

[SEMC @NYSBC] Winter EM course 2017

Overview

Electron microscopy in combination with image analysis is increasingly powerful in producing 3D structures of individual molecules and large macromolecular complexes that are unapproachable by other methods. This course is focused on the concepts and theories behind electron microscopy and will be taught in a reverse classroom format based on Grant Jensen's online course (Getting Started in Cryo-EM [<https://cryo-em-course.caltech.edu/>] from Caltech). Students will be responsible for watching these online lectures prior to class. Each week guest lecturers and SEMC staff lead discussions on the practice of solving molecular structures by electron microscopy.

The course will be held at the New York Structural Biology Center at 89 Convent Ave (133rd St).

Organization

The first month will be foundational lectures led by the NYSBC/SEMC staff. After this introduction, each Monday a guest lecturer will lead a discussion on a particular EM modality. On Wednesdays there will be optional video screenings of the Jensen lectures as well as office hours.

Classes in A-11 seminar room (Mondays 3:30-5pm and some Wednesdays 3:30-5pm)

EM fundamentals section

- Jan 9 : Introduction & SEMC tour
- Jan 11 : (Video Screening for introductory lectures)
- Jan 16 : *No class - Martin Luther King*
- Jan 18 : Challenges in biological EM & Sample Prep
[Ed Eng & Ashleigh Raczkowski, NYSBC]
- Jan 23 : Basic anatomy of the electron microscope [Laura Kim & Ed Eng, NYSBC]
- Jan 25 : Fourier transforms [Bill Rice, NYSBC]
- Jan 30 : Image Formation [Bill Rice, NYSBC]

Tomography section

- Feb 6 : Tomography (part I: Intro and overview) [David Stokes, NYU]
- Feb 13 : Tomography (part II: FIB-SEM) [Bill Rice, NYSBC]
- Feb 20 : *No class - President's Day*
- Feb 27 : Tomography (part III: Sub-tomogram averaging) [Alex Noble, NYSBC]

Single particle section

- Mar 6 : Single-particle analysis (part I: Intro and types of samples) [Joachim Frank, COLU]
- Mar 13 : Single-particle analysis (part II: Data Analysis and reconstruction workflow)
[Amedee Des Georges & Reza Khayat, CUNY]
- Mar 20 : Single-particle analysis (part III: Reconstruction workflow (cont.) & Interpretation and Limitations) [Rich Hite, MSKCC]

2D crystallography section

- Mar 27 : 2D crystallography (part I: Intro and overview) [Iban Ubarretxena, MSSM]
- Apr 3 : 2D crystallography (part II: Helical) [Hernando Sosa, AECOM]

EM challenges and new frontiers

- Apr 10 : EMDatabank: Structure Data Archiving, Validation Challenges
[Cathy Lawson, Rutgers]
- Apr 17 : Validation methods [Tom Walz, RU]
- Apr 24 : Fitting Atomic Models [TBD]
- May 1 : Conclusion & open discussion (short class) [SEMC staff, NYSBC]

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Class structure (1.5 hr class)

30 min Introduction by guest lecturer on applying the class topic to scientific questions with focus on the nuts & bolts of the technique. Examples may be from their own research or a recent paper.

15 min Coffee break/informal conversation

45 min Open ended discussion covering concept check questions on the topic

Video screenings in the SEMC conference room (starts @3:30pm, optional)

Jan 11 : Basic anatomy of the electron microscope

Jan 11 : Fourier transforms and reciprocal space

Jan 11 : Image Formation

Jan 11 : Fundamental challenges in biological EM

Jan 18: [lecture in main conference room]

Jan 25: [lecture in main conference room]

Feb 1 : Tomography (part I)

Feb 8 : Tomography (part II)

Feb 15 : [no screening]

Feb 22 : [no screening]

Mar 1 : Single-particle analysis (part I)

Mar 8 : Single-particle analysis (part II)

Mar 15 : Single-particle analysis (part III)

Mar 23 : 2D crystallography