Core Course Descriptions

Genetic Engineering: BLCHM 6400

This course covers essential techniques used in genetic engineering. Assuming modest background in biology, the course introduces fundamental aspects of molecular biology including mechanisms for storage of information in DNA and transfer of this information to RNA and protein molecules. Manipulations of DNA molecules to rearrange or remodel genetic information (cloning) are described from both theoretical and practical viewpoints. Topics covered include the use of restriction endonucleases, amplification of DNA sequences using the polymerase chain reaction (PCR), detection of DNA and RNA using hybridization (Southern and Northern blotting), properties of cloning vectors and their use in constructing genomic and cDNA libraries, DNA sequencing and sequence analysis, creating and detecting mutations in DNA and introducing these mutations into a genome, and expression and characterization of proteins.

Proteins and Nucleic Acid Biochemistry: MBIOL 6410 & BLCHM 6410

The Biochemistry course covers the structure and function of nucleic acids and proteins, as well as the thermodynamics and kinetics of their interactions with each other and with other biologically important molecules. It is expected that all students have taken an undergraduate course in Biochemistry, and you may find it useful to review chapters discussing the above-mentioned subjects in an undergraduate Biochemistry textbook. You will also need to have a basic working knowledge of kinetics and thermodynamics. (So, if you are not comfortable working with equilibrium constants, free energies, and rate constants, please review these topics in an undergraduate chemistry text.) There are no required texts for this class; readings from various texts will be made available to the class. Some professors may administer a pre-quiz at the start of their lectures to make sure you are adequately prepared for the material to be covered.

G3: Genetics, Genomes, and Gene Expression: MBIOL 6420

This course covers transmission genetics, methods of genetic and genome analysis in model systems and humans, as well as transcriptional and post-transcriptional mechanisms of gene regulation. Lectures cover both classical achievements and recent advances in these fields, with readings based chiefly in the primary literature. Grades are based on exams and problem sets.

Cell Biology: MBIOL 6480

This course covers basic and advanced topics related to cell structure and function including cytoskeleton, membrane trafficking, protein targeting/modification and degradation, cell cycle regulation, and signal transduction.

Biophysical Chemistry: BLCHM 6450

Topics covered include: Basics of thermodynamics and statistical mechanics, with applications in biochemistry; transport phenomena; enzyme kinetics and inhibition; kinetic isotope effects; principles and applications of absorbance, fluorescence, and CD spectroscopies.

Protein Chemistry: BLCHM 6460

This is a one half semester course which focuses on the mechanisms of chemical reactions involving peptides and proteins and methods for their study. Subject matter includes enzyme mechanisms, chemical modification of proteins and cofactor chemistry. Prerequisite: organic chemistry

Case Studies and Research Ethics: MBIOL 7570 & BLCHM 7570

An examination of research integrity and other ethical issues involved in scientific research. Topics may include scientific fraud, conflicts of interest, plagiarism and authorship designation, and the role of science in formulating social policy. This course is designed for graduate students, post-docs and regular faculty in the sciences.

Critical Thinking in Research: MBIOL 6200 & BLCHM 6200

In order to teach the skills required to be a successful independent scientist this course will teach students critical thinking strategies for successful research. This will include how to digest and analyze papers and problem solve, both of which will review and apply material from core courses. The instructors will develop specific course content. Topics may include: How to read a paper (read at home, discuss in class); Survey of the core services; Problem solving with open-ended problems posed on real-life or made-up situations. A focused effort will be made to help students identify topics that they can develop into grants in the Spring term. Grading will be based on participation and individual work.

Guided Grant Preparation: MBIOL 6300 & BLCHM 6300

To prepare students for their thesis research, prelims, and qualifying exams, we will offer a guided proposal preparation course in the second half of the Spring semester that builds on their experience earlier in the semester (critical thinking in research, reading of primary literature and problem solving). The guided proposal writing course will provide an opportunity for students to create an original research proposal by critical review of other grants, training in hypothesis generation, scientific writing, and experimental design. The written original grant proposal will be used as a basis for an oral qualifying examination by a faculty committee.