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
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 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 biomaterials; instrumentation for surgical implantation procedures; preclinical 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 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 an introduction to
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.

HCl-Healthcare Innovation Courses

HCl 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.

HCl 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: HCl 611 [Min Grade: C](Can be taken Concurrently) or
HCl 611 [Min Grade: C](Can be taken Concurrently)

HCl 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: HCl 611 [Min Grade: C](Can be taken Concurrently) or
HCl 611 [Min Grade: C](Can be taken Concurrently)

HCl 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: HCl 611 [Min Grade: C](Can be taken Concurrently) or
HCl 611 [Min Grade: C](Can be taken Concurrently)

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

HCl 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: HCl 641 [Min Grade: C](Can be taken Concurrently) or
HCl 641 [Min Grade: C](Can be taken Concurrently)

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

HCl 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.

HCl 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.

HCl 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.

HCl 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.

HCl 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, AI and
Robotics, Internet of Things and Biosensors.

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

HCl 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).

HCl 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.

HCl 686. Hlthcre Innovation Prac Il. 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.
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 clinical 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.

Students may perform independent study in a research laboratory setting. This work may contribute toward the concentration credits subject to program director approval.

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