MACROMOLECULAR CRYSTALLOGRAPHY: METHODS AND APPLICATIONS

This is an introductory course on methods and applications of macromolecular structure determination using X-ray crystallography. The course will be broken up into three parts: 1) Principles of X-ray crystallography involving didactic lectures on the technique with weekly problem sets; 2) Workshops on macromolecular structure determination involving hands-on experience with the technology; 3) Student "journal club" presentations on current high impact publications involving X-ray crystal structure determination.

Co-Directors
Ronen Marmorstein
Perelman School of Medicine, University of Pennsylvania
421 Curie Blvd.
BRB II/III, Room 454
Tel: (215) 898-7740
e-mail: marmor@upenn.edu

Emmanuel Skordalakes
The Wistar Institute
3601 Spruce Street
Room 330
Tel: (215) 495-6884
e-mail: skorda@wistar.org

Time and Place
Lectures will be on Tuesdays and Thursdays 10:30 A.M. - 12:00 P.M. from Sept. 4 - Dec. 6 in BRB 253 (unless otherwise indicated)

There will be no class on Oct. 4 for fall term break, Nov 8 for BMB Retreat and Nov. 22 for Thanksgiving

Required Text
Biomolecular Crystallography: Principles, Practice, and Application to Structural Biology, Bernhard Rupp, Garland Science

Course Outline
The Course will be broken up into three parts:
   (1) Principles of X-ray crystallography
   (2) Workshop on Macromolecular Structure Determination
   (3) Student presentations

Grading will be based on the following: There will be problem sets (10%) and a midterm exam covering part 1 (30%), and a final exam covering parts 2 and 3 (30%). For part 3 of the course, students will also be required to make a 20-30 minute presentation on a manuscript describing a macromolecular structure of their choice (30%).
Tentative Schedule

Sep. 4, 6, 11, 13, 18, 20, 25, 27; Oct. 2, 9, 11 (Midterm Exam)
Lecturer: Ronen Marmorstein

(1) Principles of X-ray crystallography. Topics will include:
   (i) Why Use X-Rays in Structural Biology?
   (ii) X-Ray Diffraction.
   (iii) Preparation of Crystals.
   (iv) Crystal symmetry, and space groups.
   (v) Data collection.
   (vi) The structure factor and fourier synthesis.
   (vii) The phase problem (Multiple Isomorphous Replacement, Molecular Replacement, Anamolous Dispersion, Multiple Anomalous Dispersion)
   (viii) Electron density maps.
   (ix) Electron density modification
   (x) Crystallographic refinement and analysis.

Oct. 16, 18, 23, 25, 30; Nov. 1, 6, 13
Lecturer: Emmanuel Skordalakes

(2) Workshop on Macromolecular Structure Determination. Topics will include:
   (i) Crystallization
   (ii) Data Collection & Processing
   (iii) Phase Determination
   (iv) Model Building & Refinement
   (v) Structure Analysis

Nov. 15, 20, 27, 29; Dec. 4, 6
Coordinator: Emmanuel Skordalakes (Ronen Marmorstein participating)

(3) Student Presentations:

Students will present a 30 min lecture on a manuscript describing a macromolecular structure of their choice. There will be 1 to 3 presentations per day depending on the number of students enrolled.

The Final Exam will be held on the Finals Day assigned to the course.