BIOC 303 - MOLECULAR BIOCHEMISTRY
WINTER SESSION TERM 1-2 (6 CREDITS)
SEPTEMBER 2021 – APRIL 2022

Course Coordinators:
Dr. Franck Duong (Term 1) Email: fduong@mail.ubc.ca
Dr. Thibault Mayor (Term 2) Email: mayor@msl.ubc.ca

Course Outline: The structure, function and metabolism of lipids, steroids, amino acids, nucleotides and membrane; the biochemistry and molecular biology of transport, channel, receptors, replication, transcription, translation and gene regulation. This is a six (6) credits course for students in Biochemistry and Honors programs in other life sciences. Credit will be granted for only one of BIOC 302 or BIOC 303.

Course delivery: Term 1 will use traditional lecture-based delivery of course content and assessments will be made by written examinations. Term 2: This section of the course will use team-based learning (TBL) and flip-the-classroom approaches; see grading scheme for more details.

Prerequisite: BIOC 203 or BIOL 201 and either
(a) CHEM 204, CHEM 213 or
(b) all of CHEM 205, CHEM 233.

Lectures: M/W/F, 13:00-14:00 (PST)
Location → Woodward 6 (Instructional Resources Centre-IRC 6)
Covid-19 → please read specifics below

COVID-19 For our in-person meetings in this class, it is important that all of us feel as comfortable as possible engaging in class activities while sharing an indoor space. We recognize that UBC policies will continue to evolve and be updated during the academic year.

Mask: Masks are required for all indoor classes, as per the BC Public Health Officer orders. You will need to wear a medical or non-medical mask for the duration of our class meetings, for your own protection, and the safety and comfort of everyone else in the class. You may be asked to remove your mask briefly for an ID check for an exam, but otherwise, your mask should cover your nose and mouth. Please do not eat in class. If you need to drink water/coffee/tea/etc, please keep your mask on between sips. Please note that there are some people who cannot wear a mask. These individuals are equally welcome in our class. Please inform the course chair if this the case to avoid any delays during class.

Vaccination: If you have not already done so, please arrange to get vaccinated. UBC will require COVID-19 testing for all students, faculty and staff, with exemptions provided for those who are vaccinated against COVID-19. Please follow the upcoming instructions while UBC is implementing its COVID-19 vaccine declaration and rapid testing policy.
If you’re sick, it’s important that you stay home – no matter what you think you may be sick with (e.g., cold, flu, other). Do not come to class if you think you might have Covid symptoms and/or have tested positive for Covid and/or are required to quarantine. You can do a self-assessment for Covid symptoms here: https://bc.thrive.health/covid19/en

If one of the instructors falls ill, develops COVID symptoms, or tests positive for COVID, then the in-person lectures will be cancelled. If that happens, we will make an announcement via Canvas prior to class time. Lectures will then be delivered over zoom for the whole class, re-scheduled or, as a last resort, fully cancelled. Students with specific concerns should directly contact the course chair.

**Term 1 Lecture Dates:**
**Section I (Dr. Krisinger):**  
Sept 8, 10, 13, 15, 17, 20, 22, 24, 27, 29,  
Oct 1, 4, 6, 8, 13, 15, 19, 20

**Section II (Dr. Duong):**  
Oct 22, 25, 27, 29,  
Nov 1, 3, 5, 8, 15, 17, 19, 22, 24, 26, 29  
Dec 1, 3, 6

**Term 2 Lecture Dates:**
**Section III (Dr. Tokuriki):**  
Jan 10, 12, 14, 17, 19, 21, 24, 26, 28, 31, Feb 2, 4

**Section IV (Drs. Howe# and Mayor*):** Feb 7#, 9#, 11#, 14#, 16#, 18#, 28*,  
April 1*, 4*, 6*, 8*
No Class Dates:
- Thanksgiving: Mon Oct 11, 2021
- Mid-Term break: Wed Nov 10 - Fri Nov 12, 2021
- Reading-Week Break: Mon Feb 21 - Fri 25, 2022
- Good Friday: Fri Apr 15, 2022

Textbook (recommended):
Website: https://www.macmillanlearning.com/catalog/Product/lehningerprinciplesofbiochemistry-seventhedition-nelson

Canvas:
Please login to the course web page: https://canvas.ubc.ca. Here you will find suggested readings, lecture slides & notes, problem sets, grades, and a link to the PIAZZA discussion board, as well as other important announcements as the term progresses.

Faculty:
- Dr. Michael J. Krisinger (Instructor, Section I)
  Tel: 827-1700; Email: mike.krisinger@ubc.ca
  Questions/Concerns: personal related: please email course related: please use PIAZZA

- Dr. Franck Duong (Professor, Section II) - Term 1 course coordinator
  Tel: 822-5975; Email: fduong@mail.ubc.ca
  Office (online) Hours: TBA

- Dr. Nobuhiko Tokuriki (Associate Professor, Section III)
  Michael Smith Laboratories Office 327
  Tel: 822-8156; Email: tokuriki@msl.ubc.ca
  Office (online) Hours: TBA

- Dr. Thibault Mayor (Professor, Section IV) - Term 2 course coordinator
  Networks of Centres of Excellence, Office 306
  Tel: 822-5144; Email: mayor@msl.ubc.ca
  Office (online) Hours: TBA

- Dr. LeAnn Howe (Professor, Section IV)
  Life Sciences Centre, Office 5509
  Tel: 822-6297; Email: ljhowe@mail.ubc.ca.
  Office (online) Hours: TBA

Teaching Assistants:
To be announced by instructors on Canvas
Assessments:

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<tr>
<th>Type</th>
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<tr>
<td>October Midterm Exam (Section I)</td>
<td>Wed, Oct 20, 2021 (6s-8pm)</td>
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<td>December term-end Exam (Section II)</td>
<td>TBA: Dec 11 – 22, 2021</td>
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<td>TBL - individual assessment (iASS)</td>
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<td>TBL - team assessment (tASS)</td>
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<td>TBL - peer assessment (pASS)</td>
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<td>April term-end Exam (Sections III &amp; IV)</td>
<td>TBA: Apr 12– 27, 2022</td>
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Term 2 of BIOC303 will use team-based learning (TBL) and flip-the-classroom approaches. Term 2 will be divided in 12 blocks. For each block there will be two introductory lectures (Monday & Wednesday) followed by one team assessment lecture (Friday). A short video lecture (12-20 minute) will be provided for each introductory lecture. The content of the video lecture will be discussed during the regular lecture time, notably via team problems. Before each introductory lecture, there will be an iASS that will consist of an individual online quiz. Each block will be completed with a graded tASS to be completed with the assigned team during the Friday lecture. The students will be assigned to two different teams throughout Term 2 (i.e the team composition will change in the middle of term). Students will also evaluate their teammates at the end of each team cycle (pASS). There will not be any midterm in term 2. The Final exam will be an open book exam to be completed online using a laptop personal computer and in person. More detailed information will be provided before term 2.

Overview of Course Content (subject to change):

Section I: Lipid Metabolism (September 7 to October 20, 2021)

- Structures of lipids: phospholipids, sterols, fat-soluble vitamins and eicosanoids
- Fatty Acid Synthesis
- Synthesis of triacylglycerol and glycerophospholipids
- Fatty Acid catabolism (β-oxidation pathway)
- Regulation of fatty acid metabolism
- Cholesterol metabolism
- Cholesterol derivatives
- Integration of Metabolism
- Ketone bodies
- Regulation of lipid metabolism
- Transport of cholesterol and other lipids
- Cardiovascular disease

Section II: Lipids and Membranes (October 22 to December 6, 2021)

- Types and functions of biological membranes
- Isolation, composition, and biophysical properties of membranes
- Membrane lipid bilayers – bacteria, red blood cells, nucleated cells
- Model membranes – liposomes, detergents, nanodiscs
- Membrane proteins – structures and classes
- Membrane proteins - properties and examples
- Peripheral proteins, lipid anchored proteins
- Solute transport across membranes

BIOC 303 Molecular Biochemistry

Course outline 2021-2022
• Macromolecule transport across membranes
• Membrane protein biogenesis
• Protein targeting
• Vesicular transport
• Transporters
• Channels
• Signal transduction
• Receptors
• G-protein coupled receptors

Section III: Amino Acid Metabolism (January 10 to Feb 4, 2022)
• Protein degradation by proteases, amino group transfer
• Mechanism and significance of aminotransferase reactions
• Protease specificity & Metabolic pathways (tASS-1; Jan 14)
• Nitrogen excretion and the urea cycle
• Overview of amino acid catabolism, amino acids catabolism to pyruvate
• Genetic disorder & Metabolic pathways (tASS-2; Jan 21)
• Amino acid degradation
• Biosynthesis of amino acids
• Evolution and expansion of metabolic pathways (tASS-3; Jan 28)
• Nitrogen Cycle
• Metabolic Pathways & Techniques
• Evolution of new metabolic pathways & Metabolic engineering (tASS-4; Feb 4)

Section IV: From DNA to proteins (February 7 to April 8, 2022)
• Nucleic Acid and DNA structure
• DNA editing – Restriction Enzymes
• DNA-binding Specificity (tASS-5, Feb 11)
• DNA Supercoiling and Topoisomerases
• Chromatin Structure
• Regulation of Supercoiling (tASS-6, Feb 18)
• DNA Polymerase: Accuracy & Processivity
• DNA Replication: Initiation & Replisome
• Basic Principles in DNA Replication (tASS-7, March 4)
• Eukaryotic DNA Replication: Cell Cycle & Telomerase
• DNA Mismatch Repair (MMR) and Translesion (TLS)
• Replication Fidelity (tASS-8, March 11)
• DNA Repair (BER and NER)
• DNA Recombination
• DNA Repair & Cancer (tASS-9, March 18)
• RNA Synthesis
• RNA Processing
• Expressing a eukaryotic gene in a prokaryotic system (tASS-10; March 25)
• Genetic Code and tRNA
• Ribosome & Protein Translation
• Ribosome Profiling & Translation Rate (tASS-11, April 1)
• Protein Folding
• Protein Degradation
• Protein Homeostasis (tASS-12, April 8)
IMPORTANT NOTICE REGARDING EXAMINATIONS:

All prescribed examinations – October, December, and April Exams – are mandatory. Students who miss a midterm or term-end examination will have a zero recorded as their mark for that exam. The situations in which a score of zero may be avoided are those for which the student meets all of the following conditions:

1. Circumstances clearly and absolutely beyond the control of the student caused the examination to be missed. Such circumstances include serious illness or injury, or death of a close family member. They do NOT include forgetting about the test, lack of preparation for the test, work-related or social obligations.

2. The student has notified the appropriate faculty about the missed examination. Such notification MUST occur in advance, if possible, or at the latest, on the day of the examination.

3. Proof of the circumstance is provided.

Students that miss the midterm examination because of medical problems and want to be granted a deferred midterm exam will have to provide a certificate of illness within 5 days of the exam. The treating doctor (at Student Health Service or any private clinic) is the only one who can document your illness. Any documentation has to be faxed directly from the attending doctor to the faculty member (Attn Dr. Krisinger) at 604-822-5227. Deferred examinations will be performed on a date set by the faculty member.

If these conditions are met, the student will be permitted to take a deferred examination that will be performed on a date and format (oral or perhaps written) set by the faculty member.

Students that miss the term-end examination need to report to the Dean’s office in their area of study. For Science students information can be found at: http://www.calendar.ubc.ca/vancouver/index.cfm?tree=12,215,410,1462.

Team Base Learning Evaluations: All iASS and tASS should be completed. If one tASS cannot be completed due to special circumstances (e.g. sickness, family emergency or UBC-related sport events) the student should contact Dr. Mayor by email (mayor@mail.ubc.ca) before the beginning of the lecture with a brief description of the reason of the absence, and notify all teammates. In this case, the TBL grade will be averaged using other TBL grades. In absence of a valid notification before class, 0 point will be attributed to the assessment. Late arrival to tASS will not be tolerated unless notified in advance. If an extended absence is required, a doctor note is required. In the case a student misses many assessments, an oral examination or additional assessments may be used for evaluation. While the usage of electronic device is permitted in tASS, no communication with other teams or outside people is authorized during a tASS. Cheating and plagiarism in a tASS will directly lead to a 0 for all tASS for the whole team(s) (excluding whistleblowers), and may result to a 0 to all TBL grades and final term 2 exam depending on the gravity.