Tentative List for Cooper Union

BIO 6100 Fundamentals of Epidemiology
Course Director(s): Liu, Bian
This course provides a rigorous introduction to epidemiology for students in the first trimester of the MS in Biostatistics program.
Topics covered include: an introductory overview of epidemiology, common measures of health outcome frequencies and associations, appropriate construction of an epidemiologic hypothesis, causal inferences, common epidemiologic study designs, error and bias in epidemiologic studies, confounding and effect modification, critique review and evaluation of published studies, ethics and reproducibilityin epidemiologic research.
Credits: 3 | Offered: Fall

BIO 6400 Biostatistics for Biomedical Research
Course Director(s): Bagiella, Emilia; Benn, Emma
This course covers the basic tools for the collection, analysis, and presentation of data in all areas of basics, clinical and translational research. Central to these skills is assessing the impact of chance and variability on the interpretation of research findings and subsequent implications on the understanding of disease mechanisms, drug discovery and development, and applications to clinical practice. Topics covered include: general principles of study design including internal and external validity; probability and sampling distributions, theory of confidence intervals and hypothesis testing; review of methods for comparison of discrete and continuous data including one-sample and two-sample tests, correlation analysis, linear regression, sample size and power. Additionally, students will learn to apply their statistical knowledge to complex real-world challenges, while gaining introductory statistical computing proficiency in R and SAS.
Prerequisites: Algebra
Required for MS in Biostatistics, students. **All other students must take a placement test**.
Credits: 3 | Offered: Fall

BSR 1107 Structural Biology & Molecular Biophysics of Disease
Course Director(s): Ubarretxena, Iban
This course introduces the student to core concepts and methodologies in structural biology and molecular biophysics applied to the study of disease mechanisms. From a disease perspective the course will be divided into four major diseases: Cancer, Metabolic Diseases, Neurological Disorders and Cardiovascular Disease. Each disease section will begin with a lecture by an expert who will introduce aparticular disease, discuss the most relevant disease mechanisms, and identify key protein targets involved in pathogenesis. This lecture will be followed by a series of lectures focused on the structural biology and molecular biophysics approaches employed to study these pathogenic protein targets, reveal their mechanism of action, and identify their druggability. From a technical perspective the course will cover experimental (wet lab) and computational approaches, emphasizing the complementarity of methods used to characterize biomolecular systems at different levels of temporal and spatial resolution. The course includes coverage of X-ray crystallography, NMR spectroscopy, Cryo Electron Microscopy, SAXS, Atomic Force microscopy, FRET, Nanoparticles, Molecular Dynamics Simulations, Monte Carlo Simulations, Structural Bioinformatics, and more. This course is required for second year SMD students. Credits: 3 | Offered: Spring 2

BSR 1802 Quantitative Graduate Physiology
Course Director(s): Sobie, Eric
This course will provide students with a deep understanding of cardiovascular and renal physiology. Lectures will both describe both the general functioning of these organ systems and cover selectedtopics in greater detail. Paper discussion forums and problem sets will complement the material discussed in the lectures. Emphasis will be placed on describing quantitatively the functioning of theheart and kidney, and on illustrating underlying principles that are shared by the two organ systems. Both classical systems-level and contemporary cellular-level issues will be discussed. Topics will include: 1) ionic balance in cardiac cells, 2) multidimensional electrical propagation in heart, 3) systemic control of cardiac output; 4) cotransport of ions and metabolites in renal epithelial cells, and 5) a mathematical description of nephron function. Credits: 3 | Offered: Spring

BSR 1803 Systems Biology: Biomedical Modeling
Course Director(s): Sobie, Eric
We take a case-based approach to teach contemporary mathematical modeling techniques to graduate students. Lectures provide biological background and describe the development of both classical mathematical models and more recent representations of biological processes. Students are taught how to analyze the models and use computation to generate predictions that may be experimentally tested. Credits: 3 | Offered: Spring

BSR 2001 Electron Microscopy
Course Director(s): Ronald E. Gordon
This 2 credit didactic course covering the structure and function of the electron microscopes, TEM, SEM & STEM; tissue preparation for both types of scopes; freeze fracture; immunocytochemistry at theEM level; image analysis; photographic techniques and some special applications to include energy dispersive spectroscopy (EDS), wavelength spectroscopy and a variety of others. Credits: 2 | Offered: Fall

BSR 2104 Intro to Computer Modeling & Macromolecules
Course Director(s): Mezei, Mihaly
The course relies mainly on academic software (VMD from University of Illinois at Urbana-Champaign, Simulaid and Dockres developed here) as well as on commercial software (Gaussian and Pymol). The course also relies on the use of Web resources (e.g., the Protein Data Bank or the ZINC library of small molecules, as well as various servers and software downloads). Credits: 3 | Offered: Fall

BSR 2108 Structural & Chemical Approaches to Pharmacology and Drug Discovery
Course Director(s): Osman, Roman
This course attempts to recreate in a teaching environment the fundamental approaches of rational small molecule drug discovery research, and teach the fundamental molecular and physico-chemical principles that govern the capacity of small molecules to affect or regulate biological functions of macromolecules. The course consists of three themes, covering topics ranging from lead discovery to drug candidate selection, and to mechanism of action of drugs for both validated and emerging drug target families, as listed below:
Theme #1. Structure-based Drug Discovery

- lead discovery and optimization, and drug candidate selection
Theme #2. New Advances on Validated Drug Target Families
- drugs and mechanism of action on kinases, GPCRs and others
Theme #3. Emerging Drug Targets
- Identification and characterization of drug targets relevant to epigenetics, neurodegenerative diseases and cancer.
Theme #1 teachs the principles of discovery of biological targets and active compounds by hypothesis-driven and high-throughput approaches with both experimental and computational methods. This is followed by characterization of biological target interactions with lead compounds (i.e., structure, energy and dynamics). The inferred molecular mechanisms provide the basis for lead optimization through rational design and medicinal chemistry, and drug candidate selection through evaluation of drug toxicity and efficacy, as well as drug pharmacokinetic/pharmacodynamic properties.
Themes #2 and #3 review the latest advancements in drug discovery for both validated and emerging drug target families consisting of proteins involved in enzymatic catalysis, gene transcription and translation, protein-protein or protein-nucleic acid interactions.
Credits: 3 | Offered: Spring

BSR 2301 Embryos Genes and Development
Course Director(s): Soriano, Philippe
This course will provide a thorough introduction to invertebrate and vertebrate development emphasizing cellular, genetic and molecular mechanisms. The course will focus primarily on development of fruit flies, nematodes, Xenopus, zebrafish, and mice. Emphasis will be on understanding fundamental embryological processes such as induction, determination, and pattern formation. Current technologiessuch as transgenic animals, genetics, mosaic analysis, homologous recombination, somatic cell genetics, and classical embryonic manipulations will be analyzed. Selected topics include developmental genetics of regulatory hierarchies, lateral inhibition, regeneration and development, cell lineage analysis, X-chromosome inactivation, imprinting, and sex determination. Following introductory lectures, the course will focus on primary literature detailing the current state of the field using journal club presentation (by students). The final exam will consist of grant proposals by the students tobe reviewed by other students in a study section type arrangement Credits: 3 | Offered: Fall

BSR 2400 Translational Genomics
Course Director(s): Scott, Stuart; Sharp, Andrew
The influence of Genomics is vast and affects all areas of biology,thus this course will be useful to all those who plan to do biomedical research. This course is an introduction to the goals, principles, tools, and many applications of genetics/genomics. The focus of this course will be on the human genome and in particular on naturally occurring DNA sequence variations and their impact on molecular physiology, clinical phenotypic expression, the diversity populations, and human evolution. Emphasis in on the latest advances in genetics/genomics, the use of genetic tools in understanding complex biological pathways and disease, and the translation of genomic information on clinical care. By the end of the course, the students will have a working knowledge of the current genomic technologies, approaches and types of databases and computational tools available with an overall understanding of how genomics can be used to probe disease biology.
Credits: 3 | Offered: Spring

BSR 2401 Intro to Human Genome Sequencing
Course Director(s): Kenny, Eimar; Suckiel, Sabrina
There are no specific prerequisites and no expectation of previous experience with large-scale computing.
This workshop-style course is a general offering to the entire Mount Sinai community and serves as both the prerequisite (and part of the informed decision-making process) for the fall full-semester course "Practical Analysis of Your Personal Genome", in which students will have the opportunity, if they are interested, to have their genome sequenced. This course will be of interest to anyone, however, who is getting started with next-generation sequencing in a research or clinical setting, regardless of whether they intended to take the follow-on course.
If you want to take the fall course ¿Practical Analysis of Your Personal Genome¿ (Fall, times TBD) you must register for and attend this prerequisite course. Those students wishing to take the fall course please include a brief description of your background and motivation for taking the course. Note that the fall course is capped at 20 students and because of that cap the course is effectively limited to students (who have priority) except by prior arrangement with the course staff. Students must be able to commit to 4-hours of class per week. Given that substantial time commitment, graduate students must have permission from their advisor to take the fall course. Credits: 2 | Offered: Spring 2

BSR 2601 Fundamentals of Microscopy
Course Director(s): Azeloglu, Evren
An introductory microscopy course that covers basic concepts in optical, electron and scanning probe microscopy with special emphasis on state-of-the-art technological developments. Topics will include theoretical concepts as well as applications, such as rudimentary image processing applications and contemporary imaging platforms. The course is composed of seven modules with lectures; four modules with hands on lab/demo segments; one image processing project. Credits: 3 | Offered: Spring

BSR 2703 Drug Discovery: Successful vs Usual
Course Director(s): Mobbs, Charles
The purpose of this course is to develop skills to enhance discovery of medically useful drugs.The course uses a case-study approach describing the discovery of the most valuable drugs currently in use, with an emphasis on phenotypic screening, combined with exposure to cuttingedge bioinformatics tools. Some of the drugs to be addressed are penicillin, insulin, the small pox vaccine, ether, morphine, aspirin, salvarsan, thorazine/Haldol, norethindrone, and digoxin. Of particular interest will be assessment of what is, or more generally what is not, known about mechanisms by which drugs exert their therapeutic effects, and how the development of drugs have elucidated mechanisms of disease. Credits: 3 | Offered: Fall

BSR 2901 Foundations of Biomedical Research
Course Director(s): Mobbs, Charles
The course covers the key discoveries that form the basis of current biomedical research, and most importantly how these discoveries were made, including the cell theory, discovery of the gene, the germ theory, and structural biology. The philosophy of the course is that great discoveries are most likely to be made with an understanding of how the greatest discoveries in the past were made. Credits: 3 | Offered: Spring

BSR 2930 Protecting and Commercializing Your Innovation
Course Director(s): Hanss, Basil; Gruber, Simon
This lecture course, developed jointly between Icahn School of Medicine at Mount Sinai (ISMMS) and Rensselaer Polytechnic Institute (RPI), explores the relationship between academic research, intellectual property, and commercialization. You will learn about the nuances of intellectual property, with a focus on biomedical applications, and how the products of academic research and related innovations can be protected and commercialized. The course will cover experimental design, patent strategy, interaction with regulatory agencies, and the process of starting a company or licensing an invention. Lectures will be given at both RPI and ISMMS by instructors from patent law firms, successful biotech entrepreneurs, and Mount Sinai Innovation Partners. Credits: 2 | Offered: Fall

BSR 2931 Commercialization of Biomedical Innovation: Entrepreneurship & Business Fundamentals
Course Director(s): Preker,Alexander; Nickerson, Brian
This course will allow participants to learn about entrepreneurship and business fundamentals with an aim to understanding the process of commercializing biomedical innovation. This course may be taken in sequence with the course on Intellectual Property (BSR 2930: Protecting Your Innovation) or just as one course experience (no Pre-requisites are required).
In particular, the course will introduce students to the underlying concepts of entrepreneurship ¿ both tangible and intangible. It will help the student better understand some of the ¿subsectors¿ of the health industry relevant to entrepreneurship in commercializing scientific discovery of new drugs, medical technology, diagnostics, clinical advancement, and digital health. The course will also aid participants to understand better the importance to commercialization of protecting the intellectual properties of innovation. Students will also have the opportunity to review some of the key regulatory approval processes of the FDA and reimbursement approval processes under Medicare and private health insurance.
The course will also teach students relevant fundamentals of organizational leadership, governance and management. It will allow the students to understand the range of legal entities that can be used to start a business. It will discuss the market intelligence that is needed for entrepreneurs to understand if a particular innovation has potential for commercialization, the market context in terms of supply, demand, competition and potential profits. Furthermore, the course will examine he different funding modalities, starting at the seed funding stage, progressing through the different phases of private equity and finally public offerings and mergers & acquisitions. This will include understanding a company¿s macro financial position and valuation.
Credits: 2.5 | Offered: Spring

BSR 3101 Computer-Aided Drug Design
Course Director(s): Filizola, Marta; Provasi, Davide
Please note - Attendance in this course is mandatory.
COMPUTER-AIDED DRUG DESIGN (CADD) is a hands-on course that provides an introduction to computer-aided drug design/discovery technology, including both ligand-based and structure-based rational drug design strategies. Both theoretical and practical aspects of chemoinformatics, virtual screening, and in silico design approaches are presented with the goal of teaching students how to

accelerate thediscovery of novel molecules with improved therapeutic profiles using modern technologies. To this end, lectures will be integrated with hands-on sessions and at least one `serious game¿ (a.k.a. simulation of a real-world structure-based drug discovery problem).
This course is not only designed to provide students with a solid foundation in computational structural biology, but also to help thembecome proficient in the use of modern drug discovery solutions available at Mount Sinai (e.g., the Schr"dinger¿s Small Molecule Drug Discovery Suite).
Students will also acquire an understanding ofhow to protect their own intellectual property on discoveries in preclinical stages and how to eventually move these discoveries to commercialization
Credits: 1.5 | Offered: Fall

BSR 6301 Stem Cells and Regenerative Biology
Course Director(s): Krauss, Robert, Baron, Margaret
Stem Cells and Regenerative Biology is an advanced course covering embryonic, induced pluripotent, and several different types of adult stem cells. The course will combine didactic lectures and student presentations of the primary literature. In doing so, students will gain insight into the roles of various stem cell types in development, regeneration, and diseases; currently used techniques for analysis of stem cells; and both historical perspectives and current concepts in the field. Credits: 3 | Offered: Fall

BSR 6402 Practical Analysis of a Personal Genome
Course Director(s): Kenny, Eimear
Students in this course will analyze a human genome sequence starting with raw sequence reads through identifying a list of sequence variants. Using public databases, literature and other resources students will formulate hypotheses about the phenotypic significance of these variants. This is a hands-on, laboratory course in which students will choose to analyze either their own genome or a reference genome after lectures and counseling to make the consequences of personal genome analysis clear.ies. Credits: 3 | Offered: Fall

BSR 6601 Advanced Virology
Course Director(s): Evans, Matthew; Simon, Viviana
Description: The goal of this course is to provide a broad-based systematic approach to the problem of virus-host interactions. The course is designed to be coordinated with the bi-annual New York Academy of Sciences Symposium on Virus-Host Interactions. All first year and second year PhD students as well as MD/PhD students doing their research projects in virology, cell biology, immunology, and/or molecular genetics/gene therapy are encouraged to participate.
This non-modular course will begin with an introduction to host immune defense mechanisms and will explore the strategies that viruses have developed in order to evade them. While all viruses enter cells, replicate their genomes, and exit the infected cell, the specific tactics employed differ dramatically among the virus groups.
Specifically, we will discuss (i) the basic life cycle of relevant viruses and (ii) the ways in which they interact with their host cells and evade immune detection. Credits: 3 | Offered: Fall

BSR 6701 Neuroanatomy
Course Director(s): Holstein, Gay
The goal of the course is to provide students with a basic understanding of the structural organization and connectivity of the human central and peripheral nervous system. In general, a

systems approach is used to review the major sensory, motor and integrated neural systems. Student performance is evaluated by four exams; all students attending the course are expected to take the exams, and thecourse is open to all interested students Credits: 3 | Offered: Spring

BSR 6710 The Biology of Aging
Course Director(s): Mobbs, Charles
The course covers the basic biology of aging, including the genetic and environmental contributions to normal age-related impairment as well as age-related diseases. A particular focus in the role of nutrition in aging, and the relationship between aging and metabolic impairments including obesity and diabetes. Credits: 3 | Offered: Spring

BSR 6805 Fundamentals of Nanomedicine
Course Director(s): Costa, Kevin
Nanomedicine is the application of nanostructured materials in medicine. Nanomedicine approaches are now being widely explored as diagnostic tools and novel therapeutics. This course will cover the synthesis of multifunctional nanoparticles, their characterization, applications in imaging (optical imaging, computed tomography and magnetic resonance imaging) and applications in therapy (drug delivery, genetic therapies and tissue engineering). There will be a focus on the underlying concepts that control nanoparticle properties and interactions in vivo. Credits: 3 | Offered: Spring 2

BSR 6806 Programming in Sys Bio & Bioinformatics
Course Director(s): Ma'ayan, Avi
This mini course covers computer programming methodologies applied to processing data and analysis of data in the broad fields of Bioinformatics and Systems Biology. Topics covered would include an overview of data structures and algorithms, Python scripting for processing text files, computational platforms such as R and MATLAB as well as web technologies using JavaScript, PHP, and mySQL. Students will be required to complete small programming assignments throughout the course. Credits: 1 | Offered: Spring

CLR 0207 Culture, Illness & Community Health
Course Director(s): Butts, Gary; Poliandro, Edward
This course considers Franz Boas¿ definition of culture as culture is everything but natural science.[1] Any interaction or encounter with another individual or group of individuals is in fact a cultural experience which occurs within a cultural context. Broadly, this course aims to demonstrate how culture is conceptualized, considered, and explored in a broad range of issues in the basic, clinical, and community arenas around health and illness and to distinguish the cultural context in each session. The course utilizes class room lecture and small group discussion sessions and a small group project to enable participants to integrate culturally effective approaches into the design and implementation of research across the translational spectrum that improve patient and community health outcomes and reduce health care disparities.
Course Objectives:
At the end of this course the student should be able to:
1) Demonstrate an understanding of one¿s own cultural context and its impact on patients, communities and on health care outcomes
2) Analyze evidence of health care disparities from available resources

3) Integrate culturally effective approaches into the design and implementation of research across the translational spectrum that improve patient and community health and reduce health care disparities Credits: 3 | Offered: Spring 2

CLR 0610 Meta-analysis, Decision Analysis and Cost-effectiveness Analysis
Course Director(s): Sacks, Henry
The goals of this course are to provide students with a theoretical understanding and hands on experience in literature synthesis methods. Areas to be covered include meta-analysis, decision analysis, and cost-effectiveness analysis. The course will provide a review of each method within an interactive computing environment. Students will be given opportunities to learn how to develop an appropriate question and to use RevMan and TreeAge software for assignments on each topic. Credits: 3 | Offered: All Terms

CLR 1112 Advanced Technologies and Tools in Translational Research
Course Director(s): Villanueva, Augusto
This course has a significant practical perspective. The objective is to provide the student with an overview of the mainstream genomic technologies currently used in translational research studies, with a particular focus on sequencing-based approaches. Learning objectives include: 1) To describe the experimental and analytical bases of genomic technologies, focusing on next-generation sequencing (NGS); 2) To understand the rationale and workflow of data analysis in NGS experiments; 3) To delineate the pros and cons of single-cell technologies in cancer research; 4) To interpret methods and results from high-throughput genomic analyses, 5) To infer relevant biological insights from a gene list (differential gene expression experiment). Credits: 2 | Offered: Fall

CLR 1113 Translational Oncology: Application of Translational Research in Oncology
Course Director(s): Malone, Adriana
The course will summarize the main mechanisms involved in cancer development, maintenance and regression, and how they can be exploited therapeutically. Mainstream molecular alterations in solid tumors will be discussed. A specific emphasis will be dedicated to the role of the tumor microenvironment (e.g., immune system) in cancer monitoring and therapeutics. Learning objectives include: 1) To delineate the hallmarks of cancer and how they provide opportunities for biomarker / therapeutic strategies; 2) To understand the role of the immune system in oncology; 3) To discuss the future trends in translational oncology (e.g., bid data and next generation healthcare) Credits: 3 | Offered: Spring

MGC 1400 Medical Genetics
Course Director(s): Mehta, Lakshmi; Karger, Lisa
This course is designed to provide students an introduction to medical genetics with an emphasis on molecular genetics, pedigree analysis, population genetics, clinical genetics, cytogenetics, and biochemical genetics. Throughout the course selected hereditary disorders will be presented, and the pertinent clinical presentation, diagnostic evaluation, pathophysiology, treatment, and counseling issues for each disorder will be discussed.
Credits: 4 | Offered: Spring

MPH 0013 Public Health Informatics
Course Director(s): TBD
Technology is progressing at lightning speed, revolutionizing every aspect of healthcare and life. As public health educators, we are charged with not only providing a strong foundation in the traditional practice of public health, but also preparing our students to lead the avant garde of public health as it is will be practiced tomorrow. Increasingly, such leadership requires a skill set that includes public health informatics.
Public health has always been highly interdisciplinary, but modern public health is rapidly becoming a field that requires an unprecedented level of technological savvy. Real-time syndromic surveillance, big data, mobile technologies, electronic health records, and other health information technologies are poised to benefit population health enormously. Practitioners who are not comfortably conversant in the use of these technologies will be unable to fully participate in, much less lead, the conversation. It is our responsibility to prepare our students andguide their exposure to this reality of modern healthcare. As standards of care shift, ISMMS students must be prepared to lead the way. Credits: 3 | Offered: Spring 2

MPH 0108 Comparative Health Systems
Course Director(s): Preker, Alexander
The recent introduction of the Affordable Health Care Act and further proposed reforms under the American Health Care Act has had and will continue to have a major impact on the delivery of healthcare in the USA. The course will use a comparative health systems approach looking at what has worked well and not so well in both the USA and other countries. The course will explore each country¿s geography and culture, the history of its health system, followed by a detailed analysis of evaluation of cost, quality, access and innovation. The courses is designed to be accessible by students of health administration, public health, nursing and other allied health professions. The major course output will be guided, semester-long exercises in analyzing a health system and developing strategic development plans expanding coverage for poor and vulnerable populations from a health systems perspective to guide political and economic decision making. The focus on health systems is a concrete means to understand the more general competencies involved in the application of systems analysis, which include political, financial, technical and organizational skills. The course will be particularly useful for students that may want to transition to a high level policy career or executive leadership and management role within health system.
Credits: 3 | Offered: Fall

MPH 0110 Pharmacoeconomics
Course Director(s): Arnold, Renee
This introductory course focuses on the major concepts and principles of pharmacoeconomics, with particular emphasis on modeling, methodologies and data sources. Students will learn about the international use of pharmacoeconomics in drug approval, regulation and pricing. Examples of pharmacoeconomic models used by the pharmaceutical industry and in government will illustrate the theoretical lessons. Credits: 3 | Offered: Spring

MPH 0300 Introduction to Biostatistics
Course Director(s): Doucette, John
This course provides an introduction to the principles underlying biostatistical methods and their application to problems in epidemiology, public health and clinical research. Students will learn

about basic probability distributions, descriptive statistics, presentation of data, hypothesis testing principles, and the specific hypothesis tests and analytic methods for a variety of data types. These analytic methods will include t tests, chi-square tests, nonparametric tests, analysis of variance, correlation, regression, and basic survival analysis methods. Students will have the opportunity to apply these methods to sample data both via direct calculation and using SAS® statistical software. Each week, a one-hour laboratory session will reinforce material from lecture with additional examples and instruction in use of the SAS® software. Methods for determining sample size and power for a variety of commonly used study designs will also be presented, as will measures of the accuracy of diagnostic and screening tests. Credits: 3 | Offered: Fall

MPH 0400 Introduction to Epidemiology
Course Director(s): Factor, Stephanie
This introductory course focuses on the fundamental concepts of epidemiology and its application to the field of public health. The course will provide students with an insight to epidemiologic methods and how they can be used to study health outcomes in human populations. Students will learn the elements of epidemiology, such as causation, study design, measures of effect, and potential biases. Practical and theoretical training will include lectures, small group discussions, and readings. This class meets twice per week. Tuesdays 5:30-7:30PM, Thursdays 4:00-5:00PM Credits: 3 | Offered: Fall