COURSE COLOUR CODE: TUNGSTEN

MBIOTECH

MASTER OF BIOTECHNOLOGY PROGRAM

Elective Course

BTC2110H

– Topics in Biotechnology –

STRUCTURAL BIOLOGY IN DRUG DEVELOPMENT & BIOTECHNOLOGY

Prof. Mark Currie

Winter Term, 2023

MASTER OF BIOTECHNOLOGY

UNIVERSITY OF TORONTO MISSISSAUGA

BTC 2110H – Structural Biology in Drug Development & Biotechnology

Course Outline (Winter 2023)

Class Location:	Kaneff Centre, Room 112 (KN-112)
Class Times:	Tuesdays, 6:00-9:00PM, 10-Jan to 21-Mar
Instructor:	**Prof. Mark Currie**
Office Location:	Davis Building, Room DV-3047
Office Hours:	Students can email me with questions. If we are not able to answer your question by email, we can arrange to meet via Zoom.
Contact:	mark.currie@utoronto.ca

Course Description

Biological, disease, and drug mechanisms are all determined by the three-dimensional arrangement of atoms within biological macromolecules. Therefore, knowledge of molecular structure is fundamental to protein engineering and the development of new therapeutics and vaccines. This course will cover the application of structural biology methods to drug development and biotechnology. Students will be introduced to the modern tools of protein structure determination including Cryo electron microscopy, X-ray crystallography, and NMR through lectures and tutorials. Lectures will focus on theory, techniques, and the advantages and limitations of each method. The applications of these methods to the pharmaceutical and biotechnology industries including protein engineering, target selection and drugability, lead identification and optimization, rational drug design, and drug mechanism of action will be explored through student presentations and discussions.

Course Objectives

- To develop a working knowledge of the theory and application of structural biology methods;
- To understand how these methods contribute to pharmaceutical and biotechnology product design and optimization; and
- To be able to critically assess the conclusions drawn from these tools.

Course Structure & Delivery

The course is taught using a combination of lectures, class presentations and discussions, and tutorials that illustrate key concepts.

Marking Scheme

The breakdown of the grade for the course will be as follows:

Class Participation	25%
Summaries/Critiques	10%
Presentations	30%
Report	20%
Tutorials	15%
TOTAL	**100%**

Participation: Students will be assessed based on the quality of their participation, not the quantity.

Summaries/Critiques: In weeks where students are responsible for a presentation or discussion questions, they will write a short summary/critique of the presentations and submit them via Quercus before the end of class. Further details regarding the summary/critique will be discussed in class and posted on the course Quercus site.

Presentations: Students will select papers to present and lead a discussion either alone or in small groups. Presentations should focus on teaching the material in the paper and the broader application of the methods or technology to drug development and/or biotechnology. Presentations will be 40-45 minutes in length followed by 15-20 minutes of discussion.

Discussion Questions: Each group will be assigned a topic/paper in each category in addition to the one they present. Students will prepare discussion questions to challenge the speakers and facilitate discussion within the class. Discussion questions will also be submitted through Quercus prior to class.

Report: Each student will write a report on a topic that they did not present on. Reports should be a maximum of 4 pages single spaced not including figures or references. Use 1-inch margins, 12-point Times Roman font, and references should be superscript numbers in the body of the text. Reports are due on the last day of class. Late reports will be docked 10% per day.

Tutorials: Students will work in small groups to conduct structural analysis related to the methods being discussed in lectures. Students will be assessed based on how well their group completes the tasks and answer tutorial questions.

Accessibility

The University of Toronto is committed to accessibility. If you require accommodations for a disability, or have any accessibility concerns about the course, the classroom, or course materials, please contact Accessibility Services as soon as possible: access.utm@utoronto.ca

Communication

The online course page for this course is accessed through Quercus. If you are registered for the class, you should be able to access the course page at https://q.utoronto.ca. If you have any issues, you can explore the FAQ and help section at http://www.portalinfo.utoronto.ca/students.

Academic Integrity

Please see the University of Toronto's Code of Behaviour on Academic Matters for full details on behaviours that constitute misconduct, and the procedures for addressing offenses. The full code can be found here: http://www.governingcouncil.utoronto.ca/Assets/Governing+Council+Digital+Assets/Policies/PDF/ppjun011995.pdf

SCHEDULE OF ACTIVITIES

SESSION 1: Protein Structure & X-ray Crystallography – *Lecture*

TUTORIAL: Protein structure

SESSION 2: Paper Selection

SESSION 3: Target Selection & Drugability

STUDENT PRESENTATIONS

SESSION 4: Drug Mechanism of Action

STUDENT PRESENTATIONS

SESSION 5: Single Particle Electron Cryomicroscopy – *Lecture*

TUTORIAL: Ligand fitting

SESSION 6: Protein Engineering

STUDENT PRESENTATIONS

SESSION 7: Biotechnology

STUDENT PRESENTATIONS

SESSION 8: Biological NMR Spectroscopy – *Lecture*

TUTORIAL: Model building

SESSION 9: Lead Identification & Optimization

STUDENT PRESENTATIONS

SESSION 10: Rational Drug Design

STUDENT PRESENTATIONS