Spring 2021 Course Descriptions

Block II

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BIOS 8006 Biology of Aging

COURSE DESCRIPTION:
Why do we get old? Is aging a disease or a physiological stage in life? As the percentage of aging population grows, under what has been termed as “global aging”, the need to understand the peculiarities of the aging process increases and has become a priority for public health. The common goal of aging researchers is being able to extend the healthy active years of life. Research in Biology of Aging is in exponential expansion because this field has benefit in recent years from the advances in many other areas of research going from genetics to cell biology, biochemistry of proteins, systems biology, etc. Furthermore, classical studies of genetics of longevity in laboratory species are now escalating to humans, thus making possible a better understanding of both physiological aging and age-related diseases.

This course presents an in-depth analysis of the biology of aging, building up from changes occurring at the molecular and cellular level and analyzing the consequences at the organism level. In addition, the influence of these age-related changes in what are commonly considered a disease of aging, such as neurodegeneration, diabetes, etc., will also be discussed. Topics will include: theories of aging, experimental models used to study of aging and longevity, impact of oxidative stress in cell and organ function, the metabolic syndrome of aging, functional changes in the immune and central nervous systems, genetic instability and genetics of aging and longevity.

COURSE OBJECTIVES:
- To learn about the basic cellular and molecular processes that contribute to aging.
- To understand the impact that modulating aging may have in the course of age-relate disorders.
- To gain a better understanding of ongoing interventions aiming at modulating aging.

REQUIRED MATERIALS:


PREREQUISITES/BACKGROUND PREPARATION:
Undergraduate courses in Biochemistry, Cell Biology, Genetics and Statistics highly advisable. Students who have taken graduate Cell Biology and Genetics will be able to get the most out of this course.

SUITABLE FOR 1ST YEAR STUDENTS:
Yes

STUDENT ASSESSMENT:
Grade will be combination of attendance, participation and presentations in Journal Club.

CREDIT HOURS:
2.0
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.).

We also devote about one third of the lectures to provide an introductory Python programming course with practical applications in bioinformatics.

COURSE OBJECTIVES:
- To learn fundamentals of bioinformatics algorithms and most frequent applications in protein science research
- To learn python programming

SUGGESTED MATERIALS:
Not required, but suggested:
- Protein Structure Prediction: A Practical Approach by MJE Sternberg 978-0199634965;

PREREQUISITES/BACKGROUND PREPARATION:
N/A

SUITABLE FOR 1ST YEAR STUDENTS:
Yes

STUDENT ASSESSMENT:
Midterm exam; Python programming exam; final exam: a pass requires 2 successful pass out of 3 exams

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.

REQUIRED MATERIALS:

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

SUITABLE FOR 1ST YEAR STUDENTS:
Yes.

STUDENT ASSESSMENT:
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.

This 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 concepts in adult learning, course, lesson and syllabus design, lecture hall strategies, active learning strategies, formative and summative assessment techniques.

COURSE OBJECTIVES:
- Describe the traits most common to highly successful teachers and courses.
- Identify the varied characteristics of adult students as a basis for designing learning environments and activities.
- Differentiate significant (deep) from superficial learning.
- Define cognitive hierarchies and backward design as fundamental principles for course and lesson planning.
- Design lessons, courses and syllabi consistent with defined learning objectives, learning hierarchies and diversity in learning styles.
- Describe the importance of active learning theory and varied instructional modalities to achieve active learning in diverse settings, including the lecture hall.
- Design formative and summative assessments of student learning, teaching and course effectiveness.
- Design a Teaching Portfolio component for the curriculum vitae.

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

PREREQUISITES/BACKGROUND PREPARATION:
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.

SUITABLE FOR 1ST YEAR STUDENTS:
No

STUDENT ASSESSMENT:
This is a pass/fail course. The course seeks to promote student discussion and engagement in varied active learning activities with peer learners, which may include postdocs and faculty. Therefore, to enhance the learning environment there will only be occasional quizzes. Course objectives will be achieved through a mix of instructor-directed and student-directed discussions, selected readings from texts and education research literature, and active learning strategies which engage students in group-based discussions, course planning and teaching. Successful completion of the course requires:
- Attendance/quizzes (no more than 3 absences and/or failed assignments/quizzes). All assigned readings are expected to be read prior to class and will be occasionally quizzed.
- Active weekly participation in class and group discussions/assignments.
GRADUATE PROGRAMS IN THE BIOMEDICAL SCIENCES

- Satisfactory completion of group exercises in course design.
- Satisfactory peer evaluation of contributions and performance within the learning group

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. Students will learn how to critically think about interpreting and designing experiments. 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.

COURSE OBJECTIVES:
Biological Information, i.e. DNA, RNA, Chromatin, Translation, other information stores.

REQUIRED MATERIALS:
Computer

PREREQUISITES/BACKGROUND PREPARATION:
Undergraduate course in molecular biology at the level of Alberts Molecular Biology of the Cell® and the 1st Block Biochemistry course.

SUITABLE FOR 1ST YEAR STUDENTS:
Yes

STUDENT ASSESSMENT:
There will be three take-home open-book exams. These exams will be distributed throughout the course block, covering content from lectures, discussion sections, and readings. Critical thinking, designing experiments, and experimental interpretation are key parts of the grading. Grades and constructive feedback will be returned expeditiously. The exams will count for 80% of the final grade. Discussion section participation (attendance and oral contributions) will count for 20% of the final grade.

CREDIT HOURS:
5.0
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.

COURSE OBJECTIVES:
At the end of this course, you will understand the structures and functions of most cell components and how they communicate and interact with each other. It will make scientific literature and seminars more accessible to you. You will develop an overall sense and feel for life on a cellular level.

REQUIRED MATERIALS:
Several copies are on closed reserve in the library and the E-Book is available through the Einstein online library.

Reading the relevant chapter(s) prior to the lecture is required and essential for understanding the lectures. Additional required reading material will be provided by each lecturer consisting of review articles and original research articles.

PREREQUISITES/BACKGROUND PREPARATION:
Some background in biochemistry, molecular biology, and cell biology is helpful but not required.

SUITABLE FOR 1ST YEAR STUDENTS:
Yes

STUDENT ASSESSMENT:
Based on three in-class exams and, to a minor extent, on three team-based learning sessions (TBLs). Grading is on a curve, not on a fixed score, which will be discussed after each exam.

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 neurohormonal control of cardiac contractility and output, and regulation of arterial blood pressure. The course is required for all first year MSTP students.

COURSE OBJECTIVES:
Students will learn about the following topics:

1. the autonomic nervous system and drugs used to modulate its function
2. mechanisms of contraction and regulation of skeletal and smooth muscle
3. Hemodynamics and the role of vascular tone in resistance and flow modulation
4. Cardiac electrophysiology and the EKG
5. Cardiac pump function from the molecular/cellular level to the whole organ level
6. Neurohumoral modulation of cardiac function and maintenance of arterial blood pressure
7. Systemic responses to heart failure

REQUIRED MATERIALS:
Assigned textbook chapters, and articles distributed as PDFs via Canvas.

PREREQUISITES/BACKGROUND PREPARATION:
Membrane Physiology & Transport is a prerequisite for this course. Students should have a year of undergraduate biology, chemistry, and physics covering energy and work plus the electrical concepts of voltage, current, resistance. Students should be familiar with GPCR and second messenger systems including cAMP, cGMP, IP3 and DAG. Students should be familiar with the basics of electrical excitability and action potentials, and the basics of muscle contraction.

SUITE FOR 1ST YEAR STUDENTS:
Yes. Required for 1st year MD-PhD students.

STUDENT ASSESSMENT:
There will be four quizzes and a comprehensive final exam. Class participation in TBL and other sessions will contribute to the grade. Each quiz is worth about 12.5%. The final exam is worth about 37.5%. Class participation is worth about 12.5%. These percentages are somewhat arbitrary and depend on the number of questions on each quiz, which varies. Everyone who makes a reasonable effort to learn the material will pass the course.

CREDIT HOURS:
2.0
BIOS 7011 NMR for Chemistry and Biochemistry

COURSE DESCRIPTION:
The course will provide a gentle but thorough introduction to basic NMR theory and principles followed by application of NMR to solving various chemical and biochemical problems. Topics will include one-, two-, and 3-dimensional NMR methods applied to: the covalent structure and conformation of small molecules and macromolecules, ligand binding and exchange rates, pKa values, and enzyme mechanisms. Lectures will be combined with hands-on sessions in the NMR lab, where students will be assigned projects to be completed on the NMR spectrometers.
NOTE: there are approximately 7 labs that will require some time outside of the assigned block to complete - prepare to spend 1-2 hours for each lab to run experiments and/or analyze data on your own time.

COURSE OBJECTIVES:
Students will acquire the basic skills for running NMR experiments and interpreting NMR data from a variety of applications in chemistry and structural biology.

REQUIRED MATERIALS:
Computer or laptop

PREREQUISITES/BACKGROUND PREPARATION:
A general familiarity with organic chemistry and biochemistry.

SUITABLE FOR 1ST YEAR STUDENTS:
Yes

STUDENT ASSESSMENT:
Lab reports and problem sets: 75%
Scores on late reports/problem sets are discounted 10%/day; lowest score will be dropped

Presentation: 25%
Score based on
- Introduction to paper and problem studied
- NMR methods and details of experiments performed
- Summary and discussion of results
- Conclusions, future directions and timing of talk

Grade required to pass: 65/100; w/ Honors: 93

CREDIT HOURS:
2.5
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, and the mechanisms underlying the development of these neural systems. 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, followed by investigation of the developmental mechanisms driving the structure and function of neural networks. 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.

COURSE OBJECTIVES:
- To learn the role of neural networks in high-order perceptual, motor and behavioral states functions.
- To learn computational approaches explaining brain functions.
- To learn how to write a research grant.

REQUIRED MATERIALS:
Online access to Zoom lectures, books and journals available at Einstein’s library.

PREREQUISITES/BACKGROUND PREPARATION:
Principles of Neuroscience I (Block I)

SUITABLE FOR 1ST YEAR STUDENTS:
Yes

STUDENT ASSESSMENT:
The grade in this course will be based on participation in class (20%), midterm critiques of preliminary grant proposals (30%) and a final grant proposal (50%).

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.

COURSE OBJECTIVES:
By the end of the course, students should be able to explain the homeostatic mechanisms by which the kidney maintains normal blood volume and composition.

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

PREREQUISITES/BACKGROUND PREPARATION:
Membrane Physiology & Transport is a prerequisite to this course. Students should have a year of undergraduate biology, chemistry, and physics.

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. Required for 1st year MD-PhD students.

STUDENT ASSESSMENT:
There will be four quizzes and a comprehensive final exam. Class participation in TBL and other sessions will contribute to the grade. Each quiz is worth about 12.5%. The final exam is worth about 37.5%. Class participation is worth about 12.5%. These percentages are somewhat arbitrary and depend on the number of questions on each quiz, which varies. Everyone who makes a reasonable effort to learn the material will pass the course.

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

COURSE OBJECTIVES:
The Responsible Conduct of Research course is designed to introduce key issues in the responsible conduct of research (RCR), by following the research process from inception to planning, conducting, reporting, and reviewing biomedical research. The course will provide an overview of the rules, regulations, and professional practices that define the responsible conduct of research. In addition, the course aims to provide a practical framework for ethical decision making when faced with difficult situations in the research and training environment.

REQUIRED MATERIALS:
The textbook "ORI Introduction to the Responsible Conduct of Research" by Nicholas H. Steneck (Department of Health & Human Services) features case studies, text-box inserts, discussion questions and electronic and printed resources. The text is available online as a PDF document (http://ori.hhs.gov/documents/rcrintro.pdf). Each session of the course is associated with one or more chapters from the text.

PREREQUISITES/BACKGROUND PREPARATION:
N/A

SUITABLE FOR 1ST YEAR STUDENTS:
Yes. Required for all first year PhD and MSTP students, and PREP scholars.

STUDENT ASSESSMENT:
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 HOUR:
1.0