



Weill Cornell Graduate School of Medical Sciences

Physiology, Biophysics & Systems Biology Courses

ACE Tutorial

Review of PBSB program requirements and procedures for passing the admission to candidacy exam (ACE). Principles of ACE topic choice and how to write a "winning" grant application that proposes to test a valid hypothesis will be discussed.

Advanced Topics in Cardiac Electrophysiology

This course surveys current areas of scientific interest in cardiac electrophysiology. Material covered in this course includes: introduction to cardiac electrophysiology (ion channels, action potentials, basics of cardiac electrophysiology), basic and clinical aspects of cardiac arrhythmia, dynamics, initiation, maintenance, and termination of arrhythmia, arterial and ventricular fibrillation and defibrillation, experimental methods, and mathematical modeling. The course is comprised of lectures as well as moderated videotaped presentations recorded recently by international experts in the field.

Bioinformatics and Computational Biomedicine

This course begins with a discussion of the history, techniques, and statistical analyses used in bioinformatics today. Students will begin to analyze how these tools can be used to predict RNA, gene and protein structure. The final two weeks of the course will be focused on systems biology including current techniques used to model of protein-protein interactions, protein networks and cell signaling.

Cell Physiology

This course will focus on important aspects of cell physiology that are required for normal cell functioning and disease processes. The contributions of specific organelle and molecular pathways in these processes will be discussed in the context of proper cell function. Topics in theories of biophysics and bioelectricity will also be covered.

Essentials of Human Physiology

This course consists of three parts:

1. Assigned independent readings from a textbook of human physiology followed by presentations and discussion of the readings led by an instructor
2. Assignments of special topics, journal articles, and/or physiological problems for student presentation and discussion in class
3. Physiology laboratories, including laboratories with mannequins that simulate physiological functions

Faculty Research Lunches

This course is required for all first year PBSB graduate students, but is open to all WCGS students. Come for lunch and listen to program faculty describe their research.

Introduction to Bioengineering

The objective of this one semester course is to prepare students for thesis research in fields that encompass bioengineering. The course will be team taught by Weill Cornell and Ithaca faculty using video conferencing facilities. Examples will be chosen from musculoskeletal and cardiovascular fields.

Mathematical Structures in Neuroscience

This course introduces the tools of computational and theoretical neuroscience, with a focus on principles and mathematical foundations. Students should be familiar with complex numbers, matrices, and univariate differential and integral calculus. The specific topics addressed in the course vary depending on interests of the students.

Physical Principles of Medical Imaging

This survey course will cover the basic physical, biochemical, computational, and engineering principles underlying current medical imaging techniques including: magnetic resonance imaging, positron emission tomography, radionuclide production and radiochemistry, optical imaging, X-ray computed tomography, and ultrasound. The goal of the course will be to provide students with a broad knowledge of the concepts and implementation strategies of various imaging methods relevant in current research and clinical practice. Practical applications will be used to illustrate the main themes of the course. Tours of the Biomedical Imaging Core Facility and other imaging laboratories will augment the formal course material. At the end of the course students will be able to identify appropriate imaging strategies for clinical research and have a working knowledge of the major techniques available to the investigator.

Physiologic Genomics of the Cardiovascular System

A journal club and discussion seminar approach will be used to study the process of gene regulation of cardiovascular organogenesis and function. The course will focus on fundamental advances in our knowledge in genomics and how genes regulate the structure, organization, and activity of the heart and vasculature. Weekly sessions will address topics that range from molecular to cellular to tissue to organ to organismal events.

Physiology, Biophysics & Systems Biology Seminar Series

This course is the seminar series in the Physiology, Biophysics & Systems Biology Program. Most lectures are given by speakers invited from outside the Weill Cornell community, but speakers are also drawn from within the Program and scientists at the WCGS with related interests.

Quantitative Understanding in Biology

This course will prepare students to apply quantitative techniques to the analysis of experimental data and the modeling of biological systems. To emphasize both practical and theoretical skills, the material will be presented whenever possible in a hands-on workshop style, and the completion of several projects by the students will be required. Topics include: practical aspects of data formatting and management, communication of quantitative concepts (verbal, graphical and mathematical), a review of statistics, with emphasis on the selection of appropriate statistical tests, the use of modern software packages, and the interpretation of results; the formulation, evaluation, and analysis of mathematical models of biological function, with an emphasis on linear and non-linear regression, determination of model parameters, and the critical comparison of alternative models with regard to over-parameterization. The formal components will introduce (and demystify) ordinary and partial differential equations and basic principles of non-linear dynamics, in order to enable quantitative modeling in biological arenas such as neural function, enzyme kinetics, cardiac dynamics, and signaling pathways. Additional special

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topics will also be presented (e.g., control theory, machine learning, information theory, and image analysis) and their application will be illustrated with ongoing research in the laboratories of PBSB faculty.

Responsible Conduct of Research

The objectives of this course are to heighten students' awareness of ethical considerations relevant to the conduct of research; inform students of federal, state, and institutional policies, regulations, and procedures; and provide students with critical analysis and problem solving skills for ethical decision-making.

Scientific Presentation and Critique

This course is required for all first and second year PBSB graduate students, but is open to all WCGS students. It is designed to train students in scientific presentation and critique. The structure is a formalized "journal club." Each student will choose a paper, which is subject to approval by the course directors. Each session will consist of a student formally presenting their selected paper to the class, which is expected to serve as a critical audience. The presentation should consist both of an objective presentation of the study and a subjective analysis/critique of the work.