations of Digital Health. 3 Hours.
This course introduces students to the basic concepts needed for implementing digital health solutions in health care. Digital Health Concepts and Key Components, Digital Health Technologies, and Digitally Enabled Care Models.

HCI 642. Leadership & Ethics for Digital Health. 3 Hours.
This course introduces students to leadership, ethical and strategic skills for digital health. Business and Commercialization Strategies, Ethics, Digital Health Technology Assessment.
Prerequisites: HCI 641 [Min Grade: C](Can be taken Concurrently) or HCI 641 [Min Grade: C](Can be taken Concurrently)

HCI 643. Special Topics for Digital Health. 3 Hours.
This course introduces students to special topics in digital health including blockchain in health care, mixed reality in health care and data science for digital health.

HCI 644. Health Care Innovation and Management. 3 Hours.
This course introduces students to the concepts of healthcare innovation and builds knowledge of managing healthcare innovations, fostering an innovative culture in healthcare settings, and assessing and prioritizing innovation from a strategic perspective.

HCI 645. The Organization of Healthcare Innovation. 3 Hours.
This course exposes students to organizational theories and practice related innovation. The course specifically builds knowledge and skills in analyzing the healthcare innovation case using organizational theories, as well as evaluating possibilities and limitations of organizational theories in encouraging and sustaining innovation.

HCI 646. Business Skills for Healthcare Innovation. 3 Hours.
This course provides in-depth knowledge and skills in the financial aspects of healthcare innovation, analyzing healthcare markets and marketing and considerations for start-ups and social enterprises in healthcare.

HCI 647. Healthcare Innovation Metrics and Assessment. 3 Hours.
This course builds student knowledge and skills in economic approaches to health care evaluations, health technology assessment, cost-benefit analysis, and application of health economic approaches to analyze healthcare innovations.

HCI 648. New Technologies and Healthcare. 3 Hours.
This course develops student knowledge of emerging technologies in healthcare including but not limited to digital health innovations, Al and Robotics, Internet of Things and Biosensors.

HCI 649. Design Thinking in Healthcare. 3 Hours.
Design Thinking and Innovation will teach you how to leverage fundamental design thinking principles and innovate problem solving tools to address business challenges and build products, strategies, teams and environments for optimal use and performance.

HCI 650. Making New Healthcare Markets. 3 Hours.
This course focuses on how to identify and capitalize upon marketplace design opportunities. Defines markets and marketplaces and describes the basic functions of each. Discusses attributes (e.g., heterogeneity of participants' preferences and asymmetry in available information) that determine whether and how marketplaces create value. Explains common causes of market failure; presents a framework for designing marketplaces in response. Discusses tactics for building trust and liquidity when launching new market places as well as challenges encountered as marketplaces mature (e.g. congestion and disintermediation).

HCI 680. Special Topics in Healthcare Innovation. 1-3 Hour.
Rotating special topics course focusing on healthcare innovation topics.

HCI 685. Healthcare Innovation Practicum I. 3 Hours.
This course consists of a group project and of classes addressing issues typically encountered in health care innovation projects in companies, start-up or in the health care provider organizations. Examples of these issues are concerned with innovation design, needs analysis, development of value propositions, markets and pricing of medical products, or issues in organizational implementation of innovation. Students focus on a specific innovation challenge in a specific company or health provider organization (typically a hospital). The project carries out fieldwork in its host organization to obtain the most fruitful problem statement, to collect data and to present and discuss solutions.

HCI 686. Healthcare Innovation Practicum II. 3 Hours.
This course consists of a project addressing issues typically encountered in health care innovation projects in companies, start-up or in the health care provider organizations. Examples of these issues are concerned with innovation design, needs analysis, development of value propositions, markets and pricing of medical products or issues in organizational implementation of innovation. Students focus on a specific innovation challenge in a specific company or health provider organization. The students carry out field work in its host organization to obtain the most fruitful problem statement, to collect data and to present and discuss solutions.

HCI 719. Foundations of AI in Medicine for Healthcare Leaders. 3 Hours.
This course equips healthcare executives and clinical leaders with the essential knowledge and strategic frameworks needed to successfully implement AI solutions within their organizations. Through a blend of theoretical foundations and practical applications, students will develop the expertise to lead AI initiatives that enhance patient care, operational efficiency, and clinical outcomes.

PSDO - Physician Scientist Dev Courses

PSDO 630. Physician Experience. 2 Hours.
PSDO 630 will provide practical information and experience for highly qualified students considering medical school or other health-care based professional programs. The course will emphasize real world considerations of the clincial professions including acceptance criteria, expected duration of training, average debt and compensation of various specialties. The students will also be given multiple opportunities to interact with individuals from various levels of training and backgrounds to provide focused and nuanced guidance. Finally, the course will incorporate a shadowing experience, providing students the opportunity to observe and interact with practitioners from across UAB in a variety of specialties and settings. Each student will be required to complete documentation for the UAB and Children's hospital, as well as receiving clearance from UAB Employee Health, as well as completing an online HIPAA compliance module. Students are not permitted to shadow until each is complete.

PSDO 698. Master's Level Non-Thesis Research. 1-8 Hour.
Students may perform independent study in a research laboratory setting. This work may contribute toward the concentration credits subject to program director approval.

PSDO 699. Master's Level Thesis Research. 1-8 Hour.
Students perform independent study in a research laboratory setting. This work contributes directly to the completion of the degree and meets the degree requirements for graduation.

PSDO 700. Pathway to Grant Submission. 2 Hours.
This course is designed to give students a basic background in topics necessary to succeed as a physician scientist in today's academic medical environment. Topics to be covered include the NIH funding system, how to write a fellowship, record keeping, authorship and publication, conflict of interest, animal and human subjects, and finding a mentor (Open to MD-PhD, ARISE-MD, and DMD-PhD students).

PSDO 701. Career Development Grant Writing Workshop. 1 Hour.
This course is designed to assist postdocs, residents, fellows, and rising junior faculty with the creation and submission of a K award or equivalent grant application. Topics to be covered include the NIH funding system, how to write a fellowship, how to submit animal protocols, and how to submit IRB forms. Individuals will be given a variety of reading assignments from which they will be expected to participate in group discussions and/or presentations. They will also be expected to prepare a fellowship application that will be submitted to an NIH Funding agency.

PSDO 720. Critical Approaches & Clinical Evaluation of Kidney Disease. 1 Hour.
Enhance knowledge of kidney disease physiology to include expansion of the themes from the Mount Desert Island Biologic Laboratory (MDIBL) course on the "Origins of Renal Physiology" Promote structured critical thinking skills focused on kidney disease. Enhance experimental design skills for the development and testing of new hypotheses. Enhance constructive reviewing skills. Engage in the culture and language of medicine through exposure to a range of clinical experiences. Provide opportunities for PROmoTE scholars and clinical faculty to discuss areas where basic science and clinical medicine intersect and where new information could be beneficial. Expose PROmoTE scholars to clinical problems and a variety of team-based investigation.

PSDO 798. PSDO Non-Dissertation Research. 1-8 Hour.
Non-Dissertation research. Only open to ARISE-MD students.

PSDO 799. PSDO Dissertation Research. 1-8 Hour.
Dissertation research. Only open to ARISE-MD students.
Prerequisites: GAC Z