### Fall 2019 Course Descriptions

#### Block I

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOS 7001</td>
<td>Biochemistry</td>
<td>1</td>
</tr>
<tr>
<td>CLRM 5820</td>
<td>Epidemiologic Research Methods</td>
<td>2</td>
</tr>
<tr>
<td>BIOS 7026</td>
<td>Introduction to Systems Biology</td>
<td>3</td>
</tr>
<tr>
<td>BIOS 5010</td>
<td>Membrane Physiology &amp; Transport</td>
<td>4</td>
</tr>
<tr>
<td>BIOS 7006</td>
<td>Molecular Genetics</td>
<td>5</td>
</tr>
<tr>
<td>CLRM 5860</td>
<td>Multivariable Regression</td>
<td>6</td>
</tr>
<tr>
<td>BIOS 7406</td>
<td>Principles of Neuroscience I</td>
<td>7</td>
</tr>
<tr>
<td>BIOS 7020A</td>
<td>Responsible Conduct of Research – Advanced</td>
<td>8</td>
</tr>
</tbody>
</table>
BIOS 7001 Biochemistry

COURSE DESCRIPTION: This is an 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.


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
CLRM 5820 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.


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
BIOS 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 substantial 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 required) Calculus, Linear Algebra, Differential Equations and Stochastic Processes. Also, Background in computer programming 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
BIOS 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
BIOS 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 into 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
CLRM 5860 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:
  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
BIOS 7406 Principles of Neuroscience I

COURSE DESCRIPTION: Principles of Neuroscience I is a 13-week course required for students in the Department of Neuroscience. 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 and students are also required to prepare and present at a symposium on a specific topic and to attend the weekly Neuroscience Seminar Series.

PREREQUISITES: None

SUITABLE FOR 1ST YEAR STUDENTS: Yes

UNIQUE TRAINING OFFERED IN THIS COURSE: This is one of only two courses at Einstein that broadly covers the field of Neuroscience. It focuses on the complex cell biology of neurons and how they communicate, and on the principles and mechanisms that give rise to their unique electrical properties. There is no overlap with the second course that focuses on the principles that regulate functional connectivity in the brain.

STUDENT ASSESSMENTS: Student learning will be assessed through a graded oral exam and class participation (discussion, participation, in-class quizzes).

CREDIT HOURS: 6.0
BIOS 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