Master’s Degree in Translational Health Technology

Description
This Masters degree in Biomedical Engineering is designed to develop expertise in translating biomedical ideas into clinical implementation. This degree can be completed in one year for full time students. It is offered by the Biomedical Engineering department at CWRU, and takes advantage of the large pool of expertise in Biotechnology on the campus of CWRU. It combines aspects of bioengineering, marketing, entrepreneurship, bioregulatory affairs, with ethics and experimental design. The program will require students to take a minimum of 27 credits including a design project.

Prerequisite: Biomedical Engineering Degree or equivalent or consent of program director

Special Features:
- Eight courses plus 4-hours of project
- Portions available through Distance Learning
- Flexible program to accommodate professionals schedule
- Lock-Step Program. Duration 1 year: August to August
- Projects can be done within the place of work

Curriculum
<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Semester</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBME 491</td>
<td>Introduction to Translational Health Technology</td>
<td>Fall and Summer</td>
<td>2.0</td>
</tr>
<tr>
<td>IIME450</td>
<td>Engineering Entrepreneurship</td>
<td>Fall</td>
<td>3.0</td>
</tr>
<tr>
<td>EPBI 446</td>
<td>Experimental Design for Biosciences</td>
<td>Fall</td>
<td>3.0</td>
</tr>
<tr>
<td>ETHC 4001</td>
<td>Clinical Ethics</td>
<td>Fall</td>
<td>3.0</td>
</tr>
<tr>
<td>IIME 473</td>
<td>Clinical Information Systems</td>
<td>Fall</td>
<td>3.0</td>
</tr>
<tr>
<td>IIME 446</td>
<td>Models of Health Care</td>
<td>Spring</td>
<td>1.5</td>
</tr>
<tr>
<td>IIME 447</td>
<td>Bio-Regulatory Affairs</td>
<td>Spring</td>
<td>1.5</td>
</tr>
<tr>
<td>IIME 472</td>
<td>BioDesign</td>
<td>Spring</td>
<td>3.0</td>
</tr>
<tr>
<td>EBME xxx</td>
<td>Biomedical Engineering Technical Elective</td>
<td>Fall or Summer</td>
<td>3.0</td>
</tr>
<tr>
<td>EBME 498</td>
<td>Advanced BioDesign</td>
<td>Summer</td>
<td>4.0</td>
</tr>
</tbody>
</table>

Total: 27.0

Full-Time Schedule*

<table>
<thead>
<tr>
<th>Orientation</th>
<th>Third week of August (2 days Th &amp; Fr before 1st day of classes)</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall Semester</td>
<td>Four courses</td>
<td>9.0</td>
</tr>
<tr>
<td></td>
<td>Laboratory experience</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>Progress Seminar - First week in January (1-day, resident) For distance learning students only</td>
<td></td>
</tr>
<tr>
<td>Spring Semester</td>
<td>Four courses</td>
<td>12.0</td>
</tr>
<tr>
<td>Summer Semester</td>
<td>Advanced BioDesign</td>
<td>4.0</td>
</tr>
<tr>
<td>Comprehensive Oral Exam: Third week of August (1 day); same week as orientation</td>
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</table>

*Notes: Part-time students take only a maximum of 2 courses/semester
Courses already taken can be replaced by other courses
Elective courses must be from BME course list; content should match the project topic.

Contact: Dominique Durand, dxd6@case.edu or Colin Drummond colin.drummond@case.edu
Course Descriptions
Most courses are taught in the evening and all courses can be taken through distance learning

**EBM 491: Introduction to Translational Technology (2 credits)**  
Fall and Summer  
This course is designed to introduce the student to translational health technology. It will consist of 4 full time concentrated study: Days 1 and 2 can be an intensive series of lectures and interactive workshops providing essential intellectual and social development to prepare the student for the master’s program. Day 3: Participation in incumbent student presentation from the previous year. Day 4: (August the following year): Student Capstone Presentation. *Schedule of classes is flexible but student must be on campus.*

**IIME450: Engineering Entrepreneurship (3 credits)**  
Fall  
The nature and importance of entrepreneurship is an area of importance to business leaders, educators, politicians, and individual members of the society. It is a driver of economic development and wealth creation in organization units ranging in size from the individual company to entire nations. This can occur while starting an enterprise (i.e., entrepreneurship) or while driving innovation in an existing organization (intrapreneurship). This course will also take students through a variety of issues related to enhancing innovation in the context of a technology-based organization. This is sometimes termed intrapreneurship and includes innovating new products and services within an organization. This is a very complex field and relatively young. Students will learn that there are not many "absolute truths," but there are numerous best practices and benchmarks that can assist the entrepreneur.

**EPBI 446: Experimental Design for Biosciences (3 Credits)**  
Fall  
This course deals with basic problems of the design and analysis of experiments with emphasis on experiments conducted in the biomedical sciences. Topics will include completely randomized and balanced incomplete block designs. Latin and Greco-Latin squares, factorial experiments and response surface and mixture designs. In addition to analysis and interpretation of results from experiments, optimization of design parameters, using second-order models will be covered. The course is intended for graduate students and investigators who are engaged in biomedical research.

**ETHC 4001: Clinical Ethics (3 credits)**  
Fall  
This elective will provide a direct experience with clinical ethics. Students will be assigned a primary mentor with whom they will meet weekly. They will also spend time in clinical settings such as a medical intensive care unit, a burn unit, a chronic care facility, a hospice and other locations to be chosen by students. Students will keep a journal of ethical issues and problems that they will discuss with their mentors. During their month rotation, students will be expected to do appropriate reading. Clinical experiences will be at MetroHealth Medical Center. With the objective to provide a concentrated experience with clinical ethics, the student will be required to participate in ethics committee meetings, clinical rounds, and observation in various clinical settings. Appropriate readings will be selected by mentor based on area of interest. Weekly meeting with faculty members. Students must meet with the sponsor two weeks before elective begins in order to plan and design their unique clinical experience. It is the student's responsibility to set up this meeting; without it, the clerkship cannot begin.
EBME473: Clinical Information systems (3 credits)  Fall
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.

EBME 495: Models of Health Care System (1.5 credits)  Spring
This course is for professionals who will pursue their careers in, or associated with, the health care industry; and therefore, need to understand the structure, operations and decision influences in the health care delivery system. The course is intended to develop competence and confidence in the participant's ability to understand and operate in the industry. the largest and, perhaps, the most complex in the United States. It is applicable to the private and public, profit and not-for-profit sectors. In this course students are introduced to: the different systems of care delivery; their organization and operations; their markets and the nature of the demand for their services; and the dynamics of their interoperation among themselves and with other entities in the industry (e.g., payors/insurers, regulators and accreditors, technology and pharmaceuticals suppliers). (Offered as HSMC 446 and IIME 446.)

BIOS 447: Bio-Regulatory Affairs (1.5 credits)  Spring
This mini-course introduces students to the Food and Drug Administration (FDA) and the laws and regulations it enforces. A scientific regulatory agency with far reaching enforcement authority, FDA is the most powerful consumer protection agency in the world. This course will familiarize students with FDA's mission, philosophy and organizational structure, as well as policy and procedure it uses to ensure the safety and effectiveness of the food, drugs, biologics, cosmetics, medical devices and radiation-emitting products it regulates. Recommended preparation: Enrollment in the MEM Biomedical Entrepreneurship Track. Offered as BIOS 447, HSMC 447, and IIME 447.

EBME XXX: Biomedical Engineering Technical Elective (3 credits)  Fall and Spring
Any 400-level class from the BME department is acceptable provided that the student meets the prerequisite requirements. A list of courses is available at https://bme.case.edu/Graduate/Courses
EBME 496: (IIME 472): BioDesign (3 credits)  
Spring  
Medical device innovations that would have been considered science fiction a decade ago are already producing new standards of patient care. Innovation leading to lower cost of care, minimally invasive procedures and shorter recovery times is equally important to healthcare business leaders, educators, clinicians, and policy-makers. Innovation is a driver of regional economic development and wealth creation in organizational units ranging in size from the start-up to the Fortune 500 companies. In a broader context, the pace of translational research leading to product and service innovation is highly interdisciplinary, thus, new products and services result from team efforts, marked by a systematic, structured approach to bringing new medical technologies to market and impacting patient care. In this course we examine medical technology innovations in the context of (A) addressing unmet clinical needs, (B) the process of inventing new medical devices and instruments, and (C) subsequent implementation of these advances in patient care. In short, the student learns the process of "identify, invent, implement" in the field of BioDesign.

EBME 498: Project in Advanced BioDesign (4 credits)  
Summer  
The course is a continuation of EBME 496 BioDesign and is intended to provide the students with an opportunity to refine the prototype of the project, collect additional data for safety and efficacy, write an animal protocol or an IDE for their project. A final presentation will take place at the end of the summer with the new incoming class. This project can be carried out at the place of employment. Schedule of classes is flexible but student must be on campus.

For more information please contact:

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