

BIMM 162, BGGN 262, CHEM 165, CHEM 265
Three-Dimensional Electron Microscopy
Winter 2020

Instructors

Professor Mark Herzik

Office: Natural Science Building, Room 4105

Please use the email client within Canvas (or mherzik@ucsd.edu)

See note about e-mail conduct on page 3.

Office Hours: Fridays 4:00-5:00 PM, NSB Room 4105

Professor Elizabeth Villa

Office: Tata Hall, Room 5104

Please use the email client within Canvas (or evilla@ucsd.edu)

See note about e-mail conduct on page 3.

Office Hours: Mondays 12:30-1:30 PM, Tata Hall 3101

Lectures

Monday and Wednesday 11:00-12:20 PM York 3010

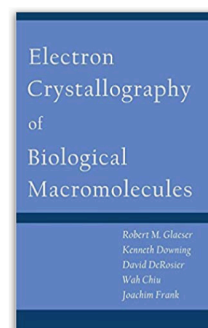
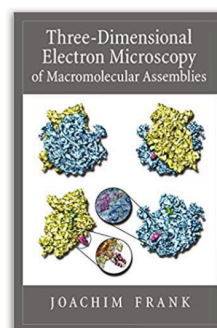
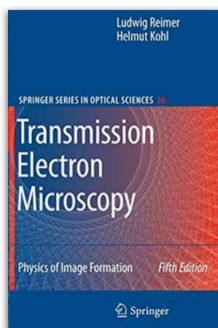
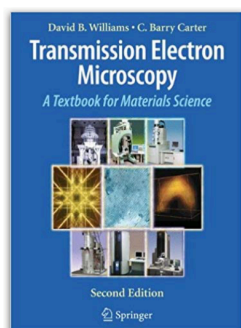
Website

Course Material, Grades & Assignments: <https://canvas.ucsd.edu> (log in, and choose BGGN262 WI20 A00). Access to our class pages is required. If you are auditing the class, contact Dr. Villa or Dr. Herzik.

Materials

Cryo-EM is a fast-evolving field. As such, there is no textbook that covers all relevant topics or contains the latest advances. The website contains a collection of material and links to external material that are considered to be useful to learning cryo-EM. Here is a list of textbooks that cover various aspects of Electron Microscopy in great detail:

Note: you are not required to purchase these textbooks for the course but may be very relevant if cryo-EM is a critical aspect of your thesis.



Notably, Prof. Tim Baker has a wonderful set of notes prepared while teaching this class from 2007 through 2013. **The lecture notes, select literature articles, and some online lectures are required reading because it is impossible to cover materials in adequate depth during lectures.** All required reading will be posted to the website.

Additionally, the slides presented during lectures will be posted as PDF files on the website after the lecture.

Grades**Undergraduate students (BIMM162 and CHEM165)**

There will be two midterms and a comprehensive final exam. You have the choice of the following grading scheme (max 500 points)

Midterm 1	100 pts
Midterm 2	100 pts
Homework 1 and 2	100 pts
Final exam, cumulative	100 pts
Paper critique	50 pts
Participation	50 pts

Alternatively, you can drop one of the midterms and redistribute the points according to the following scheme:

One midterm (highest grade out of two)	150 pts
Homework 1 and 2	100 pts
Final exam, cumulative	150 pts
Paper critique	50 pts
Participation	50 pts

This means that there are **NO MAKE UP EXAMS** and, if for ANY reason you miss a midterm exam, the second scheme will automatically be applied.

Grades**Graduate students (BGGN 262 and CHEM265)**

There will be two midterms and a comprehensive final exam. You have the choice of the following grading scheme (max 500 points)

Midterm 1	100 pts
Midterm 2	100 pts
Homework 1 and 2	50 pts
Final exam, cumulative	100 pts
Paper critique	50 pts
Group Presentation*	50 pts
*each member will receive the same score	
Participation	50 pts

Alternatively, you can drop one of the midterms, submit one extra paper critique, and redistribute the points according the following scheme:

One midterm (highest grade out of two)	125 pts
Final exam, cumulative	125 pts
Homework 1 and 2	50 pts
Paper critiques (2)	100 pts
Group Presentation*	50 pts
*each member will receive the same score	
Participation	50 pts

This means that there are **NO MAKE UP EXAMS** and, if for ANY reason you miss a midterm exam, the second scheme will automatically be applied.

The comprehensive final exam will include questions that differ from those given to undergraduate students and will also include more challenging versions of questions given to the undergraduates.

Homework This course covers a lot of different concepts and requires you to understand them and apply them. To help achieve this, two separate homework assignments will be posted on the class web site on Canvas that contain questions referencing material covered in class and will often mimic those given on exams. Each assigned homework will be submitted for a grade. During the first week of class, students will self-choose groups of 3-4 people to complete these homework assignments and will need to notify Drs. Herzik and Villa by **Monday, January 13th**. Each group is responsible for answering each homework assignment and uploading their answers to Canvas (1 document per group per assignment). All members of the group will receive the same grade. We encourage groups to contain both undergraduate and graduate students. Each group must be approved by the instructors.

Paper Critique Each student will be required to pick a paper from the list of papers provided by Drs. Herzik and Villa and provide a two-page written critique. The scope of the critique and the list of papers will be available on Canvas. Each paper will only be available to be critiqued by 2-3 people in a first come first serve basis.

Group Presentations 6 groups of graduate students will be required to pick a paper from the list of papers provided by Drs. Herzik and Villa and give a 25-minute group presentation. The scope of the presentation and the list of papers will be available on Canvas. Each paper will only be available to be presented by a single group in a first come first serve basis. Note: the paper to be presented cannot be the same paper that the student submitted a written critique for. Each person in the audience will submit an anonymous evaluation of the presenters to be considered in the group presentation score.

Participation Attendance and participation in lecture required. As obvious as it sounds, come to class well prepared. For example, complete any assigned reading and be ready with questions, especially if something from a previous lecture or in the class notes needs clarification. You will receive half of the allotted points by physically attending the lectures. The remaining allotted points will be obtained by asking questions during class, on the discussion boards, and furthering discussions.

Discussion Board Canvas has a built-in Discussion Board that can and should be used to pose questions and discuss the materials presented in class. *This is the preferred method of contact within the course.* Anyone can post questions to the

Discussion Board and, better yet, anyone can respond to the posts. More than likely, if you happen to have a question about the material then others in the class do as well and it warrants further clarification and discussion. Note: this is not Reddit and everyone is expected to behave in a respectful and cordial manner in accordance with UCSD's Principle of Community policies (<https://ucsd.edu/about/principles.html>). If someone is behaving inappropriately, they will be reprimanded in accordance with UCSD's policies.

Email etiquette Before e-mailing the instructors, please consider carefully whether your question might be already answered in the syllabus, or whether it is best to ask your question in person during office hours, or whether the question(s) are better suited for the Discussion Board (see above). For example, it is difficult to e-mail about concepts in Fourier analysis or that require drawings or demos. If you send an e-mail, make sure to **include BIMM 162, BGGN 262, CHEM 165, or CHEM 265 in the subject header**. You must send your email from your UCSD address; please make it clear who you are. As always, a well-written and professional e-mail greatly increases the likelihood that you will get a response in a timely manner.

Schedule: We are very lucky to have world experts give us guest lectures throughout the course. The schedule below is **tentative** and will vary to make sure that you learn all the key concepts in cryo-EM.

Lecture	Date	Topics	Instructor
1	6-Jan	Course introduction	Mark Herzik
2	8-Jan	Electrons as particles and waves, interactions with sample, resolution, optics	Andres Leschziner
3	13-Jan	Design of the TEM <i>Homework #1 assigned – Due January 24th at noon</i>	Andres Leschziner
4	15-Jan	Contrast and image formation, distortions <i>Homework groups must be emailed to instructors</i>	Elizabeth Villa
	20-Jan	NO CLASS - UCSD Holiday	
5	22-Jan	Sample Preparation and Challenges <i>Paper critique assigned – Due February 21st at noon</i>	Mark Herzik
6	27-Jan	Cryo-EM Facility Tour <i>Paper selection must be submitted on Canvas</i>	Elizabeth Villa & Mark Herzik
	29-Jan	MIDTERM 1 – 11:00 – 12:20 pm	York 3010
7	3-Feb	Radiation damage and imaging conditions <i>Homework #2 assigned – Due February 28th at noon</i>	Elizabeth Villa
8	5-Feb	Historical Perspective, Fourier Analysis, Central Section	David deRosier
9	10-Feb	2D image analysis and 3D reconstruction <i>Presentation groups must be emailed to instructors</i>	Andres Leschziner
10	12-Feb	3D refinement and classification, helical assemblies	Dmitry Lyumkis
	17-Feb	NO CLASS - UCSD Holiday	
11	19-Feb	Automation	Dmitry Lyumkis
12	24-Feb	Tomography Data Acquisition and Reconstruction	Elizabeth Villa
13	26-Feb	Tomography Data Mining, Subtomogram Averaging	Elizabeth Villa
14	2-Mar	Model building and validation of maps and models	Mark Herzik
	4-Mar	MIDTERM 2 – 11:00 – 12:20 pm	York 3010
17	9-Mar	Group Presentations	Elizabeth Villa & Mark Herzik
18	11-Mar	Group Presentations	Elizabeth Villa & Mark Herzik
	16-Mar	FINAL EXAM – 11:30 – 2:30 pm	

Adds/Drops/Withdrawals: Use [TritonLink](#) to add into open sections, to waitlist a full section, or to drop the course.

Special Circumstances: You must communicate special needs, including those based on medical conditions or religious beliefs, prior to January 20th. These needs will be taken into account only after they have been discussed with the professor. Students with disabilities are given my full support as long as you work through the Office for Students with Disabilities. Excusal from an exam will be granted by the professor only if proper documentation is provided (e.g., from medical/law-enforcement professionals). **No rescheduling or make-up exams are allowed**, except as noted in:
<http://www.ucsd.edu/catalog/front/AcadRegu.html>

Students with disabilities: If you have been given an Authorization for Accommodation (AFA) letter from the Office of Students with Disabilities (OSD), you must provide the instructor, and the OSD Liaison (for Chemistry contact chemosd@ucsd.edu, for Biology contact bioosd@ucsd.edu) with a copy of the letter before any accommodations will be provided. All exam scheduling will be coordinated by you and the instructor, with involvement from the OSD Liaison as needed. In order to guarantee accommodations, you must follow the guidelines established by the Instructor and/or Liaison. OSD exams will run concurrently with the scheduled exam.

Aid & Collaboration: You are encouraged to work together and form discussion groups to learn all aspects of cryo-EM. However, collaboration or aid exams is strictly prohibited unless told otherwise.

Academic Integrity: DO NOT CHEAT. This includes all exams and in-class assignments. Please read the UCSD Policy on Integrity of Scholarship, at:
<http://senate.ucsd.edu/manual/Appendices/Appendix2.pdf>
See page 5 of this syllabus for excerpts. All violations of academic integrity that are noticed by me will be sent to the Office of Academic Integrity without exception.
At minimum, if you cheat, you can expect an F for the entire quarter, not just the exam/assignment in question.

Classroom etiquette in lectures and discussions: Three-dimensional cryo-EM is a stimulating and challenging subject. The following rules are aimed to keep our classroom environment focused on the task at hand for you and your peers. You know these basics already:

- Please arrive on time to lecture and discussion.
- Reading Facebook/BuzzFeed/ etc., is not allowed.
- All phones must be off during lectures, discussions, and exams.
- Phones/tablets/computers/ must be out of sight during exam periods.

The bottom line is that we will be considerate of one another at all times in lectures and in the discussions.

Academic Integrity at UCSD

Excerpts from <http://senate.ucsd.edu/Operating-Procedures/Senate-Manual/Appendices/2>

“Integrity of scholarship is essential for an academic community. The University expects that both faculty and students will honor this principle and in so doing protect the validity of University intellectual work. For students, this means that all academic work will be done by the individual to whom it is assigned, without unauthorized aid of any kind. Instructors, for their part, will exercise care in planning and supervising academic work, so that honest effort will be upheld.”

Instructors' Responsibility.

“The Instructor shall state in writing how graded assignments and exams will contribute to the final grade in the course. If there are any course-specific rules required by the Instructor for maintaining academic integrity, the instructor shall also inform students of these in writing.”

Students' Responsibility. “Students are expected to complete the course in compliance with the instructor's standards. No student shall engage in an activity that involves attempting to receive a grade by means other than honest effort; for example:

- ☐ No student shall knowingly procure, provide, or accept any unauthorized material that contains questions or answers to any examination or assignment that is being, or will be, administered.
- ☐ No student shall complete, in part or in total, any examination or assignment for another person.
- ☐ No student shall knowingly allow any examination or assignment to be completed, in part or in whole, for himself or herself by another person.
- ☐ No student shall plagiarize or copy the work of another person and submit it as his or her own work.
- ☐ No student shall employ aids excluded by the instructor in undertaking course work or in completing any exam or assignment.
- ☐ No student shall alter graded class assignments or examinations and then resubmit them for regrading.
- ☐ No student shall submit substantially the same material in more than one course without prior authorization.”

Instructional Assistant's (IA) Responsibilities

“A student acting in the capacity of an Instructional Assistant (IA), a category including but not limited to teaching assistants, readers, and tutors, has a special responsibility to safeguard integrity of scholarship. In this role the student functions as an apprentice instructor, under the tutelage of the responsible instructor. An IA shall equitably grade student work in the manner agreed upon with the course instructor. An IA shall not provide a student with any information or collaboration that would aid the student in completing the course in a dishonest manner (e.g., providing access to unauthorized material related to tests, exams, and homework).”