MASTER OF SCIENCE IN TRANSLATIONAL RESEARCH (MTR)

MTR 5100 Introduction to Clinical and Translational Research
This introductory course lays the foundation for understanding practical aspects of conducting clinical research in an academic environment. The course is divided into two modules: Module 1: Research Methods & Protocol Development and Module 2: Regulatory Environment for Clinical Trials. The first module introduces clinical research, clinical protocols, study designs and biostatistics that underlie such studies. The second module covers ethical considerations in clinical research, study execution and oversight, and the regulatory environment for clinical research. Upon completion, students should have a strong foundation in the fundamentals of clinical research and should be able to apply contemporary research tools to clinically relevant areas of investigation.
Fall
Also Offered As: REG 5100
1 Course Unit

MTR 5350 Introduction to Bioinformatics
This course provides overview of bioinformatics and computational biology as applied to biomedical research. A primary objective of the course is to enable students to integrate modern bioinformatics tools into their research activities. Course material is aimed to address biological questions using computational approaches and the analysis of data. A basic primer in programming and operating in a UNIX enviroment will be presented, and students will also be introduced to Python R, and tools for reproducible research. This course emphasizes direct, hands-on experience with applications to current biological research problems. Areas include DNA sequence alignment, genetic variation and analysis, motif discovery, study design for high-throughput sequencing RNA, and gene expression, single gene and whole-genome analysis, machine learning, and topics in systems biology. The relevant principles underlying methods used for analysis in these areas will be introduced and discussed at a level appropriate for biologists without a background in computer science. The course is not intended for computer science students who want to learn about biologically motivated algorithmic problems; BIOL 4536/BIOL 5536 and BE 5370/CIS 5370/MPHY 6090 are more appropriate. Prerequisites: An advanced undergraduate course such as BIOL 4210 or a graduate course in biology such as BIOL 5210, BIOL 5240, or equivalent, is a prerequisite.
Fall
Also Offered As: BIOM 5350, CIS 5350
Prerequisite: BIOL 4210 OR BIOL 5210 OR BIOL 5240
1 Course Unit

MTR 6000 Introduction to Biostatistics
The goal of this course is to develop translational scientists who are able to apply the necessary statistical methods to their thesis project, critically assess the application of statistical methods in the literature, and collaborate with biostatisticians. The course will be designed to include weekly seminars to teach introductory biostatistics concepts and group assignments applying the principles through critically assessing the literature.
Fall
Also Offered As: REG 6000
1 Course Unit

MTR 6010 Practical Scientific Writing
This is a hands-on course during which students will learn and practice a wide range of skills needed to write a 'Literature Review'. For the purposes of this course, the term Literature review (hereafter, 'lit review') will be used broadly to encompass: (a) the process of summarizing and synthesizing the scientific literature that is performed for the purpose of writing key academic documents such as manuscript introductions, grant applications, scientific review articles, and introductory chapters of Masters and PhD theses; (b) the continual process that scientists engage in to stay abreast of advancements in their field and identify areas of controversy and gaps in knowledge that could be addressed with their expertise. Objective 1: Learn and practice skills that can be applied to scientific documents that require a review of the literature. These skills include: (a) defining the scope of the lit review; (b) organizing, navigating, and formatting scientific documents efficiently; (c) identifying the most relevant articles in biomedical databases including PubMed, Embase, Scopus, Web of Science; (d) reading scientific articles efficiently; (e) establishing a workflow for reading and summarizing large volumes of scientific material; (f) assessing the utility of using large language models like Chat GPT as tools for the lit review process; (g) improving writing mechanics to craft clear and compelling scientific discourse; this point encompasses ~12 different writing mechanical techniques taught and practiced over multiple class sessions. Objective 2: Apply this knowledge and skills to writing the 'Significance' section of the Written Research Proposal that is required for MTR 6020. For many students, this will involve improving the proposal that was submitted as part of the application to xxx. The expectation is that the 'Significance' section will be 1.5-2 pages long (Arial 11pt, single spaced, 0.5" margins) and include at least 40 references. Approach: To achieve the course objectives, we use didactic presentations by the course director, outside experts, and students; group/partner discussion; in-class exercises; and weekly homework assignments.
Summer Term
Also Offered As: REG 6010
1 Course Unit

MTR 6020 Proposal Development and Study Design
This course has two primary areas of focus: (i) proposal development and enhancement; and (ii) a focus on research and study design. (i) Proposal Development and Enhancement: Students apply foundational concepts by revising and refining their written proposal and presenting their research project throughout the course. Students receive an overview of approaches to developing an effective proposal; and guidance on how to write and present their hypothesis, specific aims, research strategy, significance, innovation, and approach using the general NIH application format. (ii) Research and Study Design: Students receive an overview of translational research principals and clinical study design approaches relevant to thesis projects designed to probe mechanisms of disease and translate results in basic research into investigations in humans. Topics include clinical and translational research methods, and study design and execution. Students are introduced to these topics through asynchronous and synchronous learning environments. At the end of the course, each student submits and presents their written proposal to their peers and a panel of reviewers for critique and feedback. Members of the panel include the students' research mentor(s), program mentor, and thesis committee. The panel provides feedback on the proposal which the student will then incorporate into the written proposal. Students submit their final revised proposal to be reviewed and graded by their program mentor.
Fall
Also Offered As: REG 6020
1 Course Unit

MTR 6030 Disease Measurement
Students will acquire the knowledge to effectively incorporate disease measurements into the design of clinical and translational research protocols, gain a basic understanding of measurement methodologies used in clinical medicine, understand how "normal" values are determined, and how to interpret test results in the context of patients/research subjects. Students will also approach disease measurements as a mean of answering questions, and be able to choose appropriate tests to answer the question posed. The measurement aspects of the students research protocols are evaluated during this course. The course is separated into lab and imaging sections, with common introductory lectures.
Fall
1 Course Unit

MTR 6040 Scientific & Ethical Conduct
In this course, students will learn the foundational principles of scientific, operational and ethical conduct of research, complete directed experience in evaluating ethical principles through IRB membership and ultimately be able to apply all principles to their own work. By the end of the foundational class sessions, students will understand scientific conduct, ethical considerations of human subject's research, good clinical practices (GCP), good laboratory practices (GLP), conflict of interest, and budgetary concepts. The directed experience will include becoming a member of an Institutional Review Board (IRB) (Penn or CHOP) and participating as an active member in 6 meetings.
Spring
Also Offered As: REG 6040
1 Course Unit

MTR 6050 Data Manuscript Writing
Students will write a primary data manuscript for publication with their primary lab mentor. Emphasis will be placed on identifying publishable data that was either generated by the student, or which is made available to the student for analysis from the mentor's lab. The student will be expected to learn the role of first author including 1) coordination with the senior mentor to write the introduction, 2) organize data, analyses and figures, 3) obtain or write methods and results from collaborators, 4) writing a discussion and, 5) getting it out the door. Mentors will be asked to agree to participate in this process, or identify another senior individual in their group who would perform the function as a condition to have MTR students funded in their program. Course director and members of the curriculum committee will provide guidance and critical review of work throughtout the process.
Spring
1 Course Unit

MTR 6060 Grantsmanship
Prerequisite: Students are required to be writing a career development award during the term in which they enroll in the course. If you are interested in taking the course, but unsure if you meet the requirements, contact Dr. Rachel Locke. Students will learn to write a mentored career development award (i.e. NIH K23, K08, Foundation CDA). More specifically, students will: Understand how grant proposals are reviewed by NIH and which NIH resources are available to investigators Learn how to find and follow the multiple sets of instructions that apply to many NIH proposals Develop a method to assemble, write and track the parts of an application Write an organized and concise Specific Aims page Develop a research proposal that specifically addresses review criteria Gain an improved understanding of how to present your statistical analysis Review classmates' proposals and receive coaching on how to improve their own proposal Understand how to develop a budget and how budgets are handled in the University system
Fall or Spring
1 Course Unit

MTR 6070 Thesis I
Candidates are expected to complete a thesis that involves designing a research project, writing a formal research proposal, performing the study described in it, preparing a comprehensive scholarly scientific paper reporting the results, and presenting and defending the thesis at a public seminar. At the time of application, each candidate specifies the project they will pursue, along with the lead mentor who will supervise the project.
1 Course Unit

MTR 6080 Thesis II
Candidates are expected to complete a thesis that involves designing a researchproject, writing a formal research proposal, performing the study described in it, preparing a comprehensive scholarly scientific paper reporting the results, and presenting and defending the thesis at a public seminar. At the time of application, each candidate specifies the project they will pursue along with the lead mentor who will supervise the project.
1 Course Unit

MTR 6200 Medical Entrepreneurship: Commercializing Translational Science
This course provides in depth insight into the process by which health technology platforms including scientific discoveries are transformed into viable commercial entities. This includes methods to evaluate market opportunities and derisk critical assumptions within the rapidly changing academic and healthcare environment. Topics include intellectual property creation and licensing, technology transfer, regulatory pathways, raising capital/NIH SBIR/STTR grant funding, go to market strategy, market sizing, formation equity, and recruiting co-founders. The major project will involve the formation of teams that will create a defendable business plan and consummate in a presentation (pitch deck) intended to raise capital. The course will be especially valuable for students who may be considering entrepreneurial career paths including starting a company, working for an early stage venture, healthcare consulting, or assuming innovation leadership roles.
Spring
Also Offered As: BE 6080
1 Course Unit

MTR 6210 Cell and Gene Therapy
This course will provide students with a general overview of translational research in the area of gene and cell therapy. This includes technical considerations, translating preclinical investigation into therapeutics, the execution of gene and cell therapies clinical trials, and key regulatory issues. Entrepreneurial considerations will be discussed as well. By the end of this course, students will understand the basic technologies employed for gene and cell therapy along with approaches and pitfalls to translating these therapies into clinical applications including regulatory and commercial aspects of this emerging area. Prerequisite: For graduate students, at least one prior course in immunology. An undergraduate-level or medical school immunology course is sufficient to meet the prerequisite.
Also Offered As: CAMB 7070, REG 6210
1 Course Unit

MTR 6230 Writing an NIH Grant
This course will provide a comprehensive overview of the grant writing process: fundamentals of good grant writing, general preparation of grant application (e.g. specific aims, research strategy, budgets, analysis of reviews and strategies of rebuttal and re-application), identifying RFAs, study sections, program officers and Scientific Review Officers (SROs), research strategy and detailed descriptions of the different types of funding mechanisms (e.g. R01, R21, K99/R00). While all grant mechanisms will be discussed, the class will focus on those relevant to the participants. Three mock study sections – two consisting of peer review and the other of faculty – is expected to familiarize the participants with the NIH review process. This course is expected to provide the foundation of any grant proposal, in terms of writing skills. It will be mandatory for all students to submit the intermediate proposals, and the final proposal. The participants will be drafting, revising, and working one-on-one with their peers and the course director to improve their proposal. The course will provide hands-on experience drafting the specific aims, significance, and innovation sections, through peer and faculty evaluation. Audience: Faculty or postdocs who have not written an NIH grant before or need guidance with submitting a revised application. Advanced graduate students may be permitted to enroll in the course.
1 Course Unit

MTR 6400 Seminar in Entrepreneurial Science
Seminar in Entrepreneurial Science. Permission from department required to enroll.
Fall
0.5 Course Units

MTR 9999 Master of Science in Translational Research LAB
1 Course Unit