CHEMISTRY 4052/5052
Chemical Biology
York University – Department of Chemistry

Lectures: Tu & Th, 10–11:20 am

Instructor: Ryan Hili
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Office hours: appointments can be made by email.

Purposes and aims of the seminar

1. To help you learn about the concepts and tools of biochemistry and cell biology from a chemical perspective.
2. To demonstrate how these concepts and tools are applied to solve problems at the interface of chemistry and biology.
3. To promote the critical analysis of recent research in chemical biology.
4. To inspire research projects in chemical biology and to help develop skills for writing research proposals and participating in peer review.

Seminar format

Due to the COVID-19 pandemic, this year's seminar will be delivered by Zoom and each lecture will be recorded and uploaded to eClass after the lecture. The Zoom meeting address and password will be posted on eClass (General Section) and may be periodically changed for security reasons. This seminar is formatted as both a lecture and a group discussion. The instructor will introduce topics during each lecture for 70-80 minutes. Following selected lectures, the instructor will assign one recent research article that builds upon the concepts taught during the lecture. At the beginning of the next class, there will be a 10-minute summary and discussion regarding the assigned paper, where the instructor will introduce the paper and address any concerns with the main concepts of the paper.

Zoom Lecture Etiquette and Expectations

Your mics will be muted, and video turned off upon joining the meeting. If you have questions during the class, please raise your hand (

). When called upon, please unmute mic to ask question. If I do not see your hand raised (which can happen if I am writing), please feel free to unmute yourself to ask your question. Note that the chat will be disabled in order to provide a more interactive and vocal virtual classroom environment.

Textbooks

There will be no specific textbook for this course. Course notes that are posted on the course website will be annotated during the lecture. Recordings Annotated lecture notes will not be posted online. Links to relevant literature will be provided. Any basic biochemistry textbook will provide sufficient background, if required.

Marking Schemes (CHEM 4052)
You have two options in this class. Choices can be made once you receive your final mark going into the final exam

Standard scheme WITH exam		WITHOUT exam	
Midterm 1	75 pts	Midterm 1	125 pts
Midterm 2	75 pts	Midterm 2	125 pts
Final exam	150 pts	Literature Review	150 pts
Literature Review	100 pts	Peer review	25 pts
Peer review	25 pts	Final mark	425 pts
Final mark	425 pts		

Marking Schemes (CHEM 5052)
You have two options in this class. Choices can be made once you receive your final mark going into the final exam

Standard scheme WITH exam		WITHOUT exam	
Midterm 1	75 pts	Midterm 1	125 pts
Midterm 2	75 pts	Midterm 2	125 pts
Final exam	150 pts	Research proposal	150 pts
Research proposal	100 pts	Research presentation	100 pts
Research presentation	100 pts	Peer review	25 pts
Peer review	25 pts	Final mark	525 pts
Final mark	525 pts		

Lecture schedule

Note: This is a tentative lecture schedule

10-Sep-20	Lecture 1	Introduction to the course
15-Sep-20	Lecture 2	Replication, transcription, and translation
17-Sep-20	Lecture 3	Basics of cell biology
22-Sep-20	Lecture 4	Protein expression and PCR
24-Sep-20	Lecture 5	Analysis of proteins and nucleic acids
29-Sep-20	Lecture 6	Model organisms, knockouts, RNAi, and chemical genetics
01-Oct-20	Lecture 7	Fluorescence and its application in chemical biology
06-Oct-20	Lecture 8	Bioconjugation and analysis of biomolecular interactions
08-Oct-20	Lecture 9	Combinatorial chemistry
13-Oct-20	*READING WEEK*	
15-Oct-20	*READING WEEK*	
20-Oct-20	**EXAM**	**MIDTERM 1**
22-Oct-20	Lecture 10	High-throughput compound screening
27-Oct-20	Lecture 11	Identifying biological targets of small molecules

29-Oct-20	Lecture 14	Biosynthesis of natural products
03-Nov-20	Lecture 15	Ribozymes, riboswitches, aptamers, and RNA as a target
05-Nov-20	Lecture 16	DNA-templated synthesis, DNA-encoded libraries
10-Nov-20	Lecture 17	Unnatural amino acid incorporation into proteins
12-Nov-20	Lecture 18	Biomolecule display technologies
17-Nov-20	**Exam**	**MIDTERM 2**
19-Nov-20	Lecture 19	Activity-based protein profiling
24-Nov-20	Lecture 20	CRISPR Technologies **(Proposals/Lit. Reviews Due)**
26-Nov-20	Lecture 21	Epitranscriptomics
01-Dec-20	Lecture 22	Molecular basis of cancer/Anti-cancer agents **(Proposal Evaluations Due)**
03-Dec-20	**Pres**	**Proposal presentations**
08-Dec-20	**Pres**	**Proposal presentations**
TBD	**EXAM**	**FINAL EXAM**

Midterm

The midterms will occur during class hours. The midterm will become available on eClass by 10 am, and the completed scanned exam must be emailed to rhili@yorku.ca before 11:20 am. Late exams will receive penalties. Your answers can be written on blank or lined paper; you do not need to write your answers on the printed-out exam. TO email scanned copies, I recommend using "Genius Scanner" app for either iOS or Android. It allows easy scanning of pages into a single PDF for email within minutes. Please do not take photos of each page using your phone's camera as this will lead to large email attachments that may be too large to email. I highly recommend that you become familiar with either Genius Scanner or another scanning app well before the midterms to ensure that things go smoothly!

Midterm exam questions are mainly problem-solving style questions, where students must use the concepts learnt in class to address the problem posed in the exam question. Students who miss the midterm will have the marking weight shifted to the final exam. No doctor's notes are required, and no makeups will be provided.

Final exam policy

The final exam schedule will not be known until mid-October. However, all students are expected to be available for the **complete** final exam period and no travel or other arrangements should be made to start before the end of the exam period. This is to allow for weather emergencies and other reasons for rescheduling. A conflict with previously made travel arrangements is **not** an acceptable reason for missed final exams.

Literature Review (CHEM 4052)

Each undergraduate student will be required to submit a literature review on a topic chosen from a list of chemical biology topics. Students may also suggest another topic rooted in chemical biology (not biochemistry), but must have it approved by the instructor. The rereview must be approximately 10 pages (not including references). Flexibility in length is provided (e.g., 1-2 pages longer is fine). Examples of reviews will be provided.

Research Proposals (CHEM 5052)
Each graduate student will prepare and submit an original research proposal in an area of chemical biology. Students are encouraged to develop their own proposals. Consultations on proposals will be available, and example proposals will be provided on eClass. The proposal will be 3-5 pages (single spaced) in length, including figures, and comprise an introduction, specific aims, and scientific approach. A reference section will not count toward the page limit.

Student research proposals will be marked according to the following five criteria:

1. Significance (25%): Is the problem important, and will this research contribute to the advancement of the field?
2. Approach (25%): Are the design of methods and analyses sound?
3. Innovation (25%): Does the proposal employ novel concepts, methods, and approaches?
4. Clarity (25%): Is the proposal written in a clear and concise manner?

Peer Review
25 pts toward your final mark will be an evaluation of your participation in the peer review process. In a completely anonymous fashion, each student (both undergrads and graduate students) will be assigned a peer's proposal. The student will be expected to evaluate and critique the proposal and write a brief evaluation report on the proposal (typically 1 page). Beyond written feedback on each proposal, the evaluation will require a scaling grade for each of the following elements of the proposal: Significance, approach, innovation, and clarity. Each will be marked according to the NIH scale, where 1=highest mark and 9=lowest mark. Further instructions will be provided on eClass, along with past examples.

Research Presentation
Graduate students will deliver a 15-20-minute presentation on their research proposal to the class. Students will receive their peer review report on their proposal prior to delivering their presentation should they want to adjust their proposed research according to class suggestions. Students will be evaluated on organization, knowledge of field, clarity, and on how they address questions posed by the class/instructor.

Academic Honesty
York students are required to maintain the highest levels of academic honesty and they are subject to the Senate Policy on Academic Honesty:
http://secretariatpolicies.info.yorku.ca/policies/academichonesty-senate-policy-on
The Policy affirms the responsibility of faculty members to foster acceptable standards of academic conduct and of the student to abide by such standards.

There is also an academic integrity website with comprehensive information about academic honesty and how to find resources at York to improve students' research and writing skills, and cope with university life. Students are expected to review the materials on the Academic Integrity website: https://spark.library.yorku.ca/academic-integrity-what-is-academic-integrity