EINSTEIN

Albert Einstein College of Medicine
OF YESHIVA UNIVERSITY

GRADUATE PROGRAMS IN THE BIOMEDICAL SCIENCES

COURSE CATALOG

Fall 2018

Fall 2018 Course Descriptions

Block I

7001 Biochemistry

COURSE DESCRIPTION: This is an 8 week introduction to fundamental topics in biochemistry and physical biochemistry. Topics include: protein structure, folding, and function, nucleic acid structure and protein-DNA interactions, carbohydrates & glycoproteins, lipids & membranes, enzymology, energetics & allostery, posttranslational modification of protein function, transcription, translation, and DNA replication. The course also covers some aspects of basic metabolism (glycolysis and the citric acid cycle). The material is presented in formal lectures in conjunction with a structure-based macromolecules project that includes an oral presentation, discussion sessions, and reading of the literature.

REQUIRED MATERIALS: Biochemistry, 4th Edition, D. Voet and J. G. Voet. ISBN 978-0470570951

PREREQUISITES: One semester of undergraduate biochemistry and a course in organic chemistry are required. Undergraduate physical chemistry is also helpful preparation. Students who are uncertain about the adequacy of their undergraduate training for this course should discuss the issue with their advisory committee and then consult the course leader.

STUDENT PREPARATION: Students should be familiar with the general principles of biochemistry including basic knowledge of amino acid and nucleic acid structure. They should also be familiar with general principles such as DNA replication, transcription and translation.

SUITABLE FOR 1ST YEAR STUDENTS: Yes

UNIQUE TRAINING OFFERED IN THIS COURSE: This is a general course teaching the fundamentals of biochemistry.

STUDENT ASSESSMENTS: Each student is required to take two non-cumulative examinations that cover each part of the course and to participate in and complete the macromolecules project. Grade will be based on the two exams, the macromolecules project and the discussion sessions.

CREDIT HOURS: 5.0

7404 Cell Biology of Neuronal Function

COURSE DESCRIPTION: We will consider the neuronal specific adaptations of organelles and pathways that regulate proteostasis. In-depth review of mechanisms underlying protein synthesis, recycling and degradation in neurons; mechanisms of polarized trafficking underlying protein localization at specific locations during neuronal differentiation and in mature neurons; neuronal homeostatic adaptations to activity-dependent changes in the intact circuitry; molecular basis of activity-dependent synapse remodeling under physiopathological conditions.

REQUIRED MATERIALS: No specific material, including textbook, required; the Course will be structured to include lectures, discussion of current literature and attendance to seminars by Invited Speakers on topics related to Course material.

PREREQUISITES: No prerequisite; previous attendance of the neuroscience MCN Course encouraged but not required.

STUDENT PREPARATION: Undergraduate level Cell Biology preferred but not required.

SUITABLE FOR 1ST YEAR STUDENTS: Yes

UNIQUE TRAINING OFFERED IN THIS COURSE: Current Neuroscience Courses focus primarily on electrical properties of neurons, properties of ion channels, synaptic activity (MCN); properties of neuronal networks (System Neuroscience); and devel-opment of the nervous system (Developmental Neuroscience). The proposed elective Course will complement the curriculum by providing in-depth review of fundamental cellular mechanisms that endow neurons with the molecular machinery underlying their unique property of supporting directional information flow and capacity to modify such machinery on demand.

STUDENT ASSESSMENTS: Class participation and Oral presentation

THE COURSE IS LIMITED TO A GROUP OF 15 STUDENTS

CREDIT HOURS: 1.5

7503 Epidemiologic Research Methods

COURSE DESCRIPTION: This course focuses on the analytical issues of epidemiological studies: biases, confounding, interaction, statistical methods used in case-control and longitudinal studies, and sample size/statistical power. The homework will reinforce these concepts. Students are expected to know the basic design issues of retrospective and prospective studies as well as clinical trials from the Clinical Research Intensive course.

REQUIRED MATERIALS: Moyses Szklo & F. Javier Nieto: Epidemiology: Beyond the Basics. 3rd Edition, Jones & Bartlett Publishers, Sudbury, Massachusetts, 2012. ISBN-13: 9781449604691; ISBN-10: 1449604692. Available online through the Einstein Library. To access the e-book you must be at Einstein or have remote access to the Library.

PREREQUISITES: Clinical Research Intensive

STUDENT PREPARATION: Students are expected to know the basic design issues of retrospective and prospective studies as well as clinical trials from the Clinical Research Intensive course.

SUITABLE FOR 1ST YEAR STUDENTS: No

STUDENT ASSESSMENTS: In-class exercises/class participation 50%, Mid-term test 25%, Final Exam 25%

(CLOSED REGISTRATION) LIMITED TO 15 STUDENTS NEED APPROVAL FROM PROGRAM DIRECTOR-DR. AILEEN MCGINN (PICK UP COURSE REGISTRATION FORM IN THE GRADUATE OFFICE)

CREDIT HOURS: 3.0

4004 Genomic Innovation

COURSE DESCRIPTION: Genomic Innovation is a project-oriented course focused on understanding the current landscape of genome science and on building ideas and organizations to accelerate progress in technology innovation, scientific understanding and industrial applications of genomics. The course will introduce students to cutting-edge technologies and applications in genetics and genomics and their responsible use in science and society. Students from diverse majors and backgrounds (including biology, medicine, engineering, business, sociology, and law) are welcome to participate. The course consists of a combination of lectures, classroom and homework assignments alone or in small groups, and a midterm and final project in small groups. Each class meeting will include a brief introduction of the speaker and the topic by the instructors, a talk and discussion with expert guest speaker(s), and a student-led discussion on homework assignments. The instructors encourage active participation from the students and peer-to-peer teaching/learning between students with different expertise.

This course is taught offsite at: The New York Genome Center, 101 Avenue of the Americas (6th Ave), 1st floor auditorium.

REQUIRED MATERIALS: Laptop

PREREQUISITES: N/A

STUDENT PREPARATION: The instructors do not expect specific programming skills, advanced statistical skills, or molecular biology laboratory experience, but intellectual curiosity in genomics is essential.

SUITABLE FOR 1ST YEAR STUDENTS: Yes

UNIQUE TRAINING OFFERED IN THIS COURSE: This is a unique course. Genomic Innovation is focused on understanding the current landscape of genome science and on building ideas and organizations to accelerate progress in technology innovation, scientific understanding and industrial applications of genomics. The course will introduce students to cutting-edge technologies and applications in genetics and genomics and their responsible use in science and society.

STUDENT ASSESSMENTS: Lecture summaries: 20%, Homework assignments: 35%, Midterm project & presentation: 20%, Final project & presentation: 25%

(CLOSED REGISTRATION – A REGISTRATION FORM AND PERMISSION FROM THE COURSE LEADER ARE REQUIRED. STUDENT MUST SUBMIT AN APPLICATION TO THE COURSE LEADER FOR REGISTRATION ELIGIBILITY. CONTACT JOHN.GREALLY@EINSTEIN.YU.EDU)

CREDIT HOURS: 4.0

7026 Introduction to Systems Biology

COURSE DESCRIPTION: By means of biological case studies we will cover a broad range of relevant techniques from mathematical, statistical, and computational sciences. In this course we will introduce computational and simulation platforms that the students will build upon as the course progresses. By the end of the course we expect all students to have attained a substan-tial programming proficiency. The main aim of this course is to provide the students with the means to move beyond quantitative techniques for descriptive purposes alone, towards making biologically relevant predictive models.

REQUIRED MATERIALS: Laptop computer is required for classroom work

PREREQUISITES: Quantitative background encouraged

STUDENT PREPARATION: Preferred pre-requisite (not reqired) Calculus, Linear Algebra, Differential Equations and Sto-chastic Processes. Also, Background in computer programing such as C/C++ or any other programming language as well as biostatistics is desirable.

SUITABLE FOR 1ST YEAR STUDENTS: Yes

UNIQUE TRAINING OFFERED IN THIS COURSE: The course offer the student with the knowledge of the computational platform Matlab and R, and their usage in modeling biological processes.

STUDENT ASSESSMENTS: Student are assessed by their participation and limited set of homework assignments

CREDIT HOURS: 2.0

5010 Membrane Physiology & Transport

COURSE DESCRIPTION: Membranes form essential barriers that separate the cytoplasm from the external world and from subcellular compartments such as mitochondria, endosomes, lysosomes, etc. Lipid bilayers are a major component of cellular membranes that create a barrier to the transport of ions and hydrophilic solutes across cell membranes. Membrane proteins constitute about 25% of genomes of most organisms. Transport proteins and channels create pathways for the regulated movement of solutes across cell membranes and for the creation of transmembrane electrical potentials. This course will discuss:

1) The fundamentals of solute transport across cell membranes
2) The role of ion movement in the creation of membrane potentials
3) The role and regulation of these transport processes in the physiology of nerves and epithelia

REQUIRED MATERIALS: Course readings will be distributed or made available as pdf files.

PREREQUISITES: Prerequisites include one year of general chemistry, one year of physics, and preferably at least a year of biology and a semester of biochemistry.

STUDENT PREPARATION: Students should be familiar with the structure of ions and non-electrolytes in solution, elementary thermodynamics and Gibbs free energy, acid-base chemistry, structure of biological membranes and membrane proteins, electrical potentials, resistance, conductance, and current.

SUITABLE FOR 1ST YEAR STUDENTS: Yes

UNIQUE TRAINING OFFERED IN THIS COURSE: Some material in this course will overlap with the Molecular and Cellular Neuroscience course, particularly lectures focusing on the ionic basis of membrane and action potentials. This course will be required to first year MSTP students.

STUDENT ASSESSMENTS: Student's grades will be based on class participation, multiple quizzes and an essay format final exam.

CREDIT HOURS: 2.0

7401 Molecular and Cellular Neuroscience

COURSE DESCRIPTION: The course offers a multidisciplinary approach to the study of the nervous system from first principles with a focus on the molecular and cellular basis of brain function and disease. The class format consists of a combination of formal and informal lectures and student presentations with a major emphasis on interactive class discussion. The course requires active student participation during the class and offers review sessions if needed. There is a course website and an active online discussion forum. In addition to normal course scheduled lectures, the course includes lab visits. Students are also required to prepare and present at a symposium on a specific topic (e.g. sensory transduction, molecular & cellular basis of brain disorders, other), and to attend the weekly Neuroscience Seminar Series.

RECOMMENDED MATERIALS:

- Neuroscience: Exploring the Brain. Mark F. Bear and Barry W. Connors, Wolters Kluwer 2016, 4th Edition, ISBN-13: 978-0781778176
- From Molecules to Networks. John H. Byrne, Ruth Heidelberger, M Neal Waxham. 2014 Academic Press/Elsevier, 3rd Edition. ISBN-13: 978-0123971791
- Cellular and Molecular Neurophysiology. Constance Hammond. 2015 Academic Press/Elsevier, 4th Edition. ISBN-13: 978-0123970329
- From Neuron to Brain. John G. Nicholls et al. 2012 Sinauer Associates, 5th Edition. ISBN-13: 978-0878936090
- The Synapse. Morgan Sheng, Bernardo L. Sabatini and Thomas C Südhof. 2012 Cold Spring Harbor Laboratory Press. ISBN-13: 978-1936113026
- Fundamental Neuroscience. Larry Squire et al. 2013 Academic Press/Elsevier, 4th Edition. ISBN-13: 978-0123858702

PREREQUISITES: None

STUDENT PREPARATION: N/A

SUITABLE FOR 1ST YEAR STUDENTS: Yes

UNIQUE TRAINING OFFERED IN THIS COURSE: The students learn to approach topics from first principles. They also learn how to be very interactive, identify knowledge-gaps, and defend their points of view.

STUDENT ASSESSMENTS: Class participation (discussion, presentation and in-class quizzes) 50%; final oral exam 50%.

CREDIT HOURS: 6.0

7006 Molecular Genetics

COURSE DESCRIPTION: The course is designed to convey genetic concepts and their application in a diverse set of model systems. It will allow students to understand and critically evaluate the literature. The course is divided in to three sections. In the first section, students will briefly review basic genetic concepts. This part is followed by a discussion of yeast and bacteria as genetic models and their use in high throughput and classical biochemical approaches. In the second section, students will learn about the major vertebrate systems, including human genetics, mouse genetics, and zebra fish genetics. The third section is dedicated to invertebrate genetics (including worms and flies) as well as to a discussion of special aspects of cancer genetics. Overall, this course should convey graduate level genetics in all its modern facets and constitute the foundation for more advanced studies.

REQUIRED MATERIALS: Computer

PREREQUISITES: Undergraduate genetics is required

STUDENT PREPARATION: Basic concepts should be known, including but not limited to DNA as the basis for heredity, Mendelian concepts of inheritance, structure of DNA and genes as well as basic genetic methods.

SUITABLE FOR 1ST YEAR STUDENTS: Yes

UNIQUE TRAINING OFFERED IN THIS COURSE: Unique to this course is a comprehensive syllabus that includes a brief introduction and an overview of all major model organisms currently in use for research. Using both classic and modern examples, the possibilities and contributions of the field of Genetics to the understanding of biological processes will be discussed.

STUDENT ASSESSMENTS: 3 exams.

CREDIT HOURS: 5.0

7504 Multivariable Regression

COURSE DESCRIPTION: Multivariable Regression builds on the knowledge of univariate and bivariate analyses that were learned in the Clinical Research Intensive course and introduces concepts related to multivariable model building for multiple linear regression, logistic regression and survival analysis. Both the lecture and the lab will focus on multiple regression model building, interpretation and diagnostic tests, assessing for interaction, and statistical adjustment for confounding.

REQUIRED MATERIALS:

- Regression Methods in Biostatistics. *Vittinghoff et al*: ISBN-13: 9781461413523; ISBN-10: 1461413524 NOTE: this textbook is available online via the Einstein Library as a pdf
- *Primer of Applied Regression and Analysis of Variance*. *Glantz & Slinker*. ISBN-13: 9780071360869; ISBN-10: 0071360867. NOTE: available for loan via the CRTP Library—please see Nancy Marte in Block 506
- Applied Logistic Regression by David W. Hosmer, Stanley Lemeshow & Rodney X. Sturdivant (3rd edition). ISBN-13: 9781118548356; ISBN-10: 1118548353. NOTE: this textbook is available online via the Einstein Library as a pdf
- Survival Analysis: A Self-learning Text by David Kleinbaum and Mitchel Klein (3rd edition). ISBN-13: 9781493950188; ISBN-10: 1493950185. NOTE: this textbook is available online via the Einstein Library as a pdf

PREREQUISITES: Clinical Research Intensive

STUDENT PREPARATION: Students are expected to know the material covered in Clinical Research Intensive, including univariate and bivariate statistical analyses and basic epidemiological study designs.

SUITABLE FOR 1ST YEAR STUDENTS: No

STUDENT ASSESSMENTS: Class Participation 10%, Homework 30%, In-class quizzes 15%, Take home exams 45%

(CLOSED REGISTRATION) LIMITED TO 15 STUDENTS NEED APPROVAL FROM PROGRAM DIRECTOR-DR. AILEEN MCGINN (PICK UP COURSE REGISTRATION FORM IN THE GRADUATE OFFICE)

CREDIT HOURS: 5.5

7019 Protein Folding: Disease to Design

COURSE DESCRIPTION: This course will focus on current research in understanding the relationship between the biophysical nature of proteins and how misfolding can lead to disease states, and will provide up-to-date insights in current approaches of protein engineering and its application to development of immunotherapeutics and vaccines.

REQUIRED MATERIALS: Computer; access to internet and Angel website (or equivalent). Student presentations are required.

PREREQUISITES: First 'Block' Graduate course in Biochemistry required; Fundamentals of Biophysics recommended.

STUDENT PREPARATION: Protein structure and composition; physical chemistry of protein structure; thermodynamics; some basic knowledge of metabolic pathways; enzyme mechanism.

SUITABLE FOR 1ST YEAR STUDENTS: Yes.

UNIQUE TRAINING OFFERED IN THIS COURSE: The uniqueness of the course is that it takes a very broad and comprehensive view of the nature and fundamental role of proteins in life. There is slight overlap in some topics with Fundamentals of Biophysics, Computational Biology of Proteins, and probably others which cover some aspects of the course topics in depth but more narrowly.

STUDENT ASSESSMENTS: Throughout the term, students are asked to provide original presentations. A final consisting of thinking through and presenting a research program aimed at some specific disease.

CREDIT HOURS: 3.0

8002 Quantitative Imaging of Cells

COURSE DESCRIPTION: This class will include both lectures as well as hands on lab sessions. The lectures will cover a broad range of topics in microscopy as it applies to biomedical research. Topics covered will include fundamentals of optics as they apply to brightfield microscopy. Other microscopy topics covered will include fluorescent microscopy with discussion of the nature of different fluorophores, confocal microscopy, multiphoton microscopy including intravital imaging, advanced imaging techniques including TIRF, FRET, FLIM, Optical Tweezers, and superresolution microscopy, Electron Microscopy including SEM, TEM, and CryoEM, as well as image analysis and image presentation. Lab sessions will consist of hands on demonstrations of the different microscopy techniques.

REQUIRED MATERIALS: Fundamentals of Light Microscopy 2nd Edition by Douglas Murphy and Michael Davidson, numerous handouts, and frequent data processing exercises requiring use of a Mac or PC. ISBN-13: 9780471692140; ISBN-10: 047169214X

PREREQUISITES: N/A

STUDENT PREPARATION: Students should have taken Molecular Cell Biology, Biochemistry, and undergraduate physics. Basic statistics is STRONGLY encouraged. The course does not require calculus.

SUITABLE FOR 1ST YEAR STUDENTS: The course is not suitable for first year students as it is very time intensive with lectures and labs.

STUDENT ASSESSMENTS: Grades will be based on three exams, student presentations and homework.

CREDIT HOURS: 3.5

7020A Responsible Conduct of Research – Advanced

COURSE DESCRIPTION: The National Institutes of Health (NIH) requires that all pre-doctoral and post-doctoral trainees receive training in the responsible conduct of research at a frequency of no less than every four years. This advanced course in the responsible conduct of research is for the more experienced (5th year) graduate students and postdocs. (All pre-doctoral and post-doctoral trainees are required to take the first instance of the RCR course in year one of training.)

This advanced course will cover the following topics:

- Overview of RCR and Policies
- Data Management Practices and Problems
- Mentor and Trainee Responsibilities and Relationship Issues
- Authorship and Publication – Balancing Expectations and Realities; Strategies for Success

This is a four-week course. The first session will be a general overview and review of institutional, professional and national policies. The other three sessions will include a 40-45 minute-lecture followed by small breakout group sessions (1 hour) to review scenarios and problem-based case studies.

This course fulfills an NIH retraining in RCR requirement and is *required for PhD students and post-doctoral fellows in the 5th year of training.*

REQUIRED MATERIALS: Course readings will be distributed or made available as pdf files.

PREREQUISITES: 1st year Responsible Conduct of Research

SUITABLE FOR 1ST YEAR STUDENTS: No

STUDENT ASSESSMENTS: To satisfy this advanced course, attendance at every session (lecture and breakout) is required. Missing a session (due to illness or professional travel) will require the submission of a make-up assignment in order to satisfactory complete the course.

CREDIT HOURS: N/A