

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) Macromolecular structures by X-ray crystallography presented by selected faculty members; 3) Student "journal club" presentations on current high impact publications involving X-ray crystal structure determination.

Course Director

Ronen Marmorstein

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Time and Place

Lectures will be on Tuesdays and Thursdays 10:15 A.M. - 11:45 P.M. from Aug. 31 - Dec. 10 in BRB 253 (unless otherwise indicated)

There will be no class on Sept. 7 (Rosh Hashanah), Sept. 16 (Yom Kippur) Oct. 14 (fall term break), Nov. 25 (Thanksgiving) and Dec. 2 (BMB Retreat)

Required Text

Crystallography made crystal clear-third edition, Gail Rhodes, Academic Press

Course Outline

The Course will be broken up into three parts:

- (1) Principles of X-ray crystallography
- (2) Macromolecular structures by X-ray crystallography
- (3) Student presentations

Grading will be based on the following: There will be problem sets (10%) and a mid-term 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 give a 10 minute presentation on a manuscript describing a macromolecular structure of their choice (30%).

Tentative Schedule

Aug. 31; Sept. 2, 9, 14, 21, 23, 28, 30; Oct. 5, 7, 12, 19, 21 (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, Anomalous Dispersion, Multiple Anomalous Dispersion)
- (viii) Electron density maps.
- (ix) Electron density modification
- (x) Crystallographic refinement and analysis.

* Oct 26, 28 - Crystallography workshop with Kushol Gupta (meet in BRB 253 to go to G11 Blockley Hall)

Nov. 2, 4, 9, 11

(2) Macromolecular structures will be presented by selected faculty members:

- Nov. 2: Kushol Gupta
- Nov. 4: Greg Van Duyne
- Nov. 9: Sriram Krishnaswamy
- Nov. 11: Roberto Dominquez

Nov. 18, 23, 30; Dec. 7, 9

Coordinator: Ronen Marmorstein

(3) Student Presentations:

Students will present a 10 min. lecture on a manuscript describing a macromolecular structure of their choice. There will be 5-6 presentations per day depending on the number of students enrolled.

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