

CHEMISTRY 4052/5052

Chemical Biology

York University – Department of Chemistry

Lectures: Tu (FC 203) & Th (ACW 004), 11:30 am – 1:00 pm,

Instructor: Bill Kim

Email: bkim271@yorku.ca

Office: LSB 429F

Standing office hour (drop by anytime): Mon 3-4pm

Office hour by appointment: Please send me an email

Lecture notes, announcements, and other course materials: **Access through eClass**

Learning objectives

1. To become conversant with 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.

Course Description

This course introduces students to the fundamentals of chemical biology, which focuses on the use of chemistry to study, probe, re-engineer, and exploit biological systems. Topics covered will include cellular profiling of biomolecules; chemical genetics; genetic and protein engineering; and synthetic biology. The course will focus largely on the applications of chemical biology to human health and disease.

Seminar format

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 discussion regarding the assigned paper, where the instructor will introduce the paper and address any concerns with the main concepts of the paper.

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. 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	<u>Peer review</u>	<u>25 pts</u>
<u>Peer review</u>	<u>25 pts</u>	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	<u>Peer review</u>	<u>25 pts</u>
<u>Peer review</u>	<u>25 pts</u>	Final mark	525 pts
Final mark	525 pts		

Lecture schedule

Note: This is a tentative lecture schedule

Date	Lecture	Topic
9-Jan-24	Lecture 1	Introduction to the course
11-Jan-24	Lecture 2	Replication, transcription, and translation
16-Jan-24	Lecture 3	Basics of cell biology
18-Jan-24	Lecture 4	Protein expression and PCR
23-Jan-24	Lecture 5	Fluorescence and its application in chemical biology
25-Jan-24	Lecture 6	Bioconjugation and Bioorthogonal chemistry
30-Jan-24	Lecture 7	DNA Sequencing Technologies
1-Feb-24	Lecture 8	Analysis of nucleic acids (and proteins)
6-Feb-24	Lecture 9	DNA Editing Technologies (CRISPR introduction)
8-Feb-24	Lecture 10	Targeting RNA and protein (chemical genetics)

13-Feb-24	Lecture 11	Combinatorial chemistry + High-throughput compound screening
15-Feb-24	EXAM	MIDTERM 1
20-Feb-24	READING WEEK	
22-Feb-24	READING WEEK	
27-Feb-24	Lecture 12	DNA-encoded Libraries
29-Feb-24	Lecture 13	Biosynthesis of natural products
5-Mar-24	Lecture 14	Directed evolution
7-Mar-24	Lecture 15	Biomolecule display technologies
12-Mar-24	Lecture 16	Unnatural amino acid incorporation into proteins
14-Mar-24	EXAM	MIDTERM 2
19-Mar-24	Lecture 17	Activity-based protein profiling
21-Mar-24	Lecture 18	Advanced CRISPR Technologies (Proposals/Lit. Reviews Due)
26-Mar-24	Lecture 19	Cancer
28-Mar-24	Lecture 20	Cancer therapy (Proposal Evaluations Due)
2-Apr-24	PRESENTATION	Proposal presentations
4-Apr-24	PRESENTATION	Proposal presentations
TBD	EXAM	FINAL EXAM

Midterms

Midterms will take place in person during lecture time, and are designed to be completed in 60 min, but you will have full class period to complete them. Midterms will be open book; you can bring your printouts of lecture notes or 'cheat sheets', but **no electronic devices** will be allowed. 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 midterm. 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 review must not exceed 10 pages (single spaced) including figures but not including references. Examples of reviews will be provided. *Late penalty is 10%, plus prorated 10% per 24 hrs.*

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. *Late penalty is 25%, plus prorated 25% per 24 hrs.*

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 (CHEM 5052)

Graduate students will deliver a 15-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.

Notes:

(1) **email policy.** All emails must include the name of the sender. Emails should be sent from your yorku email address and should include "Chem 4052" or "Chem 5052" in the subject line. Messages from accounts like fuzzy_bunny@hotmail.com or similar may not receive a reply, probably because the email will be sent to my spam folder.

(2) There will be **no make-up** for a missed midterm. If you miss Midterm Exam 1, its value will be evenly split between Midterm Exam 2 and the Final Exam. If you miss Midterm Exam 2, its value will be added to the Final Exam.

(3) **Missed final exam.** Missed final exam requires an 'Attending Physician's Statement'. Doctor's notes will NOT be accepted. This documentation must be submitted within 3 working days of the missed exam.

(4) **Re-grade policy:** If, after graded exams are returned, there is a question concerning the grading of the exam, the entire exam should be returned. The entire exam may be re-graded. All requests for re-grading must be made in writing and must be submitted to Dr. Kim no later than the end of lecture 1 week after the exam is returned to the class. The request should identify the question of concern and briefly explain the scientific reason why your answer merits further consideration.

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>

RESOURCES

Assistance for Students (Academic and Well-Being)

Academic Advising*: <https://www.yorku.ca/science/academic-advising/> * Departments also offer program-specific advising. Check with your Department's Undergraduate Office.

Centre for Human Rights, Equity, and Inclusion: <https://rights.info.yorku.ca>

Centre for Indigenous Students Services: <https://aboriginal.info.yorku.ca/>

Food Access, Funding, & Supports/Resources: <https://students.yorku.ca/food>

Good2Talk 24-hour Ontario Student Helpline: 1-866-925-5454 /Text: GOOD2TALKON to 686868

Keep.meSAFE: <https://myssp.app/keepmesafe/ca/home>

Learning Commons (general academic learning supports including library research, time management, study skills, career planning, etc.): <https://learningcommons.yorku.ca/>

Peer Assisted Study Sessions (PASS): <https://www.yorku.ca/colleges/bethune/get-help/pass/>

Peer Tutoring: <https://www.yorku.ca/colleges/bethune/get-help/peer-tutoring/>

Sexual Violence Response and Support: <https://thecentre.yorku.ca>

Student Counselling, Health & Well-being: <https://counselling.students.yorku.ca/>

Support Services for International Students:

<https://yorkinternational.yorku.ca/international-student-support/>

Writing Services: <https://www.yorku.ca/colleges/bethune/get-help/writing/>

York University Student Services: <https://family.yorku.ca/student-services/#SCD>

York University Student Well-being Resources:

<https://www.yorku.ca/well-being/resources/students/>

Accessibility

York University is committed to principles of respect, inclusion, and equality of all persons with accessibility needs across campus. The University provides services for students with accessibility needs (including physical, medical, learning, and psychiatric needs) needing

accommodation related to teaching and evaluation methods/materials. These services are made available to students in all Faculties and programs at York University. If you are in need of these services, please register with accessibility services as early as possible to ensure that appropriate academic accommodation can be provided with advance notice. **You are encouraged to schedule a time early in the term to meet with each professor to discuss your accommodation needs.** Please note that registering with accessibility services and discussing your needs with your professors is necessary to avoid any impediment to receiving the necessary academic accommodations to meet your needs.

Additional information is available at the following websites:

Student Accessibility Services: <https://accessibility.students.yorku.ca>

York Accessibility Hub: <http://accessibilityhub.info.yorku.ca/>

Religious Observance Accommodation

York University is committed to respecting the religious beliefs and practices of all members of the community and making accommodations for observances of special significance to adherents. Should any of the dates specified in this syllabus for an in-class test or examination pose such a conflict for you, contact the Course Director within the first three weeks of class. To arrange an alternative date or time for an examination scheduled in the formal examination periods (December and April/May), students must complete and submit an accommodation request form at least 3 weeks *before the exam period begins*. <https://secure.students.yorku.ca/pdf/religious-accommodation-agreement-final-examinations.pdf>

Student and Instructor Conduct in Academic Situations

Students and instructors are expected to maintain a professional relationship characterized by courtesy and mutual respect. Moreover, it is the responsibility of the instructor to maintain an appropriate academic atmosphere in the classroom and other academic settings, and the responsibility of the student to cooperate in that endeavour. Further, the instructor is the best person to decide, in the first instance, whether such an atmosphere is present in the class. The policy and procedures governing disruptive and/or harassing behaviour by students in academic situations is available at <http://secretariat-policies.info.yorku.ca/policies/disruptive-andor-harassing-behaviour-in-academic-situations-senate-policy/>.

Academic accommodation refers to educational practices, systems and support mechanisms designed to accommodate diversity and difference. The purpose of accommodation is to enable students to perform the essential requirements of their academic programs. At no time does academic accommodation undermine or compromise the learning objectives that are established by the academic authorities of the University. University rules regarding registration, withdrawal, appealing marks, and most anything else you might need to know can be found on the university's website, here: <https://calendars.students.yorku.ca/policies-and-regulations>

Prepared 29 December 2023