Department of Chemistry
Biochemistry II
Chem3271/Biol3272
Course ID: 147955/147462
2024 Winter
Course Outline

**Instructor Information**


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|---|---|
| Instructor: | Dr. Justin Jiang |
| Office Location: | CB4021 |
| Telephone: | 807-343-8010 ext. 7171 |
| E-mail: | zjiang@lakeheadu.ca |
| Office Hours: | Wednesday 4:00 – 5:00 pm; or by appointment |


**Lab Instructor Information**


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|---|---|
| Lab Instructor: | Christina Richard |
| Office: | CB2028A |
| Phone: | 807-343-8765 |
| Email: | crichar3@lakeheadu.ca |


**Course Prerequisites:** Chem3251/Biol3252 or equivalent

**Course Description (in Course Calendar)**

Enzyme kinetics. Mechanism of enzyme reactions. Biosynthesis of terpenes and steroids. Sequence determination of DNA and RNA using electrophoretic methods. Chemical synthesis of polynucleotides. DNA replication. Protein synthesis.

**Course Location and Times**

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|---|---|
| Class Location: | RB2047 |
| Class Times: | Monday & Wednesday 1:00 – 2:30 pm |

**Labs**

This course has a laboratory component and is required for obtaining the course credit. If you are repeating this course and wish to use your previous lab mark, this may be considered. Please contact the course instructor in the first week to discuss whether you are eligible for exemption from the labs.

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|---|---|
| Location: | CB2050/2051 |
| Time: | Monday and Friday |

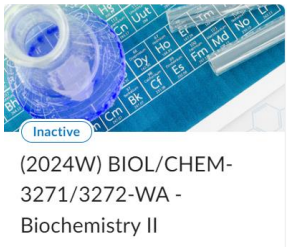
**Key Course Learning Objectives**

Upon successful completion of this course, the student will have reliably demonstrated the ability to:

- Understand the key concepts of enzymes including enzyme kinetics, catalytic and regulatory strategies, and enzyme inhibition.
- Identify the common cellular signaling pathways and the general strategies of signal transduction.
- Describe the key features of energy metabolism involving glycogen/glucose, proteins and amino acids, and how different metabolic pathways are interconnected and integrated.
- Identify the biochemical reasons behind a number of diseases and how certain drugs work.
- Conduct experiments according to laboratory procedures and critically analyze experimental data.
- Perform literature search on a specific bio/chemical topic and collect relevant information.
- Develop writing skills in effectively communicating laboratory findings and literature information in the general format of a research paper.

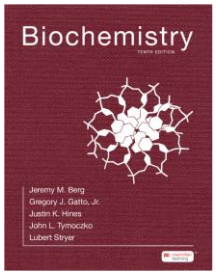
**Course Resources**

- **myCourseLink on D2L**: https://mycourselink.lakeheadu.ca/d2l/home/130577




Lecture notes, Lab Manual, and other course materials will be uploaded on D2L.

- **Textbook**: Biochemistry (with Achieve), 10th edition, Jeremy M. Berg, Gregory J. Gatto, Jr., Justin Hines, John L. Tymoczko, and Lubert Stryer – W. H. Freeman and Company. New York, NY.




Both digital and hard copies of the textbook are available at the LU Bookstore.

- **Achieve** (macmillan learning): The digital textbook and online assignments of this course are supported by Macmillan Learning. The course on Achieve is displayed as the following:

Chem3271-Biol3272 (2024W): Biochemistry II
MW 1:00 PM-2:30 PM

Course ID: 4cw3tp

Course URL: https://achieve.macmillanlearning.com/courses/4cw3tp

If you purchased a two-term (or multiple-term) access in the Fall, you may follow the instructions in the link below to get into the course for the Winter:

https://mhe.my.site.com/macmillanlearning/s/article/Achieve-Enroll-in-the-second-term-of-a-course-using-multi-term-access

Should you need to purchase a one-term access, here is the ISBN for one term:
ISBN 9781319417475.

**Assessments**

To successfully complete this course, students must achieve a passing grade of 50% or higher in the overall course and 50% or higher for the lab component. Students would not be eligible for the Special Exam if their overall grades are in the range of 40 – 49 but their lab grade is below the passing grade of 50%.

| Item | Weight% |
|---|---|
| Assignments (x 8) | 15 |
| Labs | 25 |
| Midterm exam | 25 |
| Final Exam | 35 |
| Total | 100 |

**Assignments**

There are eight online Assignments on Achieve (Macmillan Learning), which corresponds to the end-of-chapter problems from those chapters we are discussing in the class. These assignments are helpful in assisting you with learning the course materials. Each Assignment is typically open for two weeks for you to complete. The due dates of these Assignments are provided in the course outline as well as on the Achieve course website.

**Due Dates**:

- Grading activities carry due dates which are posted on the Course Outline/Lab Manual and/or on D2L/Achieve. It is the student's responsibility to meet these deadlines.
- Extension of a deadline may be considered at the course/lab instructor's discretion if requested prior to the deadline with justification.

**Late Assignments/Lab Reports**

- Late assignments will automatically receive a zero (0) mark. Students will not be able to submit any specific Assignment after the due date.

- Late lab reports will receive a penalty of mark deduction. Please refer to the Lab Manual for more information.

**Exams**

- There is one midterm exam scheduled on Wednesday, February 14, 2024, which will be written in class. The final exam will be scheduled by the University. All exams are in principle cumulative, and all exams are in-person exams unless the University's (health) policy requires otherwise.
- **Missed Exams**: Any exam missed for compassionate or medical reasons must be justified with proper documentation, which must be provided to the instructor within two days after the exam is over. **There will be no make-up exam for the missed midterm exam for this course**. The default option for the missed midterm exam is that the weight% of the missed midterm exam will be shifted to the final exam. Missed final exams will be dealt with by the Registrar's office.

**Course Policies**

- Attendance - Attendance to Labs is required. Attendance to Lectures is highly recommended as this is the most important way the instructor can help the students with their studies of the course materials.
- Safety regulations
  - All students attending Chemistry labs, whether in-person or online, must complete the compulsory safety/ethics modules on **myChemistry**:
    1. WHMIS with GHS
    2. Chemistry Department Safety Regulations
    3. Academic Integrity Matters

    myChemistry is available on myCourselink. See the lab manual for more details and the due dates for completing these modules.

    Please note that students who do not complete these modules by the deadline will be barred from further lab participation, and a grade of zero will be assigned to each missed lab report. In addition, students who miss half of the labs will receive no lab credit for the course.

- Group work/collaboration – By completing quizzes and exams, or submitting assignments and lab reports, the student has read, understands and agrees to the following Academic Integrity Statement:

  I understand and agree that:

  (1) Unless otherwise allowed by the course instructor, I must complete the assignments and lab reports in this course without the assistance of anyone else, and without using any content from past assignments and/or lab reports.

(2) Unless otherwise allowed by the course instructor, I must not access any sources or materials (in print, online, or in any other way) to complete any course exam.

I further understand and agree that, if I violate either of these two rules, or if I provide any false or misleading information about my completion of course assignments or exams, I may be prosecuted under the Lakehead University Student Code of Conduct – Academic Integrity, which requires students to act ethically and with integrity in academic matters and to demonstrate behaviours that support the University's academic values.

**Academic Integrity**

A breach of Academic Integrity is a serious offence. The principle of Academic Integrity, particularly of doing one's own work, documenting properly (including use of quotation marks, appropriate paraphrasing and referencing/citation), collaborating appropriately, and avoiding misrepresentation, is a core principle in university study. Students are strongly advised to familiarize themselves with the Student Code of Conduct - Academic Integrity ("The Code") - and, in particular, **sections 26 and 83 through 85**. Non-compliance with the Code will NOT be tolerated in this course and the Code will be adhered to in terms of disciplinary action. The Code provides a full description of academic offences, procedures when Academic Integrity breaches are suspected and sanctions for breaches of Academic Integrity. For more information about Student Code of Conduct, please visit: https://www.lakeheadu.ca/students/student-life/student-conduct

**Copyright**

Students should be aware that all instructional, reference, and administrative materials prepared for this course are protected in their entirety by copyright. Students are expected to comply with this copyright by only accessing and using the course materials for personal educational use related to the course, and that the materials cannot be shared in any way, without the written authorization of the course instructor. If this copyright is infringed in anyway, students may be prosecuted under the Lakehead University Student Code of Conduct – Academic Integrity, which requires students to act ethically and with integrity in academic matters and to demonstrate behaviours that support the University's academic values.

**University Regulations**

It is the responsibility of each student registered at Lakehead University to be familiar with, and comply with all the terms, requirements, regulations, policies and conditions in the Lakehead University Academic Calendar. This includes, but is not limited to, Academic Program Requirements, Academic Schedule of Dates, University and Faculty/School Policies and Regulations and the Fees and Refund Policies and Schedules.

Here is the link to the University's 2023-2024 Academic Calendar:
https://csdc.lakeheadu.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&loaduseredits=False/

**Supports for Students**

There are many resources available to support students. These include but are not limited to:

- Health and Wellness

- Student Success Centre
- Student Accessibility Centre
- Library
- Lakehead International
- Indigenous Initiatives

Lakehead University is committed to achieving full accessibility for persons with disabilities. Part of this commitment includes arranging academic accommodations for students with disabilities and/or medical conditions to ensure they have an equitable opportunity to participate in all of their academic activities. If you are a student with a disability and think you may need accommodations, you are strongly encouraged to contact Student Accessibility Services (SAS) and register as early as possible. For more information, please contact Student Accessibility Services (SC0003, 343-8047 or sas@lakeheadu.ca).

For more information about resources available for Student Supports, please visit: https://www.lakeheadu.ca/campus-life/student-supports

**Important Dates**

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|---|---|
| First day of classes | Monday, January 8, 2024 |
| Final day of classes | Tuesday, April 9, 2024<br>Monday, April 8, is a make-up day for Good Friday.<br>Tuesday, April 9, is a make-up day for Easter Monday. |
| Final day to register | Friday, January 19, 2024 |
| Final day to withdraw | Friday, March 8, 2024 |
| Marks due | Friday, April 26, 2024 |
| Study Break | Monday, February 19 - Friday, February 23, 2024 |
| Good Friday | Friday, March 29, 2024 |
| Easter Monday | Monday, April 1, 2024 |

**Tentative Schedules and Lecture Topics**

- Lecture notes will be posted on D2L in advance. They are intended as guides. The corresponding chapters in the textbook must be studied for exams.
- Lecture topics are subject to change. Schedules are approximate.

| Week | Date | Topic | Textbook | Assignments Due dates | Lab |
|---|---|---|---|---|---|
| 1 | Jan 7-13 (M/W) | 1. Course Overview and Review of pKa, Buffers, and Amino Acids (1.5) | chapter 1.3<br>chapter 2.2 | | No lab |
| 2 | Jan 14-20 (M/W) | 2. Enzyme Core Concepts and Kinetics (2.5) | chapter 5.0 – 5.4 | Assignment 1<br><br>Wed/Jan 24 | Lab 1: Buffers, buffering capacity and the Henderson-Hasselbalch equation (3.5%) |
| 3 | Jan 21-27 (M/W) | 3. Enzyme Inhibition (2) | chapter 5.6<br>chapter 12.4<br>chapter 32.1, 32.2 | Assignment 2<br><br>Wed/Jan 31 | Lab 2: Vitamin C content in fruit juices (3.5%) |
| 4 | Jan 28-Feb 3 (M/W) | 4. Enzyme Catalytic Strategy and Enzyme Cofactors (2) | chapter 6.0 – 6.3<br>chapter 5.1 | Assignment 3<br><br>Wed/Feb 7 | Lab 3: Michaelis-Menten kinetics of mushroom tyrosinase (6%) |
| 5 | Feb 4-10 (M/W) | 5. Enzyme Regulatory Strategy and Enzyme protective mechanisms (2) | chapter 7.0 – 7.4<br>chapter 18.3<br>chapter 20.5<br>chapter 27.4<br>chapter 32.3 | Assignment 4<br><br>Wed/Feb 14 | No lab |
| 6 | Feb 11-17 (M/W) | 6. Mini Review<br>**Midterm Exam (Wed Feb 14)** | | | Lab 4: Inhibition studies of mushroom tyrosinase (3.5%) |
| 7 | Feb 18-24 | Study Break – No class | | | No lab |
| 8 | Feb 25-Mar 2 (M/W) | 7. Signal Transduction I<br>a. Overview and protein-ligand binding<br>b. GPCR Signaling Pathways (2) | chapter 14.0 – 14.6 | | No lab |
| 9 | Mar 3-9 (M/W) | 7. Signal Transduction II<br>a. Tyrosine Kinase Receptor Signaling Pathways<br>b. Innate Immune Defense (2) | chapter 14.0 – 14.6 | Assignment 5<br><br>Wed/Mar 13 | Lab 5: Ligand Binding: The binding of HABA and biotin to avidin (4%) |
| 10 | Mar 10-16 (M/W) | 8. Glycogen Metabolism (2) | chapter 21.0 – 21.5 | Assignment 6 Wed/Mar20 | No lab |
| 11 | Mar 17-23 (M/W) | 9. Protein Turnover and Amino Acid Catabolism (2) | chapter 23.0 – 23.6 | Assignment 7<br><br>Wed/Mar 27 | No lab |
| 12 | Mar 24-30 (M/W) | 10. Integration of Energy Metabolism (2) | chapter 24.0 – 24.5 | Assignment 8<br><br>Wed/Apr 3 | No lab |
| 13 | Mar 31-Apr 6 (W) | Easter Monday – No class<br>11. Biosynthesis of Amino Acids (1.5) | chapter 25.0 – 25.4 | | Lab 6: Computer-based investigation of the Biochemistry of Diseases (4.5%) |
| 14 | April 7-11 (T) | Mini Review (0.5)<br>Study Period | | | |
| 14-16 | Apr 12-22 | Exam Period | | | |