

CHEM 3251/BIOL 3252 Biochemistry 1

2020F

Class Organization

Instructor	Dr. Wely B. Floriano Phone: (807) 766-7215 Email: wely.floriano@lakeheadu.ca
Virtual Office Hours	Tue and Thu 2:30pm-3:15pm Zoom meeting links available on Desire2Learn under "Course calendar". Email the instructor if you need to schedule a private Zoom meeting.
Experimental Coordinator	Christina Richard (CB 2028A, 343-8765, crichar3@lakeheadu.ca) Please email to schedule Zoom meetings as needed.
Prerequisites	Organic II
Course Description	Chemistry and metabolism of monosaccharides, disaccharides and polysaccharides. Chemistry of amino acids and proteins. Structure and reaction of fatty acids, triacylglycerols and phospholipids. Structure and properties of nucleotides and polynucleotides of DNA and RNA.
Course Resources	All course materials are posted on Lakehead's Desire2Learn (D2L).
Required EBook	<ul style="list-style-type: none"> • <i>Biochemistry</i>, 9th edition by Stryer/Berg/Tymoczko/Gatto, 2019. ISBN:9781319234362 Ebook with SaplingPlus • You are not required to purchase a hard-copy of the book; only the electronic form. Contact Lakehead's bookstore to purchase the EBook as they charge Canadian dollars. If you buy online from Macmillan, the price is in US dollars. • According to Macmillan, you can download the complete EBook at any time before your access key expires and use it offline for up to 4 years. • Once you have your access key, follow these instructions to enroll in Sapling Learning for this course and access your EBook: https://sites.google.com/macmillan.com/f20chem3251floriano/home.
Learn	<ul style="list-style-type: none"> • Web asynchronous • Materials includes video notes, PDF lecture notes, interactive videos, reading assignments, quizzes, case studies, and problems.
Experiment	<ul style="list-style-type: none"> • Web asynchronous; no in-person "wet" labs • Materials include written instructions, guides and videos. • Instructions, guides and videos as well as data sets for analyses and reporting are posted on the weekly sections under "Experiments".
Grading	<ul style="list-style-type: none"> • D2L Interactive Video (1%) – watch a video and answer questions when prompted. • D2L Lab Report (6 X 3.5% = 21%) – watch videos and/or read notes, perform analysis of experimental data and submit a report. • Sapling (Learning Curve, Homework, Case Study, Reading Quiz) (24%) – read assigned EBook material and complete an online quiz, homework, case study or learning curve. • Examination (2 X 27% = 54%) – synchronous.
Due Dates	<ul style="list-style-type: none"> • Graded activities carry due dates posted on the Course Schedule (see below), on D2L, and on Sapling. • It is the responsibility of each student to meet these deadlines without reminders from the instructor.

Late Assignments	<ul style="list-style-type: none"> • Late assignments will automatically receive a mark of 0. • Extension of a deadline may be considered at the instructor's discretion if requested prior to the deadline. If granted, extensions will be extended to all students. • Late lab reports will be deducted 10% of the total marks for each day they are late.
Missed Exam	<ul style="list-style-type: none"> • Any exam missed for compassionate or medical reasons must be justified with proper documentation. • Missed exams will be replaced with an oral examination scheduled at the instructor's convenience, in consultation with the student.
Copyright	<p>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.</p>
Academic Integrity	<p>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 should view the Student Code of Conduct - Academic Integrity for a full description of academic offences, procedures when Academic Integrity breaches are suspected and sanctions for breaches of Academic Integrity.</p>
Accommodations	<p>Lakehead University is committed to achieving full accessibility for persons with disabilities. Part of this commitment includes arranging academic accommodations for students with disabilities to ensure they have an equitable opportunity to participate in all of their academic activities. If you 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 visit: http://studentaccessibility.lakeheadu.ca</p>
Student Support	<p>There are many resources available to support students. These include but are not limited to:</p> <ul style="list-style-type: none"> • Health and Wellness • Student Success Centre • Student Accessibility Centre • Library • Lakehead International • Indigenous Initiatives
Regulations	<p>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 (Lakehead University Regulations webpage, 2020-21).</p>

Tentative Course Schedule

Week	Learn (2X90 minutes)	Experiment (180 minutes)
1 Sep 8 to Sep 11	<p>Watch</p> <p>D2L</p> <ul style="list-style-type: none"> Welcome! Course description and organization Review of biochemical concepts <p>Sapling</p> <ul style="list-style-type: none"> Introduction to Sapling Learning <p>Read</p> <ul style="list-style-type: none"> Sapling - What you need to know to get started EBook - Review of biochemical concepts - Chp 1 Sections 1.1, 1.2, 1.3 <p>Assignments to complete</p> <ul style="list-style-type: none"> Sapling – Chp 1 Homework (15 questions) Open until Sep 18 <p>Summary sheets (pdf)</p> <ul style="list-style-type: none"> Welcome! Course Description and Organization Lecture 1 Review of biochemical concepts 	<p>Complete D2L course “myChemistry”.</p> <p>All students are required to complete the Department of Chemistry’s online chemical safety course.</p> <p>All 3 components must be completed:</p> <ol style="list-style-type: none"> WHMIS and GHS Chemistry Department Safety Regulations Academic Integrity <p>A student is required to complete the safety course only once for all chemistry courses in the 2020-2021 academic year.</p>
2 Sep 14 to Sep 18	<p>Read</p> <p>EBook</p> <ul style="list-style-type: none"> Nucleic acids (chp 4) - sections 4.1 to 4.3 with exclusions DNA replication, transcription and translation (chp 4) sections 4.4 to 4.6 with exclusions <p>Assignments to complete</p> <ul style="list-style-type: none"> D2L - Interactive video 1: short DNA molecule Sapling – Chp 4 Reading Quiz (15 questions) Due on Sep 18 <p>Summary notes (pdf)</p> <ul style="list-style-type: none"> Lecture 2 Nucleic acids (chp 4) Lecture 3 DNA replication, transcription and translation (chp 4) 	<p>Lab 1 Standard Curve</p> <p>Watch</p> <ul style="list-style-type: none"> Using a Micropipette - University of Leicester Micropipette technique demo How to Use a Spectrophotometer-Novaspec How to use a Spectrophotometer - Genesys20 <p>Assignments to complete</p> <ul style="list-style-type: none"> Questions and answers (Q+A) Experimental Data Assignment (EDA) <p>Due on Sep 23</p>
3 Sep 21 to Sep 25 Last day to add Sep 21	<p>Watch</p> <p>Sapling Chapter 5 animations:</p> <ul style="list-style-type: none"> Animated Technique - Gel Electrophoresis with Restriction Digest file (2.30 minutes) Animated Technique - Dideoxy Sequencing of DNA file (3:08 minutes) Animated Technique - Polymerase Chain Reaction (PCR) file (4:34 minutes) <p>Read</p> <p>EBook</p> <ul style="list-style-type: none"> Exploring Genes and Genomes (chp 5) sections 5.1, 5.2, 5.3 with exclusions Exploring Evolution and Bioinformatics (chp 6) sections 6.1 and 6.2 <p>Assignments to complete</p> <ul style="list-style-type: none"> D2L - Interactive Video 2: tRNA synthetase Sapling - Chp 5 Reading Quiz (8 questions) Sapling - Chp 6 Homework (7 questions) Due on Sep 25 <p>Summary sheets (pdf)</p> <ul style="list-style-type: none"> Lecture 4 Genomes and Genome sequencing (chp 5) Lecture 5 Introduction to Bioinformatics (chp 6) tRNA synthetase 	<p>Lab 2 Introduction to recombinant DNA methodology</p> <p>Watch</p> <ul style="list-style-type: none"> agarose gel electrophoresis agarose gel electrophoresis #2 making an agarose gel - University of Leicester DNA electrophoresis sample loading <p>Assignments to complete</p> <ul style="list-style-type: none"> Questions and answers (Q+A) Experimental Data Assignment (EDA) <p>Due on Sep 30</p>

<p>4 Sep 28 to Oct 2</p>	<p>Watch D2L</p> <ul style="list-style-type: none"> Levels of Protein Structure <p>Sapling Chapter 3 Animations:</p> <ul style="list-style-type: none"> Animated Technique - Gel-Filtration Chromatography Animated Technique - Affinity Chromatography <p>Read EBook</p> <ul style="list-style-type: none"> Protein composition and structure (chp 2) sections 2.1 to 2.6 with one exclusion Exploring proteins and proteomes (chp 3) - Read section 3.1, subsections 3.1.1 to 3.1.3 <p>Assignments to complete</p> <ul style="list-style-type: none"> Sapling - Chapter 2 Case Study: pH Peril (10 questions) Sapling - Chapter 3 Homework (5 Questions) <p>Due on Oct 2</p> <p>Summary sheets (pdf)</p> <ul style="list-style-type: none"> Lecture 6 Protein composition and structure (chp 2) Lecture 7 Protein assay and purification (chp 3) 	<p>Lab 3.1 Purification of bovine liver lactate dehydrogenase: Affinity chromatography and LDH quantification</p> <p>Watch</p> <ul style="list-style-type: none"> affinity chromatography packing a chromatography column affinity chromatography #2 <p>Assignments to complete</p> <ul style="list-style-type: none"> Questions and answers (Q+A) Experimental Data Assignment (EDA) <p>Due on Oct 21</p>
<p>5 Oct 5 to Oct 9</p>	<p>Watch D2L</p> <ul style="list-style-type: none"> Calculate the charge of a peptide at a given pH ELISA <p>Sapling Chapter 3 Animations:</p> <ul style="list-style-type: none"> Animated Technique - Gel Electrophoresis (SDS-PAGE) file Animated Technique - Isoelectric Focusing file Animated Technique - Two-dimensional Electrophoresis file Animated Technique - Western Blotting (Immunoblotting) <p>Read EBook</p> <ul style="list-style-type: none"> Exploring proteins and proteomes (chp 3) - Read section 3.1, subsections 3.1.4 to 3.1.5; section 3.2, subsections 3.2.1 to 3.2.4, 3.2.6; section 3.3, subsections 3.3.1, 3.3.4 <p>Assignments to complete</p> <ul style="list-style-type: none"> Sapling - Chp 3 Homework (18 Questions) <p>Due on Oct 9</p> <p>Summary sheets (pdf)</p> <ul style="list-style-type: none"> Lecture 8 Proteins: physical characterization (chp 3) Lecture 9 Uses of pure protein and Protein detection methods (chp 3) 	<p style="text-align: center;">EXAM 1</p> <p style="text-align: center;">Synchronous</p> <p style="text-align: center;">Thu, Oct 8, 2020 at 10:00am EDT</p>
<p>6 Oct 12- 16</p>	<p>FALL STUDY BREAK</p>	<p>FALL STUDY BREAK</p>

<p>7 Oct 19 to Oct 23</p>	<p>Watch</p> <ul style="list-style-type: none"> • Introduction to metabolism (chp 15) • Sapling - Problem Solving Video - Free Energy, ATP, and Creatine in Resting Muscle <p>Read</p> <ul style="list-style-type: none"> • Metabolism: Basic Concepts and Design (chp 15) – sections 15.1 to 15.4 with one exclusion <p>Assignments to complete</p> <ul style="list-style-type: none"> • Sapling - Chp 15 Learning Curve (300 points, ~15 questions) <p>Due on Oct 23</p> <p>Summary sheets (pdf)</p> <ul style="list-style-type: none"> • Lecture 10 Introduction to metabolism (chp 15) 	<p>Lab 3.2 Purification of bovine liver lactate dehydrogenase: Protein content determination by the Bradford method</p> <p>Watch</p> <ul style="list-style-type: none"> • Bradford protein assay • Measurement of the protein concentration with the Bradford Assay • How to make an SDS-PAGE gel • How to run an SDS-PAGE gel • How to stain an SDS-PAGE gel <p>Assignments to complete</p> <ul style="list-style-type: none"> • Questions and answers (Q+A) • Experimental Data Assignment (EDA) <p>Due on Oct 28</p>
<p>8 Oct 26 to Oct 30</p>	<p>Read EBook</p> <ul style="list-style-type: none"> • Carbohydrates (chp 11) - sections 11.1 to 11.4 • Lipids and Cell Membranes - <p>Assignments to complete</p> <ul style="list-style-type: none"> • Sapling - Chapter 11 Homework (15 questions) • Sapling - Chapter 12 Reading Quiz (8 questions) <p>Due on Oct 30</p> <p>Summary sheets (pdf)</p> <ul style="list-style-type: none"> • Lecture 11 Carbohydrates and Glycoproteins • Lecture 12 Lipids (chp 12) 	<p>Lab 4 Carbohydrate content of fruit</p> <p>Watch</p> <ul style="list-style-type: none"> • Test for reducing compounds using 3,5-DNS • Glucose quantification and assay using a spectrophotometer <p>Assignments to complete</p> <ul style="list-style-type: none"> • Questions and answers (Q+A) • Experimental Data Assignment (EDA) <p>Due on Nov 4</p>
<p>9 Nov 2 to Nov 6</p> <p>drop date Nov 6</p>	<p>Read EBook</p> <ul style="list-style-type: none"> • Lipids and Cell Membranes - sections 12.4 to 12.6 • Membranes, Channels and Pumps - sections 13.1 to 13.4 with exclusions <p>Assignments to complete</p> <ul style="list-style-type: none"> • Sapling - Chapter 12 Reading Quiz (6 questions) • Sapling - Chapter 13 Reading Quiz (8 questions) <p>Due on Nov 6</p> <p>Summary sheets (pdf)</p> <ul style="list-style-type: none"> • Lecture 13 Cell membranes (chp 12) • Lecture 15 Transport across membranes (chp 13) 	<p>Lab 5 Lipids – Iodine number determination and lipase activity</p> <p>Watch</p> <ul style="list-style-type: none"> • Estimation of Iodine value of fats and oils • Iodine value demonstration <p>Assignments to complete</p> <ul style="list-style-type: none"> • Questions and answers (Q+A) • Experimental Data Assignment (EDA) <p>Due on Nov 11</p>
<p>10 Nov 9 to Nov 13</p>	<p>Watch</p> <ul style="list-style-type: none"> • Sapling – Problem Solving Video - Arsenate poisoning and tracking ATP generation through glycolysis (3:29 minutes) <p>Read EBook</p> <ul style="list-style-type: none"> • Signal-transduction pathways (chp 14) - section 14.1 • Glycolysis and Gluconeogenesis sections 16.1 to 16.4 with exclusions. <p>Assignments to complete</p> <ul style="list-style-type: none"> • Sapling – Chapter 14 Reading Quiz (8 questions) • Sapling – Chapter 16 Case Study (16 questions) <p>Due on Nov 13</p> <p>Summary sheets (pdf)</p> <ul style="list-style-type: none"> • Lecture 15 Membrane proteins (chp 12, 13 and chp14) • Lecture 16 Glycolysis and Gluconeogenesis (chp 16) 	

<p>11 Nov 16 to Nov 20</p>	<p>Watch</p> <ul style="list-style-type: none"> D2L - Introduction to TCA and oxidative phosphorylation COMING SOON! <p>Read EBook</p> <ul style="list-style-type: none"> The Citric Acid Cycle (chp 17) - sections 17.1 to 17.4 with exclusions Oxidative Phosphorylation (chp 18) - sections 18.1 to 18.4 and 18.6, with exclusions <p>Assignments to complete</p> <ul style="list-style-type: none"> Sapling – Chapter 17 Homework (18 questions) Sapling – Chapter 18 Case Study: The Narrow Window (16 questions) <p>Due on Nov 20</p> <p>Summary sheets (pdf)</p> <ul style="list-style-type: none"> Lecture 17 TCA cycle (chp 17) Lecture 18 Oxidative phosphorylation (chp 18) 	
<p>12 Nov 23 to Nov 27</p>	<p>Read EBook</p> <ul style="list-style-type: none"> The Calvin Cycle and the Pentose Phosphate Pathway (chp 20) - sections 20.3 to 20.5 (excludes the Calvin cycle) <p>Assignments to complete</p> <ul style="list-style-type: none"> Sapling – Chapter 20 Homework (8 questions) <p>Due on Nov 27</p> <p>Summary sheets (pdf)</p> <ul style="list-style-type: none"> Lecture 19 Pentose phosphate pathway (chp 20) 	<p>EXAM 2</p> <p>Synchronous</p> <p>Thu, Nov 26, 2020 at 10:00am EDT</p>
<p>13 Nov 30 to Dec 4</p>	<p>Read EBook</p> <ul style="list-style-type: none"> The Biosynthesis of Membrane Lipids and Steroids (chp) - sections 26.1 to 26.4 <p>Assignments to complete</p> <ul style="list-style-type: none"> Sapling - Chapter 26 Learning Curve (300 points) Sapling - Chapter 26 Reading Quiz (10 questions) <p>Due on Dec 4</p> <p>Summary sheets (pdf)</p> <ul style="list-style-type: none"> Lecture 20 Synthesis of cholesterol and TAGs (chp 26) Lecture 21 Transport of cholesterol and TAGs (chp 26) 	
<p>14 Dec 7 to Dec 11</p>	<p>STUDY PERIOD</p>	
<p>15 Dec 14 to Dec 18</p>	<p>EXAMINATIONS PERIOD Marks due on Dec 24</p>	