



MASTER OF BIOTECHNOLOGY PROGRAM

*Elective Course*



BTC 2110H

*– Topics in Biotechnology –*  
STRUCTURAL BIOLOGY IN  
DRUG DEVELOPMENT &  
BIOTECHNOLOGY

Prof. Mark Currie

Winter/Spring Term, 2022

# MASTER OF BIOTECHNOLOGY

## UNIVERSITY OF TORONTO MISSISSAUGA

### BTC 2110H – Structural Biology in Drug Development & Biotechnology

#### Course Outline (Winter 2022)

Class Location:	Kanef Centre, Room 130 (KN-130)
Class Times:	Tuesdays, 6:00-9:00PM, 11-Jan to 15-Mar
Instructor:	<b>Prof. Mark Currie</b>
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:	<a href="mailto:mark.currie@utoronto.ca">mark.currie@utoronto.ca</a>

#### 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.

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## Marking Scheme

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

Class Participation .....	25%
Quizzes .....	10%
Presentations.....	30%
Report .....	20%
Tutorials .....	15%
<b>TOTAL .....</b>	<b>100%</b>

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

**Quizzes:** Students should read the papers that will be presented in preparation for class. There will be a short quiz on these papers at the beginning of each session of student presentations.

**Presentations:** Students will be assigned papers to present and lead a discussion on 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.

**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](mailto: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>

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UNIVERSITY OF TORONTO MISSISSAUGA

**BTC 2110H – Structural Biology in Drug Development & Biotechnology**

**SCHEDULE OF ACTIVITIES**

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

*TUTORIAL: Protein structure*

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**SESSION 2: Target Selection & Drugability**

*STUDENT PRESENTATIONS*

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**SESSION 3: Single Particle Electron Cryomicroscopy – Lecture**

*TUTORIAL: Ligand fitting*

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**SESSION 4: Drug Mechanism of Action**

*STUDENT PRESENTATIONS*

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**SESSION 5: Protein Engineering**

*STUDENT PRESENTATIONS*

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**SESSION 6: Biotechnology**

*STUDENT PRESENTATIONS*

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**SESSION 7: Biological NMR Spectroscopy – Lecture**

*TUTORIAL: Model building*

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**SESSION 8: Lead Identification & Optimization**

*STUDENT PRESENTATIONS*

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**SESSION 9: Rational Drug Design**

*STUDENT PRESENTATIONS*

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