LAND ACKNOWLEDGEMENT

UBC's Point Grey Campus is located on the traditional, ancestral, and unceded territory of the xwməθkwəy̓əm (Musqueam) people. The land it is situated on has always been a place of learning for the Musqueam people, who for millennia have passed on their culture, history, and traditions from one generation to the next on this site.

COURSE INFORMATION

Course Title	**Course Code Number**	**Credit Value**
Molecular Biochemistry	BIOC 303	6

PREREQUISITES

One of BIOC 203, BIOC 202, BIOL 201 and either (a) CHEM 213 or (b) CHEM 233.

COREQUISITES

None. Note that Credits will be granted for only one of BIOC 302 or BIOC 303.

COURSE LOCATION AND TIME

Time (Day(s), Hour)	**Room**
Term 1: Monday, Wednesday, Friday at 1pm to 1:50pm	IRC6
Term 2: Monday, Wednesday, Friday at 1pm to 1:50pm	Hennings 200

COURSE CHAIR

Course Chair	**Contact Details**
Term 1: Dr. Franck Duong (he/him/his)	fduong@mail.ubc.ca
Term 2: Dr. Thibault Mayor (he/him/his)	mayor@mail.ubc.ca

COURSE INSTRUCTOR(S)

Course Instructor(s)	Contact Details	Office Location	Office Hours
Dr. Eden Fussner-Dupas (she/her/hers)	eden.fussner@ubc.ca	BIOL3119	Wed 9-10pm and Fri 10-11am
Dr. Franck Duong (he/him/his)	fduong@mail.ubc.ca	LSC5440	Tue/Fri 3-4pm
Dr. Nobuhiko Tokuriki (he/him/his)	tokuriki@msl.ubc.ca	MSL327	Tue/Fri 1-3pm
Dr. LeAnn Howe (she/her/hers)	ljhowe@mail.ubc.ca	LSC5509	Mon/Wed 3-4pm
Dr. Thibault Mayor (he/him/his)	mayor@mail.ubc.ca	NCE306	Tue 12-1pm & Wed 3-4pm

LEARNING OUTCOMES

The overall goal of this course is to provide to biochemistry students a broad and solid base understanding of the structure, function and metabolism of lipids, amino acids, proteins and DNA; the biochemistry and molecular biology of membrane transport, channels and cell receptors, DNA replication, transcription, translation and protein homeostasis. Term 1 uses a traditional lecture-based teaching format with an emphasis on knowledge acquisition and the ability to solve problems directly and indirectly related to the course content. Students are encouraged to use the PIAZZA discussion platform moderated by faculty in order to enhance writing and discussion skills. A major focus of term 2 is to enhance students' analytical and communication skills. The students will be required, using a team-base-learning (TBL) approach, to answer questions and complete assignment related to the taught topics throughout term 2.

COURSE OUTLINE

TERM1

Term 1 will use traditional in-person lecture-based delivery of course content and assessments will be made by written examinations (mid-term in mid-October and final in December). In the Duong's section, some knowledge/deduction bonus questions will be provided throughout the course via Canvas, and additional support to questions will be provided via weekly TA-lead 50 minutes Zoom-meeting, currently scheduled on Monday's at 4-5pm.

TERM2

Term 2 will use both flip-the-class room approach and team-based learning (TBL). It is divided into 12 blocks and for each block there will be three classes. The Monday and Wednesday classes will have two components: pre-recorded lectures (~15-20 min) that students are expected to watch before coming to

class, and in-class exercises to be completed with help of the students' team. The two introductory lectures will be followed by one team assessment lecture (Friday). The students will have 50 minutes to complete a graded team assessments (tASS). Before each tASS, the students will also have to complete an online individual assessment (iASS) to ensure they are prepared. The iASS will cover both contents in the video lectures and class discussions. The students will be assigned to two different teams as the team composition will change in the middle of the Term 2. Students with accommodation should contact the course chair (mayor@mail.ubc.ca) to decide how to best assist each student during iASS and tASS.

COURSE SCHEDULE 2023-2024

TERM 1

PART 1 (6 weeks - Sept 06 to Oct 18) Dr. Eden Fussner-Dupas

I. Lipid structures *(~2 lectures*)

Types of Lipids: Fatty acids, Triacylglycerols, Glycerophospholipids, Sphingolipids, Sterols, Others

II. Fatty Acid Metabolism (*~5 lectures*)

A. fatty acid synthesis cycle, stoichiometry, sources and transport of acetyl CoA and NADPH
B. Elongation and Desaturation
C. Activation, transport, β-oxidation cycle, stoichiometry and ATP yield of fatty acids

III. Synthesis of triacylglycerols and glycerophospholipids (*~2 lecture*)

IV. Cholesterol Metabolism (*~2 lecture*)

A. Structure, function, de novo synthesis & regulation
B. Cholesterol derivatives

V. Integration of Metabolism (*~7 lectures*)

A. Hormonal and local regulation of fatty acid & fat metabolism
B. Thermogenesis in brown fat, Ketone Bodies & Fat metabolic map
C. Lipoprotein particle structures & functions
D. Cholesterol and cardiovascular disease (CVD)

PART 2 – (6 weeks Oct 20-Dec 05) Dr. Franck Duong

I. Structure of the Cell membrane *(~3 lectures*)

A. Structure and types of membrane phospholipids
B. General structure and type of membrane proteins
C. Interaction between membrane lipids and membrane proteins

II. Biogenesis of the ER membrane *(~4 lectures*)

A. The ER membrane biosynthesis machinery
B. Mechanism of transport of proteins across and into the cell membrane
C. Mechanism and experimental determination of membrane protein topology
D. Protein modification and maturation during ER transport
E. Transport to organelles

III. Biogenesis of the Plasma membrane *(~3 lectures*)

A. Vesicular transport from ER to plasma membrane
B. Vesicular transport from plasma membrane to ER

III. Function of Membrane Proteins and Operation Mechanisms *(~7 lectures*)

A. Transporters (Passive and Active)
B. Channels (Selectivity and Gating)
C. Receptors (GPCRs and Signal Transduction)

IV. Experimental Procedures *(~1 lecture*)

Principle of Protein Purification: soluble versus insoluble.

Important dates: https://vancouver.calendar.ubc.ca/dates-and-deadlines
National Day for Truth and Reconciliation: **Saturday September 30**
Observation Day for Truth and Reconciliation: **Monday October 2**(*)
Thanksgiving Day: **Monday, October 9**
(*)Make-up Thanksgiving Day: **Thursday, October 12**
Midterm Break: **November 13 – 15** (Inclusive of Remembrance Day **Saturday November 11)**
Midterm Oct Exam: **Oct 26** (6 - 8 pm, Location TBD)
Final Exam Period: **December 11-22, 2022**

(*)Thursday October 12, 2023 has been designated as a "Make-up Monday" for the Term 1 academic schedule. Classes normally scheduled for Thursday, October 12 are cancelled, and will be replaced by classes normally scheduled on a Monday. This includes our course.

TERM 2

Part I - Amino Acid Metabolism
Block 1: Protein to amino acids - Dr Tokuriki (Jan 8 - 12)
Lecture 1 (Monday): Protein degradation by proteases through the digestive tract (Chapter 18.1)
Lecture 2 (Wednesday): Mechanism and significance of aminotransferase reactions (18.1)
Lecture 3 (Friday - Team Assessment (tASS): Proteases

Block 2: Urea cycle and other key reactions - Dr Tokuriki (Jan 15 - 19)
Lecture 4 (M): Nitrogen excretion and the urea cycle (Chapter 18.2)

Lecture 5 (W): Overview of amino acid catabolism and carbon transfer reactions (Chapter 18.3)
Lecture 6 (F - tASS): Genetic disorder (presentation)

Block 3: Degradation and synthesis of amino acids - Dr Tokuriki (Jan 22 - 28)
Lecture 7 (M): Examples of amino acid degradation pathways (Chapter 18.3)
Lecture 8 (W): Biosynthesis of amino acids (Chapter 22.2)
Lecture 9 (F - tASS): Biosynthesis of BCAA amino acids

Block 4: Nitrogen cycle and evolution of new metabolic pathways - Dr. Tokuriki (Jan 29 - Feb 2)
Lecture 10 (M): Nitrogen cycle (Chapter 22.1)
Lecture 11 (W): Techniques for studying metabolic pathways
Lecture 12 (F - tASS): Evolution of new metabolic pathways (presentation)

Part II - From DNA to Protein
Block 5 - DNA Structure - Dr Howe (Feb 5 - 9)
Lecture 13 (M): Nucleotides and DNA Structure (Chapter 8)
Lecture 14 (W): DNA binding proteins (Chapters 9.1 and 28.1)
Lecture 15 (F - tASS): Sequence recognition by DNA binding proteins

Block 6 – Genome organization - Dr Howe (Feb 12 - 16)
Lecture 16 (M): DNA Supercoiling and Topoisomerases (Chapters 24.1 and 24.2)
Lecture 17 (W): Chromatin (Chapter 24.3)
Lecture 18 (F - tASS): Regulation of Supercoiling

Reading Week: Feb 19-23 - Change of Teams

Block 7 - Transcription - Dr. Howe (Feb 26 - March 1)
Lecture 19 (M): RNA Synthesis (Chapters 26.1, 28.1, and 28.2)
Lecture 20 (W): RNA Processing (Chapter 26.2)
Lecture 21 (F - tASS): Expression of a eukaryotic gene in a prokaryotic system

Block 8 - DNA Replication - Dr Mayor (March 4 - March 8)
Lecture 22 (M): DNA Polymerase (Chapter 25.1)
Lecture 23 (W): DNA Replication (Chapter 25.1)
Lecture 24 (F - tASS): Basic Principle in DNA replication: the Melsesson and Stahl experiment

Block 9 - DNA Repair - Dr Mayor (March 11 - 15)
Lecture 25 (M): DNA Mismatch Repair (MMR), Cancer & DNA Damage (Chapter 25.2, 8.3)
Lecture 26 (W): Base Excision Repair (BER) & Nucleotide Excision Repair (NER) (Chapter 25.2)
Lecture 27 (F - tASS): DNA Repair & Cancer

Block 10 - DNA Recombination - Dr. Mayor (March 18 - 22)
Lecture 28 (M): Transposase & Recombinase (Chapter 25.3)
Lecture 29 (W): Homologous Recombination (Chapter 25.3)
Lecture 30 (F - tASS):

Block 11 - Protein Translation - Dr. Mayor (March 25 - April 3)

Lecture 31 (M): Genetic Code and AA-activation (March 29) (Chapter 27.1)
Lecture 32 (W): Ribosome & translation (April 1) (Chapter 27.2)
Lecture 33 (W - tASS): Translation stalling and TRP catabolism

Block 12 - Protein Homeostasis - Dr. Mayor (April 3 - 10)
Lecture 34 (F): Protein Folding (Chapter 4.4)
Lecture 35 (M): Protein degradation & the Ubiquitin Proteasome System (Chapter 27.3)
Lecture 36 (W - tASS): Protein Homeostasis

Mid-Term Break: **February 19 – 23, 2024** (Inclusive of Family Day statutory holiday)
Final Exam Period**: April 16 – 27, 2024**
Easter Holiday: **March 29 – April 1, 2024**

COURSE MATERIALS

Lehninger: *Principles of Biochemistry* (8th or 7th edition), Macmillan Publishers, 2021 or 2017. Also available as loose-leaf package with on the editor web portal.

GRADING SCHEME

Assignment	Grade Weight
Term 1 Midterm in Fall	25 %
Term 1 Final in December	25 %
Term 2 Individual Assessments (iASS)	10%
Term 2 Team Assessments (tASS)	5%
Term 2 Peer Assessments	5%
Term 2 Final in April	30%

GRADING AND COURSE POLICY

Please login to the course web page in Canvas to get access to lectures slides, additional information, problem sets, access to iASS and tASS, grades, as well as other important announcements as the term progresses. For discussion, use the PIAZZA discussion board. For the on-line tutorial, please use the ZOOM application platform.

In term 2 and for each block there will be one **iASS** that is an individual online quizz to be completed

before the Friday lecture and a graded **tASS** to be completed during the Friday lecture. For tASS, usage of electronic devices is permitted. However, no communication with other teams or outside people is authorized before and during tASS (see academic misconduct section below). Students will also evaluate their teammates at the end of each team cycle (peer evaluation). There won't be any traditional mid-term during Term 2 as students will be evaluated on a weekly basis. The final exam in April will cover all term 2 material and will be completed **in person** and **online**. Therefore, students will have to bring their personal laptop computer. Students who cannot do so will have to contact the term 2 course chair to discuss alternatives. Students will be allowed to bring a cheat sheet and more information will be provided during the term 2.

Students with disabilities and ongoing medical conditions have the option to request an accommodation for the course assessments after registering with the Centre for Accessibility. If you are eligible for exam accommodations, you will need to write your exams with the Centre for Accessibility. To book an exam, notify the course chair or instructor by email and register with the Centre for Accessibility at least one week in advance of the midterm date or summer final, or at least 7 days before the start of the examination period for a final in April and December. Students with accommodation should contact the term 2 course chair (mayor@mail.ubc.ca) in December or early January to decide how to best assist each student during iASS and tASS in term 2.

If you are ill, please do not attend class. If you do miss class assessment or a midterm because of illness:

For term 1, contact the course instructor directly via email. For term 2, 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 the term 2 course chair by email (mayor@mail.ubc.ca) before the beginning of the lecture with a brief description of the reason for 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 (>5min) to tASS will not be tolerated unless the course chair and the instructor is notified in advance. In case of an extended absence where more than iASS or tASS are missed, then a doctor's note is required.

If you do miss a final exam because of illness: Students who miss a final exam due to illness or extreme personal distress and would like to apply for a deferred exam must submit a request for an academic concession within 48 hours of the missed exam. All appropriate documentation must be submitted within 14 calendar days of the missed exam. In addition, the course chair and instructor should also be notified by email within 48 hours to coordinate the deferred exam. The instructors will decide what will be the format of the deferred exam that could be an oral.

If the instructor is sick: We will all do our best to stay well, but if one of the instructors falls ill then they will not come to class. If that happens, all efforts will be made to communicate that to students in a timely manner prior to class time, usually via an announcement in Canvas. Depending on the situation a substitute lecturer will take over, the lecture may take place over zoom, or the class may be cancelled.

ACADEMIC MISCONDUCT

UBC and the Department of Biochemistry and Molecular Biology take the issue of academic misconduct very seriously; the honest assessment of student learning is key to both the success of the university and success for individual students. Cheating, in any form, undermines the value of a degree and can have serious consequences for your continued academic success. As such it is important to know what your

responsibilities are, what constitutes misconduct and how you can avoid it. With some effort and forethought no student should ever have to find themselves facing discipline for academic misconduct; inform yourself as to the expectations placed on you and what your responsibilities are. UBC definition of academic misconduct can be found in the UBC Calendar and additional information is available in this UBC resource link.

What consequences can arise from academic misconduct?

The severity of the discipline can range from a letter of reprimand or a zero on the assignment in question all the way to expulsion from the University. Perhaps the most common outcome in these cases are grades of zero in the course in which the misconduct occurred. Cheating and plagiarism in a tASS will directly lead to a zero for ALL tASS for the whole team(s) (with exception for whistleblowers), and may result to a zero on term 2 of BIOC303.

EQUITY DIVERSITY AND INCLUSION (EDI) POLICIES

It is our goal that students from all diverse backgrounds and perspectives be well-served by this course, that students' learning needs be addressed both in and out of class, and diversity that the students bring to this class be viewed as a resource, strength and benefit. We make a commitment to present materials and activities that are respectful of diversity: gender identity, sexuality, disability, age, socioeconomic status, ethnicity, race, nationality, religion, and culture. We will foster a climate within the classroom where students of diverse backgrounds and identities feel comfortable sharing their opinions and experience with varied topics throughout the class. We (like many people) are learning about diverse perspectives and identities. If something was said in class (by anyone) that made you feel uncomfortable or if you observe a situation where someone else is made to feel uncomfortable, please talk to us about it. This includes concerns about any class-related interactions that lead to feelings of exclusion or marginalization. We welcome and encourage your feedback on how we can better cultivate a sense of inclusion in our course. This can be done through meetings, email or anonymous feedback through canvas. We aim to do our best to address each situation as it arises and effect meaningful changes moving forward. For more information visit our departmental EDI webpage.

STUDENT RESOURCES

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence. UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom. UBC provides appropriate accommodation for students with disabilities and for religious observances. UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions. Details of the policies and how to access support are available on the UBC Senate website.

Mental Health Resources

In case you are struggling with mental health, or are feeling stressed or anxious, UBC Counselling services provides information about a number of resources for students to use. Additionally, UBC students receive

mental health coverage of up to $1500 under the AMS Health & Dental Plan (more information about coverage here).

Here2Talk is available for BC post-secondary students to talk with trained counsellors 24/7 (via voice call or text messages). If you are a student living in UBC residence, Counsellors in Residence can also be a valuable resource to provide mental health support. If you have a UBC email address, Therapy Assistance Online (TAO) is a free online resource that provides tools to manage stress, relationship problems, substance use, etc.

COVID RELATED POLICIES

For UBC's latest response to COVID-19, please visit covid19.ubc.ca. 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. Non-medical masks that cover our noses and mouths are a primary tool to make it harder for COVID-19 to find a new host. The higher the rate of vaccination is in our community overall, the lower the chance of spreading this virus. You are an important part of the UBC community. Please arrange to get vaccinated if you have not already done so. **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).**

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