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BIOS 7018 Computational Biology of Proteins

COURSE DESCRIPTION: An introductory course to Protein Bioinformatics. We provide a systematic introduction to the major techniques, algorithms and tools used in Bioinformatics (for sequence alignments, classifications, secondary and tertiary structure predictions, modeling, sampling of conformations, energy functions, prediction of various functional and structural features of proteins, docking etc.).


PREREQUISITES: No

STUDENT PREPARATION: Clear understanding of basic biochemical and biophysical concepts are expected. I.e. Biochemistry course in first Block is advised.

SUITABLE FOR 1ST YEAR STUDENTS: Yes

STUDENT ASSESSMENTS: A midterm and a final exam.

CREDIT HOURS: 2.5
CLR 5000 Design and Conduct of Clinical Research

**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:** None.

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

**SUITABLE FOR 1ST YEAR STUDENTS:** Yes.

**UNIQUE TRAINING OFFERED IN THIS COURSE:** Follows up on concepts introduced in the Clinical Research 101 lecture series, and provides a deeper dive into study design and interpretation.

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

**CREDIT HOURS:** 2.0
**BIOS 8009 Fundamentals of Course Design and Teaching**

**COURSE DESCRIPTION:** Research and teaching are two major spheres of scholarship and responsibility for most faculty in academic sciences. Training in the science and art of teaching is uncommon, however, particularly in the research intensive environment of a medical school. Although we are often expected to teach and show evidence of good teaching, our training in pedagogy is frequently weak, and research training does not substitute for training to teach.

The proposed course will present fundamental concepts and principles widely used in the design and execution of courses for adult learners (college and postgrad). Topics will include cognitive hierarchies and multiple intelligences in adult learning, course, lesson and syllabus design, lecture hall strategies, active learning strategies, formative and summative assessment techniques.

**REQUIRED MATERIALS:** Computer access to course management website. Textbooks are suggested in syllabus.

**PREREQUISITES:** Open to advanced graduate students who have completed their required courses and qualifying exam. This course cannot be used to fulfill a graduate course or graduate program requirement. Also open to postdocs and faculty. The course enrollment will be limited to 45.

**STUDENT PREPARATION:** No specific academic knowledge requirements.

**SUITABLE FOR 1ST YEAR STUDENTS:** No

**UNIQUE TRAINING OFFERED IN THIS COURSE:** There is no overlap with other courses. This is the only course organized specifically to teach pedagogical principles of course design, lesson planning and diverse teaching approaches/skills.

**STUDENT ASSESSMENTS:** Participants who successfully complete (pass/fail) the course will receive an official institutional certificate of completion to add to their CV. Successful completion of the course will be assessed by attendance, weekly participation in discussions/assignments and satisfactory completion of exercises in course design. Written reflections are required for each objective; a course syllabus and lesson plans are produced and evaluated; a teaching philosophy statement; No more than 3 absences/missed assignments are permitted.

**CREDIT HOURS:** 2.0
BIOS 7007 Gene Expression: Beyond the Double Helix

COURSE DESCRIPTION: This course deals with molecular mechanisms of biological information content. Specifically the course will tackle the question of how the information contained within DNA, RNA, and chromatin is stored and used in different biological contexts. The major focus is on the molecular mechanisms of the regulation of gene expression and their impact on cellular functions. Topics include: the genome and DNA, the biochemistry of DNA transcription into RNA, biochemistry of chromatin and the histone code, regulation of transcription and of chromatin structure, its modification and role in epigenetic phenomena; metabolism of the major cellular classes of RNA, emphasizing transcription, processing, stability/degradation, and translation of messenger RNA into protein and control at each of these steps; the role of RNA-mediated catalysis in biology and evolution; the biology and biochemistry of non-coding RNA and the use of RNAi as an experimental and therapeutic tool.

REQUIRED MATERIALS: Computer.

PREREQUISITES: Undergraduate course in molecular biology at the level of Alberts “Molecular Biology of the Cell” and 1st Block Graduate Biochemistry.

STUDENT PREPARATION: Students should be familiar with nucleic acid structure, college-level genetics, graduate biochemistry level protein structure/function.

SUITABLE FOR 1ST YEAR STUDENTS: Yes

UNIQUE TRAINING OFFERED IN THIS COURSE: This course uniquely targets molecular mechanisms of the storage of biological information in nucleic acids and chromatin and the utilization of this biological information through transcription, RNA processing, and translation. Modest overlap with graduate biochemistry and molecular genetics is expected and useful.

STUDENT ASSESSMENTS: Three take-home exams (80% total), and weekly student-led paper discussions and problem sets (20%).

CREDIT HOURS: 5.0
BIOS 7022 Immunology

COURSE DESCRIPTION: This course will provide students with a broad overview of basic immunology, while also delving deeply into cellular and molecular details in areas of central importance to this field. The course will consider both innate and adaptive immunity and include the structure and function of key receptors including immunoglobulins, T cell receptors and innate pattern recognition receptors. The mechanisms of antibody formation and molecular aspects of cellular immunity, including T and B cell interactions and lymphocyte memory formation, will be emphasized, and connections to modern biomedical science will be highlighted. These will include presentations and discussions on autoimmunity, immunity against major microbial pathogens (viruses, bacteria, parasites), transplantation and tumor immunology. The course will rely on multiple materials, including formal lectures (from >22 Einstein Faculty), Seminal papers discussion and Immunological methods/mouse model lectures (prepared by advanced postdoctoral fellows), Assigned reading (selected textbook chapters, cutting edge review articles and didactic videos), Data driven learning sessions (“Hands-on” data analysis and interpretation) and mandatory attendance to select seminars of the Microbiology and Immunology Department. Successful completion of the course will provide students with strong fundamental knowledge in basic immunology, and assist them in deepening their knowledge of current research and developments in modern immunology.

REQUIRED MATERIALS: Janeway's Immunobiology 9th edition Kenneth P. Murphy, ISBN 978-0-8153-45053-0 Published by Garland Science, Taylor & Francis Group, LLC ; computer access; internet access

PREREQUISITES: None.

STUDENT PREPARATION: Gene expression; protein structure; cell structure and organization

SUITABLE FOR 1ST YEAR STUDENTS: Yes

UNIQUE TRAINING OFFERED IN THIS COURSE: Immunology training is provided by this course and no other. The course will also cover methods used extensively in immunology research and applicable to other fields.

STUDENT ASSESSMENTS: Exams (Midterm, Final); Class and Discussion Participation, Basic Concept Homework

CREDIT HOURS: 4.0
BIOS 7005 Molecular Cell Biology

COURSE DESCRIPTION: This course will cover basic areas in cell biology with emphasis on selected topics of current interest. The three main areas will be intracellular protein transport, the nucleus, and the cytoskeleton. Topics include: membrane structure and biogenesis, functions of intracellular membranes and the signal hypothesis, protein trafficking and intracellular sorting, glycosylation, exocytosis, endocytosis and membrane fusion, nuclear structure and organization, nuclear transport, mRNA localization, self assembly of cytoskeletal structures, actin, microtubules, intermediate filaments, molecular motors, mitosis, cell junctions, extracellular matrix, cytoskeleton and signal transduction.


Reading the relevant chapter(s) prior to the lecture is required and essential for understanding the lectures. Several copies are on closed reserve in the library. The cheapest source for the book is Amazon and the E-Book is available through the Einstein online library at:

http://zc6sj2ch8l.search.serialssolutions.com/?V=1.0&N=100&tab=BOOKS&L=ZC6SJ2CH8L&S=AC_T_B&C=Lewin%27s+cells

PREREQUISITES: This is a demanding course involving a substantial amount of reading and should only be taken by those first year students with a background in biochemistry and cell biology.

SUITABLE FOR 1ST YEAR STUDENTS: Yes

STUDENT ASSESSMENTS: 3 exams and 3 team based learning sessions

CREDIT HOURS: 5.0
BIOS 5011 MSTP Cardiac Physiology

COURSE DESCRIPTION: The course will cover the fundamentals of cardiovascular physiology. The initial part of the course will cover the basics of muscle contraction and the differences between cardiac, skeletal and smooth muscle, as well as the autonomic nervous system and hemodynamics. The second part of the course will focus on cardiac function covering electrophysiology, pump function, and neurohumoral control of cardiac contractility, output and blood pressure. The course will be required for all first year MSTP students.

REQUIRED MATERIALS: Assigned textbook chapters, and articles distributed either as paper copies or pdfs.

PREREQUISITES: Students should have a year of biology including organ systems biology and a year of physics covering energy and work plus the electrical concepts of voltage, current, resistance. Students should also know about second messenger systems including cAMP, cGMP, IP3 and DAG. The Block 1 graduate course Membrane Physiology and Transport is a required prerequisite for this course.

STUDENT PREPARATION: Students should be familiar with the basics of electrical excitability and action potentials. They should have knowledge of hormonal second messenger systems and the basics of muscle contraction.

SUITABLE FOR 1ST YEAR STUDENTS: Yes

UNIQUE TRAINING OFFERED IN THIS COURSE: N/A

STUDENT ASSESSMENTS: Small group TBL participation, surprise quizzes and an essay final exam.

CREDIT HOURS: 2.0
BIOS 7011 NMR for Chemistry and Enzymology

COURSE DESCRIPTION: The course will provide a gentle introduction to basic NMR theory, and a more thorough treatment of the application of NMR to solving biochemical problems. Topics will include one-, two-, and possibly 3-dimensional methods applied to: the covalent structure and conformation of small molecules and macromolecules, ligand binding and exchange rates, pKa values, and enzyme mechanisms. Three weekly discussion sessions based on assigned readings will be combined with hands-on sessions in the NMR lab, where students will be assigned projects to be completed on the NMR spectrometers.

REQUIRED MATERIALS: Access to a computer or laptop.

PREREQUISITES: None.

STUDENT PREPARATION: A general familiarity with organic chemistry and biochemistry.

SUITABLE FOR 1ST YEAR STUDENTS: Yes

UNIQUE TRAINING OFFERED IN THIS COURSE: This is a fairly practical, hands-on course on using high resolution solution NMR to answer chemical and biochemical questions. It does not overlap with it or any other course.

STUDENT ASSESSMENTS: Student learning will be assessed by problem sets, lab write-ups, and one exam.

CREDIT HOURS: 2.0
BIOS 7407 Principles of Neuroscience II

COURSE DESCRIPTION: Principles of Neuroscience II is a 13-week course required for students in the Department of Neuroscience. In this course, students will explore how complex neural systems integrate afferent information and direct efferent outflow. The overall goal will be to explore higher order functions, such as the structure and function of neural systems underlying sensation and movement, learning and memory at the sensory and motor levels, as well as higher-level cognitive processes including object perception and attention. Student knowledge in these areas will be built on a firm understanding of the underlying physiology and anatomical structure. Principal areas of interest will be on hierarchical neural systems, the plasticity of neural networks, serial and parallel neural processing, cognition and computational modeling.

REQUIRED MATERIALS: N/A

PREREQUISITES: Principles of Neuroscience I

STUDENT PREPARATION: N/A

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. Principles of Neuroscience II focuses on the principles that regulate functional connectivity in the brain.

STUDENT ASSESSMENTS: Student learning will be assessed through class participation, and writing and critiquing a grant proposal.

CREDIT HOURS: 6.0
BIOS 5012 Renal, Respiratory and Acid-Base Physiology

COURSE DESCRIPTION: This course will cover the basic principles of renal, respiratory and acid-base physiology from the whole animal to the cellular and molecular levels. It will focus on functional mechanisms and homeostatic regulatory processes that maintain the volume and composition of body fluids. Homeostatic mechanisms will be discussed in relationship to human pathophysiological conditions. The course is required for all first year MSTP students.

REQUIRED MATERIALS: Readings from textbooks, journal and review articles will be provided.

PREREQUISITES: Membrane Physiology & Transport in Block 1 is a prerequisite to this course. Students should have a year of undergraduate chemistry and biology and preferably physics.

STUDENT PREPARATION: Students should be familiar with fundamental membrane and epithelial transport processes, membrane potentials, fluid mechanics and hemodynamics. Students should know about the G-protein coupled receptor second messenger signaling pathways regulating intracellular cAMP, cGMP, protein kinase C and IP3.

SUITABLE FOR 1ST YEAR STUDENTS: Yes.

UNIQUE TRAINING OFFERED IN THIS COURSE: The course has no overlap with any other graduate division course. It will provide the students with an understanding of the kidney and lung function and how their function is homeostatically regulated to maintain the volume, composition and acid-base balance of body fluids.

STUDENT ASSESSMENTS: Students will be assessed on in class paper presentations, class participation and a take home essay and short answer exam.

CREDIT HOURS: 2.0
BIOS 7020 Responsible Conduct of Research

COURSE DESCRIPTION: This course fulfills an NIH mandated training requirement and is required for all 1st year PhD and MSTP students and pre-and post-doctoral students.

Topics:

- Overview of RCR
- Research Misconduct
- Protection of Human Subjects
- Welfare of Laboratory Animals
- Conflicts of Interest
- Data Management Practices
- Mentor & Trainee Responsibilities
- Collaborative Research
- Authorship & Publication
- Peer Review

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

PREREQUISITES: N/A

STUDENT PREPARATION: N/A

SUITABLE FOR 1ST YEAR STUDENTS: Yes

UNIQUE TRAINING OFFERED IN THIS COURSE: N/A

STUDENT ASSESSMENTS: No class session may be missed in order to receive credit. An incomplete grade for the course will require retaking missed sessions the following semester.

CREDIT HOURS: 1.0
BIOS 7031 Structural Molecular Biology

COURSE DESCRIPTION: Structural Molecular Biology seeks to provide a complete and coherent picture of biological phenomena at the molecular and atomic level. The goals include developing a comprehensive understanding of the molecular shapes and forms embraced by biological macromolecules and extending this knowledge to understand how different molecular architectures and mechanisms are used to perform the reactions and processes that are central to life.

Related processes will be included such as protein folding, protein dynamics, molecular modeling, drug design and computational biology. Central tools used in this research include X-ray diffraction, NMR, electron microscopy, small angle scattering, integrative approaches to larger systems, and simulation and experimental comparison using molecular dynamics. The course will be complimented by specific workshops on the technical aspects. In addition, students with specific interests will be guided to ancillary courses for deep immersion in detailed topics.

REQUIRED MATERIALS: Laptop

PREREQUISITES: Biochemistry

SUITABLE FOR 1ST YEAR STUDENTS: Yes

UNIQUE TRAINING OFFERED IN THIS COURSE: The overall objective is that students will be able to assess the literature in this area critically, and to design their own use of the covered methods to answer critical biomedical questions.

STUDENT ASSESSMENTS: Quizzes, Exam, Participation

CREDIT HOURS: 4.0