EINSTEIN

Albert Einstein College of Medicine

Graduate Programs in the Biomedical Sciences

COURSE CATALOG

Spring 2023 Block III

Spring 2023 Course Descriptions

Block III

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Subject to change

CLRM 5821 – Advanced Epidemiologic Research

COURSE LEADER:
Ilir Agalliu, MD, ScD

COURSE SCHEDULE:
February 2 – May 11, 2023
Thursdays, 11:00-12:50

COURSE DESCRIPTION:
This course will introduce advanced methods in epidemiology with the primary goal of expanding knowledge of evolving methodological issues for epidemiological studies and causality inference. Topics include efficient study designs (e.g. nested case-controls, case-cohort, case-crossover) in epidemiological studies, causal diagrams and causal inference, propensity score and instrumental variable analysis to address confounding and bias. At the end of the course students will have a better understanding of various epidemiological methods used in clinical and epidemiological studies.

REQUIRED MATERIALS:
Rothman KJ, Greenland S, Lash TL. Modern Epidemiology; 3rd Ed. 2008. Lippincott, Williams & Wilkins, Philadelphia, PA; ISBN-10:1451190050, ISBN-13: 9781451190052

PREREQUISITES:
Clinical Research Intensive; Epidemiologic Research Methods

SUITABLE FOR 1ST YEAR STUDENTS:
No. This is an advanced course.

STUDENT ASSESSMENT:
Case Studies, In-Class Discussion, Written Critiques and Final Exam.

CREDIT HOURS: 2.0

BIOS 7409 – Approaches to Study Neural Circuits in Behaving Animals

COURSE LEADER:
Anita Autry, PhD | Lucas Sjulson MD, PhD

COURSE SCHEDULE:
March 14 – May 2, 2023
Tuesdays, Thursdays, 10:30-12:30

COURSE DESCRIPTION:
This course will introduce students to techniques for in vivo recording of neural activity and approaches to define connectivity and expression profiling of neurons. Emphasis on techniques, instrumentation, and data analysis (demos for analysis). We will introduce the basics of measurement and instrumentation for in vivo physiology, in vivo calcium imaging, and introduce methods for manipulation, anatomy, and expression profiling of neurons. A key motivation in going over the techniques will be to compare methods for recording and manipulation (i.e. physiology versus imaging, optogenetics versus chemogenetics) in terms both of the mechanisms at the level of individual neurons and how that manipulation will impact resulting data and interpretation of behavioral/activity outcomes. Course meetings will be lectures to go over the basic information as well as hands on demonstrations with equipment and example data analysis. Students will be evaluated based class participation and on a final presentation (around 15 minutes) of recent advances in the application or analysis of one of the techniques discussed in class.

COURSE OBJECTIVES:
- understand principles of measurement and analysis
- understand the advantages and limitation of specific approaches for neural recordings
- get hands-on experience handling data sets from in vivo recording experiments
- understand the advantages and limitations of methods for manipulating neurons
- become versed in visualizing and interpreting data from neural recording and neural manipulation experiments

PREREQUISITES:
None

REQUIRED MATERIALS:
If students would like to follow along with data analysis demonstrations, a computer and free software (TBA) will be required. Demos will also be shown on a screen.

SUITABLE FOR 1ST YEAR STUDENTS:
Yes. Priority enrollment is given to grad students, but postdocs and other are welcome if the max enrollment has not been reached.

STUDENT ASSESSMENT:

Students will be assessed based on in-class participation and a final presentation (75% participation; 25% final presentation). Participation will be assessed by daily or weekly reflections on Canvas, that will include short summaries of the main points covered in that week, and assessment of lab notebook.

Attendance and Participation

No more than one unexcused absence will be allowed. All absences (excused or otherwise) must be "made-up" by completing the requisite work completed in class.

CREDIT HOURS: 2.0

BIOS 7411 – Data Analysis

COURSE LEADER:
Maria Gulinello, PhD

COURSE SCHEDULE:
March 13 – May 15, 2023
Mondays, Wednesdays, 9:30-11:30

COURSE DESCRIPTION:
Targeted to the needs of graduate students, this course compliments and expands on existing mathematical-based instruction with practical, "plain English" explanations in order to provide the skill requisite to applying and interpreting statistical concepts appropriately. Actual data sets (provided by neuroscience faculty, open data sources and the students) and hands-on data visualization and analyses in each session provide real-world examples of the typical and unique challenges faced in experimental science. Assignments are practical elements of a qualifying exam, grant proposal or research paper.

COURSE OBJECTIVES:
1) Practical experience, through the use of actual data-sets (detailed below), in choosing appropriate data analysis tools and statistical models for typical data encountered in neuroscience studies.
2) Choosing the Correct Statistical Tests: Mastery of the implications, pros and cons, assumptions and limitations of various statistical models. Effective and transparent data visualization and illustration.
3) Application of statistical principles to pre-registration and experimental design (including power analysis).
4) Learning to correctly report statistical data – learning to interpret and understand statistical data reporting and identify errors and false assumptions in published and presented data.
5) Avoiding common pitfalls.
6) Application of these basic principles to complicated data sets for the greatest transparency and rigor.

PREREQUISITES:
None. Undergraduate statistics recommended.

REQUIRED MATERIALS:
- Computer (either platform) – contact the course director if this is an issue.
- JMP (SAS) cost $29.95.

SUITABLE FOR 1ST YEAR STUDENTS:
Yes. Priority enrollment is given to grad students, but postdocs and other are welcome if the max enrollment has not been reached.

STUDENT ASSESSMENT:
Weekly HW assignments – 30% of grade

1 data management project, 1 data analysis and visualization project, 1 submission of dataset, 2 take home exams (in the form of mock qualifying exams, mock grant proposals or mock publication) 70% of grade (one mid, one final)

Feedback given for each assignment and in class. Problem sets with feedback in class.
Other formative assessments include – daily or weekly reflections on Canvas, short summaries of the main points covered in that week. Assignments may include webinar type instructional videos for how to use the software (although in class instruction is provided).

Attendance and Participation:
No more than one unexcused absence per session. All absences (excused or otherwise) must be "made-up" by completing the requisite work. No more than 3 excused absences per session.
The data sets and resulting analysis should have been completed during each class session, with appropriate guidance to a reasonable standard. Students will be required to upload these to Canvas

Objective Assessments:

- Summative assessments = 2 exams, 1 data management and simulation spreadsheet, 1 data analysis and visualization project.
- Formative assessments - weekly HW and in class exercises in software use, data analysis and data management – includes Peer reviews, presentation, and critical analysis of published papers, and submission of sample data in your field.

Subjective assessments:
Will be assessed before and after the class.

- Familiarity with, and confidence in judging and evaluating the suitable models available for statistical analysis.
- Familiarity with and confidence in evaluating statistical data reported in seminal and relevant publications.
- Completes the worksheets, analysis in class correctly and demonstrates sufficient familiarity with software features
- Reflections will be requested weekly.

It should be noted here that despite the fact that many students have a decent rote understanding of the mathematical formulae and assumptions underlying basic statistics, they do not recognize these in the real world and express a profound (and accurate) lack of confidence about the application of these basic principles in their daily work.

CREDIT HOURS: 2.5

CLRM 5861 – Design and Analysis of Longitudinal Data Studies

COURSE LEADER:
Shankar Viswanathan, DrPH

COURSE SCHEDULE:
February 7 – April 25, 2023
Tuesdays, 11:00-12:50

COURSE DESCRIPTION:
This course consists of 14 lectures/labs which will be taught in two 7-week modules. The first module will cover logistic regression and the second module will cover survival analysis. Each module has a required textbook and will have weekly reading and graded homework assignments and a take-home exam.

COURSE OBJECTIVES:

- To learn the basics and applications of logistic regression in assessing associations between exposure/explanatory variables and a dichotomous outcome variable.
- To learn fundamental methods in analyzing time to event data using survival analysis, especially Cox proportional hazards modeling.
- Use STATA software to conduct both logistic regression and survival analysis and to be able to interpret the statistical output related to these modeling techniques.

RECOMMENDED MATERIALS:

- For Module One: Applied Logistic Regression by David W. Hosmer & Stanley Lemeshow (2nd edition), 2000, Wiley; ISBN-13: 978-0471356325
- For Module Two: Survival Analysis: A Self-learning Text by David Kleinbaum and Mitchel Klein (3rd edition) Springer; ISBN: 978-1-4419-6645-2 (Print) 978-1-4419-6646-9 (Online) NOTE: this textbook is available via the Einstein library.

PREREQUISITES:
N/A

SUITABLE FOR 1ST YEAR STUDENTS:
No.

STUDENT ASSESSMENT:
A final grade of pass/fail for Biostatistics III will be assigned based on both modules: Class Participation 10%; Homework 30%; Module one exam 30% and Module two exam 30%

CREDIT HOURS: 2.0

CLR 5000 – Design and Conduct of Clinical Research

COURSE LEADER:
Paul Marantz, MD, MPH | Nadia Laniado, DDS, MPH, MS

COURSE SCHEDULE:
March 7 – April 27, 2023
Tuesdays, Thursdays, 5:00-6:30

COURSE DESCRIPTION:
This seminar course aims to introduce students to clinical research with a focus on epidemiology and study design. The course uses an introductory clinical research text, along with a critical assessment of papers from the scientific (clinical and epidemiologic) literature, in order to learn about study designs: their strengths and weaknesses and how such studies are conducted. Topics to be covered include: basic epidemiology, measures of association, basic statistics, cohort studies, case control studies, clinical trials, causal inference, and research ethics.

PREREQUISITES:
Interest in and some familiarity with clinical research preferred (Clinical Research 101 lecture series recommended)

REQUIRED MATERIALS:
Designing Clinical Research, Hulley SB, Cummings SR, Browner WS, Grady DG, Newman TB., 4th Ed. Lippincott Williams & Wilkins; Philadelphia: 2013. ISBN-10: 1608318044 | ISBN-13: 978-1608318049

SUITABLE FOR 1ST YEAR STUDENTS:
Yes

STUDENT ASSESSMENTS:
Final exam (multiple choice/short answer); preparation and participation in class

CREDIT HOURS: 2.0

BIOS 7002 – Human Metabolism: Regulation and Disease

COURSE LEADER:
Maureen Charron, PhD

COURSE SCHEDULE:
March 14 – June 15, 2023
Tuesdays, Thursdays; Lectures 3:20-4:10, Discussions, 3:20-4:45

COURSE DESCRIPTION:
The course combines lecture, self-study and weekly small group student-led discussions of contemporary literature relevant to the lecture topics.

The course is both an extension of Biochemistry taught during Block I as well as an opportunity for students to develop a more cohesive view of the nature and regulation of human metabolism. The course will cover key areas in metabolism and will highlight relationships to clinically relevant topics and the integration and regulation of carbohydrate, lipid, amino acid and nucleic acid metabolism.

COURSE OBJECTIVES:
The goal of Human Metabolism: Regulation and Disease is to provide students with an understanding of the principles of the interrelated pathways of human metabolism and the ability to apply those principles to discussion of the pathophysiology and the design of new therapies for human disease.

PREREQUISITES:
A passing grade in, or exemption from *Biochemistry* (Block I), is required.

The student should be conversant in the basic concepts of biochemistry that are presented in the Biochemistry course prerequisite. These include but are not limited to a familiarity with the fundamental biochemical species of amino acids, lipids, oligosaccharides and nucleic acids, biochemical energetics, the fundamental energy-producing biochemical pathways, enzymatic catalysis and enzyme regulation.

REQUIRED MATERIALS:
Textbook: Thomas M. Devlin (ed) Textbook of Biochemistry with Clinical Correlations, 6th edition. ISBN 978-0-471-67808-3

SUITABLE FOR 1ST YEAR STUDENTS:
Yes.

STUDENT ASSESSMENT:
- Exam 1 covering sections 1 and 2: 40%
- Exam 2 covering sections 3 and 4: 40%
- Discussion 1: 5%
- Discussion 2: 5%
- Discussion 3: 5%
- Discussion 4: 5%

Students are expected to attend all lecture, discussion and exam sessions. If an absence is anticipated, the student must contact the course leader *before* the session.

Attendance at the Review Sessions given throughout the course and before each exam is optional but highly recommended.

CREDIT HOUR: 4.0

BIOS 7013 – Mechanisms of Disease

COURSE LEADER:
David Fooksman, PhD

COURSE SCHEDULE:
March 13 – June 14, 2023
Mondays, Wednesdays, 10:30-11:50

COURSE DESCRIPTION:
This multidisciplinary course will investigate the pathobiology of human diseases and relevant animal models. Topics will include cellular pathology and the mechanisms of cell injury and repair. The course will emphasize the immunologic, molecular, genetic, and biochemical mechanisms that result in the gross and microscopic changes taking place within affected tissues. Types of injury to be explored in depth will include: biochemical/genetic (mechanisms of neurodegeneration, lysosomal disease, chromosomal abnormalities), aging, cancer, infectious, inflammatory, immunologic injury (Tuberculosis, Ebola, Acquired Immunodeficiency Syndrome, Multiple Sclerosis), and environmental (DNA damage).

COURSE OBJECTIVES:
The course will provide background knowledge of pathologic processes, including genetic, biochemical, inflammatory and immunological mechanisms, and neoplasia. The goal is to demonstrate knowledge of the epidemiology, etiology, pathogenesis and mechanisms of several diseases. Knowledge of gross and histopathologic morphology of diseased and normal organ function will be examined. An understanding of the strategies employed to study disease pathogenesis and models to advance treatment and function. Demonstrate an understanding of select mycobacteria, viruses, fungi and parasites with respect to their epidemiology, pathogenesis, clinical manifestations and their potential treatment in select models of disease. An understanding of the rationale behind the translational approach and the research to explore and reduce the pathogenesis of the disease state.

PREREQUISITES:
Knowledge of Immunology and Biochemistry is helpful.

REQUIRED MATERIALS:
The course requirements will be assigned readings and open discussion, 2 oral presentations and a written assignment.

SUITABLE FOR 1ST YEAR STUDENTS:
Yes.
Limited to 11 students.

STUDENT ASSESSMENT:
Grading will be based on class participation (25%) and oral presentations (50%), and a follow-up assignment(s) (25%). Attendance is mandatory for all lectures.

For class participation: students will be expected to prepare to discuss the papers at each class. Participation quality will be prioritized over quantity.
For oral presentations: presenting student will prepare with a deeper understanding of the paper and topic, understanding the nuances of the approaches, results, the gaps in knowledge, implications of the work, limitations, and next steps. Presenter will be responsible for conducting an effective journal club discussion and incorporating peers in the conversation.
Follow- up assignment will be based on the presentation, developing next steps in the form of a short grant aim.

Grading will be honors/pass/fail. Completion of all assignments will be required for passing. Honors will be based on quality of class participation, depth and quality of oral presentations, and quality of the follow-up assignment.

CREDIT HOURS: 3.0

BIOS 7035 – Modern Artificial Intelligence in Biomedical Research- Seminar and Tutorial

COURSE LEADER:
Ruben Coen-Cagli, PhD

COURSE SCHEDULE:
March 15 – May 10, 2023
Mondays, Wednesdays, 1:30-3:20

COURSE DESCRIPTION:
This elective course will expose students to modern methods in Artificial Intelligence (AI), particularly focusing on AI for biomedical research, through critical reading and discussion of selected papers, and associated coding tutorials.

During the last decade, AI has achieved impressive progress in real-world applications that appeared out of reach just a few years ago, and now features regularly in both scientific and general news. Modern AI methods are also becoming increasingly recognized as an integral component of the toolbox of the biomedical research community. The goal of this course is to provide an introduction to the most important classes of such AI algorithms, through critical reading and discussion of research papers relevant for graduate students in biomedical sciences. Each of the selected papers adopts those algorithms in one of three ways: 1) as a powerful tool for analysis of complex and/or arge scale data (e.g. “alpha-fold”, a deep learning algorithm for protein folding); 2) as a core component in semi-automated medical applications (e.g. the “UNet” for analysis of CT scans and x-rays); 3) as a computational model of biological processes (e.g. “deep convolutional neural networks” to explain the logic of neural activity in visual areas of the brain).

COURSE OBJECTIVES:
The first objective is for students to learn modern AI methods and their application to biomedical research, through reading and discussion of selected papers.
The second objective is to familiarize students with code and related tools associated with the papers of each class, through hands-on coding tutorials.
After the course, students will have acquired literacy and practical resources. This will enable them to communicate fluently with AI experts, both in academia and industry, as well as provide the starting point for those who may be interested in applying modern AI methods in their thesis research.

PREREQUISITES:
Linear algebra; probability and statistics; calculus; basic curve fitting (linear regression/classification); coding in Python. Introductory tutorial to Python: https://python.tyto.xyz/neuro2022/.

REQUIRED MATERIALS:
Laptop with an internet browser for tutorial classes. Students need to install “Anaconda” and Python (instructions: https://python.tyto.xyz/install-instructions.php).

SUITABLE FOR 1ST YEAR STUDENTS:
No.

STUDENT ASSESSMENT:
Two or three papers (depending on class size) will be discussed in each discussion class. Each paper is presented by one group of students, and criticized by one other group. There will be a 15-20-minute presentation, followed by 15-20-minute Q&A/scientific debate between the two groups. Grades will be based on the understanding of papers, demonstrated by the clarity of presentation of the assigned papers and by the relevance of questions to other presenters. Each discussion class is followed by a coding tutorial class. Assessment will be based on completing the tutorials.

Students are expected to attend all classes. If missing a tutorial class, they will have to complete the tutorial on their own time (code and guidance will be provided). If missing a discussion class, student will write a 1-2-page (plus figures and bibliography, optionally) critical review of the two papers.

Final Grade:
80%: demonstrate understanding of papers
20%: complete the coding tutorials

The final grade (honors/pass/fail) is cumulative and will be transmitted at the end of the course. A grade of honors can be obtained by consistently (i.e. throughout all classes) showing knowledge and understanding beyond the assigned paper/tutorial, for instance, by identifying other papers related to the assigned paper and finding deep connections or conflicts between them. A student will receive a fail if they consistently fail to present clearly their paper, or to ask relevant questions about the other papers.

CREDIT HOURS: 2.0

BIOS 7014 – Molecular Approaches to Drug Action and Design

COURSE LEADER:
Derek Huffman, PhD | Hayley McDaid, PhD

COURSE SCHEDULE:
March 14 – June 15, 2023
Tuesdays, Thursdays, some Fridays 10:30-11:50

COURSE DESCRIPTION:
As a society, where would we be without drugs? Antibiotics, chemotherapeutics and small molecules for the treatment of infections, cancer, diabetes, blood pressure, pain and a multitude of other conditions has allowed us to live longer, healthier and more productive lives. This course will provide an essential foundation of pharmacology for students interested in understanding how some of the most impactful drugs were discovered or designed and their mechanisms of action via state-of-the-art lectures and in-depth discussion. Modules will cover the principles of modern pharmacology (e.g., pharmacokinetics, pharmacodynamics, pharmacogenomics), methodologies of drug discovery/design and therapeutics for the treatment of cancer, metabolic diseases and infections. The course will also introduce newer concepts in drug development, including drugs to target aging, neurodegenerative diseases, and the role of the microbiome. Throughout, emphasis will be placed on the biology and chemistry of interactions between agents and their cellular targets, including specific enzymes, and their cellular processes. When available, their impact on physiologic systems will also be discussed, including preclinical data that spurred these drugs toward clinical trials, to evidence for their eventual successes (or failures) in humans.

COURSE OBJECTIVES:

- Develop a fundamental understanding of pharmacology concepts and their application to guiding drug development
- Become familiar with how various types of drugs, from small molecules to antibodies, are designed, developed and tested for potential clinical use
- Become familiar with major classes of drugs, including their mode of action, used to treat common chronic conditions, including cancers, type 2 diabetes, infections and metabolic disease
- Gain a holistic understanding of the challenges and opportunities in successfully developing and bringing a drug candidate to market

PREREQUISITES:
Should have the equivalent of graduate school biochemistry. Specifically, students should have some familiarity with thermodynamics, enzyme kinetics, protein structure and function, receptor ligand interactions.

REQUIRED MATERIALS:
None

SUITABLE FOR 1ST YEAR STUDENTS:
Yes

STUDENT ASSESSMENT:
Student performance will be dependent on class participation (30%), three mini take-home exams (10% each), and two student group presentations (20% each). Student participation will be based on regular attendance and discussion during faculty lectures and student projects. Students will also be expected to demonstrate mastery of concepts learned during lectures on both take-home exams and group projects/presentations.

CREDIT HOURS: 3.0

BIOS 7029 – Stem Cells, Development and Disease

COURSE LEADER:
Andreas Jenny, PhD | Teresa Bowman, PhD

COURSE SCHEDULE:
March 14 – June 15, 2023
Tuesdays, Thursdays, 4:20-5:30

COURSE DESCRIPTION:
The course focuses on the fundamentals of developmental biology, stem cells and regenerative medicine. The pathways and processes central to embryogenesis are often reused during tissue regeneration. Moreover, many diseases have their origins in mis-regulation of developmental pathways. A fundamental knowledge of development can thus strengthen your understanding of regenerative biology, aging, and disease. In this course, we will focus on the major principles and appropriate experimental approaches utilized in researching questions in development and stem cell biology.

The course is comprised of lectures, team-based learning discussions and writing sessions. For all aspects of the course, students are highly encouraged to raise their own questions about material presented and to voice their agreement (or dissent!) with thoughts raised during discussions. Course leaders and instructors will make sure that everyone has a chance to participate in the discourse.

COURSE OBJECTIVES:
The goal of this course is for students to get an overview of the state-of-the-art of research in developmental biology and stem cells. Students will learn to critically evaluate literature and seminars, to understand relevant experimental approaches, and to develop logical thinking and good experimental design skills for studying development and stem cell biology.

PREREQUISITES:
None

REQUIRED MATERIALS:
None; 'Developmental Biology' by Gilbert et al. or similar standard textbooks can be helpful. Instructors will point out relevant literature for further reading. Material to be studied in advance will be posted with sufficient notice on Canvas.

SUITABLE FOR 1ST YEAR STUDENTS:
Yes.

STUDENT ASSESSMENT:
Grading is primarily based on participation. Course leaders and instructors evaluate participation of student (preparedness, quality of questions and answers) during lecture-based classes and journal club presentations. In case of paper discussions, a student will act as facilitator and will introduce the topic and randomly select students to present figures or answer questions emerging from the ongoing discussion. All students are expected to be part of the paper discussion. The facilitator will summarize conclusions

and future directions or details that should be further addressed. Discussion leaders of JCs will receive extra credit.

Additionally, there is a group writing exercise that will comprise 12.5% of the final grade. The class will be divided into groups of 3-4 students each. Each group will write a one-page grant proposal on a development or stem cell topic, and then present it to the class. Grades will be assigned based on the logic and experimental approach of the proposal and presentation.

Attendance and participation in ALL classes are required. Absences must be excused prior to class meeting. More than two absences per term will result in a failing grade for the course.

CREDIT HOURS: 2.5

BIOS 7410 – Techniques in Human Neuroscience

COURSE LEADER:
Sophie Molholm, PhD | Elyse Sussman, PhD

COURSE SCHEDULE:
April 20 – May 16, 2023
Tuesdays, Thursdays, 2:00-4:00

COURSE DESCRIPTION:
This course will provide a survey of current methodologies used in the study of human neuroscience and behavior. These include functional magnetic resonance imaging (fMRI), diffusion tensor imaging (DTI), functional near-infrared spectroscopy (fNIRS), event-related brain potentials, mobile brain/body imaging (MOBI), and clinical assessments. Lectures will focus on the tools and techniques used to understand brain systems that enable memory, attention, language, scene perception, and executive functions, and the development of these processes across the lifespan.

COURSE OBJECTIVES:
- Learn the range of methodologies used to investigate the brain basis of human cognition.
- Identify strengths and limitations in the study of complex brain functions.

PREREQUISITES:
None.

REQUIRED MATERIALS:
Suggested reading: The Cognitive Neurosciences, 5th Edition (2014). Eds: Michael S. Gazzaniga and George R. Mangun. MIT press, Cambridge MA. ISBN-13: 978-0262027779

SUITABLE FOR 1ST YEAR STUDENTS:
Yes

STUDENT ASSESSMENT:
Grades will be based on attendance (10%) class participation (30%) and presentation of a paper that includes the strengths and weaknesses of the technique for answering questions about human behavior (60%). Participation will be assessed by daily or weekly reflections on Canvas, that will include short summaries of the main points covered in that week.

Attendance and Participation
No more than one unexcused absence will be allowed. All absences (excused or otherwise) must be "made-up" by completing the requisite work completed in class.

CREDIT HOURS: 1.25

BIOS 7412 – The Cellular, Molecular and Genetic Basis of Neurological and Psychiatric Disorders

COURSE LEADER:
Herbert Lachman, MD

COURSE SCHEDULE:
May 18 – June 13, 2023
Tuesdays, Thursdays, 2:00-4:00

COURSE DESCRIPTION:
This block will be subdivided into four, weekly sessions devoted to neurological and psychiatric disorders, as follows:

- Psychiatric disorders (schizophrenia, bipolar disorder, addiction)
- Speech and hearing disorders; auditory processing
- Neurodegenerative disorders (e.g., Alzheimer Disease, Parkinson Disease, Huntington Disease)
- Neurological disorders (e.g., epilepsy, stroke)

The lectures will combine a clinical description of the disorders with the modern approaches being used to understanding their molecular and genetic basis, for the purpose of developing novel therapies. The methods that will be discussed include genome wide association studies (GWAS), copy number variant (CNV) analysis, whole genome and exome sequencing, induced pluripotent stem cell disease-modeling, CRISPR-editing, high throughput drug screening using human neuronal cells, regenerative medicine, and gene therapy/antisense oligonucleotides.

The course provides an overview of a broad range of neurological, neurodevelopmental and psychiatric disorders, along with descriptions of modern research tools designed to help understand their underlying basis. The course has a unique translational perspective. There is no other course at Einstein dedicated to teaching about brain disorders.

COURSE OBJECTIVES:
Acquaint Ph.D. students with the clinical features of various neurological and psychiatric disorders, which are among the most disabling disorders in the world, and show how the tools of modern basic science research are being used to develop novel therapies.

PREREQUISITES:
None.

REQUIRED MATERIALS:
Suggested reading: Each lecture will be accompanied by one article; either a review or a relevant research paper related to that particular lecture.

SUITABLE FOR 1ST YEAR STUDENTS:
Yes

STUDENT ASSESSMENT:
40% of the final grade will be based on attendance and class participation. At the end of each class, the students are expected to upload a short (250 word) paragraph to canvas on what they have learned in class.

CREDIT HOURS: 1.25

BIOS 7015 – Viruses

COURSE LEADER:
Vinayaka Prasad, PhD | Ganjam Kalpana, PhD | Kartik Chandran, PhD

COURSE SCHEDULE:
March 14 – June 15, 2023
Tuesdays, Thursdays, 1:20-2:40

COURSE DESCRIPTION:
The study of viruses helped lay the foundation of modern molecular biology, and continues to provide new insights into the biology of cells and organisms. We live in an increasingly interconnected and crowded world in which "new" viruses can emerge and spread throughout the globe seemingly overnight, and are being discovered at an ever-accelerating pace through cutting-edge genome sequence-based technologies. At the same time, "old" viruses such as HIV-1 remain a global threat and viruses we thought we had defeated, such as measles, are resurgent today. Therefore, a sophisticated and broad-based understanding of animal viruses is needed now more than ever. In this course, we will study how viruses are put together, how they multiply in their hosts and cause disease, how we find new viruses and characterize them, and how we exploit them as tools for basic research and therapeutics.

'Viruses' will be kicked off with lecture/seminar by noted virologists. This will be followed by didactic lectures featuring Einstein's own virology faculty complemented by invited outside speakers. All speakers are international experts in different areas of the study of viruses. The course is organized into 5 units and the lectures will cover virus structure, mechanisms of virus entry and replication, regulation of viral and host gene expression, virus assembly, virus egress, host responses to viral infections, and viral pathogenesis. 'Viruses' will demonstrate how these basic principles offer opportunities for diagnosis, prevention, and treatment of prevalent and emerging viral diseases, and for the development of new applications that utilize viruses as tools.

This year we have arranged two special events for the benefit of Viruses students on March 23rd. The first one is an inaugural seminar by Dr. Stanley Perlman, a world renowned expert on Coronaviruses. This is a school-wide seminar from 12:00 to 1:00 PM open to everyone and the students will specifically benefit from this lecture. The second one is a special kick-off lecture at 1:20 to 2:40 PM by the authors of "Principle of Virology", Drs. Vincent Racanielo and Theodora Hatziioannou.

COURSE OBJECTIVES:
To be able to understand the fundamentals about viruses: how they replicate, how they cause disease, how they evolve. Students should be able to appreciate the intricacies of viral biology to a level that allows them to be able to think about how to devise strategies of control – by virus inhibition or via vaccines.

PREREQUISITES:
Biochemistry, Gene Expression: Beyond the Double Helix, and Molecular Genetics courses are recommended, but not mandatory.

REQUIRED MATERIALS:

- A computer to access email and internet.
- Principles of Virology 4th Edition. by S.J. Flint, V. R. Racaniello, Rall, G. and A.M. Skalka (2015) ASM Press. ISBN # 978-1-55581-9330.

SUITABLE FOR 1ST YEAR STUDENTS:
Yes

STUDENT ASSESSMENT:
The entire course is graded on two take home exams. The exams are graded on a curve. No minimum set.

CREDIT HOURS: 3.0