Biochemistry
UNIVERSITY OF TORONTO

BCH210H - Biochemistry I: Proteins, Lipids and Metabolism - Fall 2018

Coordinator and Lecturer: **S. Andreopoulos**
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Lecturers: **R. Reithmeier**
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Lectures: Con Hall, Tues/Thurs/Fri 10 – 11 am

Tutorials: **Thursday:** Wallberg Building Room 116, 11am – 1 pm
Friday: Con Hall, 11am – 1 pm

Academic Integrity: Academic integrity is fundamental to your learning and achieving the course goals. The evaluations in this course are designed to give you an opportunity to learn important skills and concepts by making honest attempts through your own thinking, writing and hard work. Academic integrity is taken very seriously and there are significant consequences if you are caught cheating or engaging in academic misconduct. All academic work in this course must adhere to the ***Code of Behaviour on Academic Matters.*** You are expected to be familiar with the contents of this document and the ***potential offences*** associated with the taking of the quizzes, term tests and final exam along with the submission of the bonus assignment in this course. If you are not aware of these rules or need a reminder, check this ***resource*** to help you avoid accidental offences. It is your responsibility to earn your degree with integrity at the University of Toronto.

Course Description: This 12-week course covers the basics of biochemistry with a focus on the forces influencing protein structure and function, methods of protein analysis and enzyme kinetics, the structure of phospholipids and biological membranes, carbohydrate structure and their importance in metabolism, as well as the various metabolic pathways responsible for the generation of energy.

Prerequisites: The prerequisites for the course are CHM135H + CHM136H (previously CHM138H +CHM139H) or CHM151Y (or equivalent credits). If these credits do not appear on your ROSI record please contact Dr. Andreopoulos NO LATER than September 19th, 2018 to ensure your registration is maintained.

Course Conflicts with Exam Dates: If you have a **UofT course conflict** with ONE or BOTH term test dates, you will need to inform Dr. Andreopoulos of this NO LATER than September 19th, 2018, 5pm. There are **NO exceptions** to the deadline. All emails must be received from a U of T account and include your full name, student number, timetable and your course conflict.

Student Assessment: There will be **two term tests, twelve self-assessment quizzes, an assignment and a final examination**. The first term test, worth 31% of the course mark, will cover all of Dr. Reithmeier's material (Lectures 1-12) and be held on Thursday October 4th, 2018, 6-8pm. The second term test, worth 26%

of the course mark, covers all of Dr. Melnyk's material (Lectures 13-17) and Dr. Andreopoulos' material (Lectures 18-22), and will be held on Thursday November 1st, 2018, 6-8pm. The **final examination,** worth 35% of the course mark, will cover Dr. Patterson's material (Lectures 23-36). Students must check that their student numbers are correct and that their grades are accurate when grades are released. Any discrepancies or problems with exam results must be resolved BEFORE classes end. Any questions related to a specific lecture topic should be directed to the Professor who gave the lecture.

Please note that the date for the December exam is arranged by the Faculty of Arts and Science. You cannot miss an exam because you have purchased airline tickets, are on holiday etc. This is an intense 12-week course, and your enrolment indicates a commitment to the lectures and evaluation process.

Self-Assessment Quizzes **-** There will be twelve self-assessment online quizzes (0.5% each) worth a total of 6%, administered on the BCH210H Quercus Site. The self-assessment quizzes will take place on Sundays, starting at 12 pm (noon) and running until Mondays, at 12 pm (noon). The dates of the self-assessment quizzes and their content are listed in the table below and in the course schedule found on pages 7-8 of the syllabus:

Self-Assessment Quiz No.	Date (24 hrs) (Sun 12pm to Mon 12pm)	Lecture Content
1	Sept 9-10	1 and 2
2	Sept 16-17	3 to 5
3	Sept 23-24	6 to 8
4	Sept 30-Oct 01	9 to 11
5	Oct 07-08	13 and 14
6	Oct 14-15	15 to 17
7	Oct 21-22	18 to 20
8	Oct 28-29	21 and 22
9	Nov 11-12	23 to 26
10	Nov 18-19	27 to 29
11	Nov 25-26	30 to 32
12	Dec 02-03	33 to 35

All self-assessment quizzes will be 15 min long and will include 10 questions. Once you start the quizzes online, the system will automatically log you off and submit whatever answers have been entered 15 minutes after the initial start time. Each student will be expected to take the quizzes independently without aids (ie. without notes, textbooks, other resources etc.). The web-based quizzes will only be available for 24 hours and students are responsible for arranging their schedule to write the self-assessment quizzes online. **If you do not write a quiz, you will receive a grade of 0. NO EXCEPTIONS will be made and there will be no make up quizzes or re-allocation of the marks.** The Discussion Board on Quercus will also not be accessible during the time when the quizzes are in progress. Once you have written the quizzes, you should not discuss the questions with anyone in order to maintain Academic Integrity. Any knowledge of quiz question discussion will be investigated and may jeopardize your performance in the course. Marks will be released the next day once the results of the quizzes have been compiled and analyzed.

Assignment **-** The assignment is worth 2% of your final grade in the course. You will be able to submit your assignment through Quercus as a **pdf file starting November 26th (12 am) until December 4th (11:59 pm)**. Based on the first letter of your last name, you have been assigned an enzyme classification group (A-H – Enzyme classification groups 1 and 2; I-Q – Enzyme classification groups 3 and 4; R-Z – Enzyme classification groups 5 and 6). Using the following search engine http://www.brenda-enzymes.org/ecexplorer.php?browser=1 and the information presented to you in this course relating to protein structure and function, choose an **ENZYME not discussed in class from your classification group** that has an associated disease arising due to a genetically inherited mutation. Create a **SINGLE**

informative slide that comprehensively engages the reader and communicates the following about your enzyme:

i) Identifies the single amino acid change that leads to the inherited disease.
ii) Describes and depicts the specific effect the single amino acid change has on **BOTH** the protein's structure and function. Be sure to focus on the biochemistry associated with the change, either visually or in a succinct description.

Convert your presentation slide to a **pdf** and upload it to Quercus. You will have only one opportunity to upload the assignment. Once submitted, you cannot make edits to it. 1% of the final mark will be allotted to the visual component of your slide, while the other 1% will count toward the slide's content. Emailed assignments **WILL NOT BE** accepted/graded.

NOTE: In addition to those discussed in class, you are not allowed to use the following enzymes: alpha-N-acetylhexosaminidase, beta-hexosaminidase A, branched chain alpha-ketoacid dehydrogenase, NatA acetyltransferase, Phenylalanine Hydroxylase (PAH), Superoxidase dismutase I (SOD1).

Missed Term Tests - Students who miss the term test MUST ADHERE to the following procedure:

a) Email (using Utoronto email) the Course Coordinator (Dr. Andreopoulos, MSB 5219) **on the** DAY **of the term test. NO EXCEPTIONS will be considered. Only e-mails from the UofT domain will be answered. Do NOT use yahoo/gmail/etc.** These sources will be rejected as spam.
b) **Include** in your email a written explanation detailing the reason for missing the exam and provide your student number, course timetable and a list of all other course term work due the week of the term test.
c) Deliver the **ORIGINAL** University of Toronto student medical certificate dated for the **DAY** of the test to Dr. Andreopoulos (or the BCH Office MSB 5207) **PRIOR** to the date of the make-up.
d) **INCOMPLETE** emails will not receive a response.

NOTICE: Upon submission of the above [1-3], students will be informed of the date/time/location of the makeup exam (to be held several days after the date of the term test). If you have written the makeup exam and there are any questionable issues with the documentation supplied, a meeting will be arranged with Dr. Andreopoulos to discuss this. The makeup exam will either be all multiple choice, all short answer or a combination of multiple choice and short answer.

If the term test is NOT WRITTEN, a mark of zero will be assigned. **There will be NO reweighting/ reallocation of marks in this course.** Any student unable to write the final exam must contact their college registrar.

Method of Delivery: The course content will be covered in three 1-hour formal lectures each week (see exact schedule for dates and topics), with course notes provided in advance on Quercus **solely for personal, noncommercial use**. **"All material in BCH210 Quercus/Canvas is, unless otherwise stated, the property of the Department of Biochemistry at the University of Toronto. Copyright and other intellectual property laws protect this material. Reproduction or retransmission of the materials, in whole or in part, in any manner, without the prior written consent is a violation of copyright law."**

Help session tutorials are provided to assist with your understanding of the course material. Your instructors and TAs are available to help, but please be courteous when contacting us via email and don't forget to use the discussion board for general questions. Remember, complex issues may be too time-consuming to answer by e-mail; in this case it may be better to resolve these issues by meeting with the professor after lecture or during

office hours. In addition to lectures and tutorial handouts, additional problem sets will be available online to help further your understanding of the material.

Class Participation: Activities, multiple-choice questions and problem-solving questions will be provided in both lectures and tutorials, in order to measure your comprehension of ideas. If you have an i>clicker, you are encouraged to bring it to class to participate in these questions, however, they will not be used for attendance and no participation marks will be given. Alternatively, the free app Socrative is available for your handheld devices and laptops. Your instructors will provide more details on how you can be a part of this class, be more engaged in the material and enjoy learning why biochemistry is crucial for life.

Technology in the classroom: Do feel free to bring your laptops, iPads and handheld devices to class in order to take notes and participate, but please only use them in a manner that will not disrupt your fellow peers around you. Please do not use your computer for anything other than activities related to this biochemistry course when it is underway. Also be sure to turn off your cell phones or put them on silent before class begins, and do not text-message during the lecture. You have registered in this course and have made a commitment to be engaged and learn the material, so please do try to be focused during lectures and problem-solving review sessions. Studies have shown that distractions result in lower grades, so do focus on the material when you are present in class.

Communication throughout the course: You are responsible for accessing all course materials through the Quercus/Canvas site. Here you will find the lecture notes and discussion board which are set up to assess and assist with your understanding of the material. Please feel free to post any questions you may have regarding the course on the Discussion Board so that we may share the information with your peers. When emailing the instructors and TAs directly, please only use your University of Toronto email address. Please indicate the nature of your inquiry in the subject line preceded by BCH210H. Please begin your email with Dear : and include your full name and student number so that we may be able to best address your concern in the utmost respectable manner. Emails to your professors will only be answered during business hours, so if you require an immediate response, try asking a classmate. Course-related announcements will also be posted on the Quercus/Canvas site so please do check in regularly.

Textbook: The following textbook is highly recommended and is a great Canadian up-to-date version that you may use as a reference for your other courses in addition to this one. Biochemistry, First Canadian Edition, R.H. Garrett, C.M. Grisham et al. (2013, Nelson Education). This textbook includes chapter questions, which may assist with your understanding of the material, and associated readings may be assigned.

The material covered in this course is fundamental to future work you may explore in any field of biological science, nutrition, molecular biology, medicine, etc. We hope that you enjoy the course and succeed! We are here to assist you in any way possible, but it is your responsibility to keep on top of the material. This is a very fast-paced course and your attendance at the lectures is key in assisting your understanding of biochemistry, the molecular basis of life.

~Sincerely the BCH210H teaching team

****BCH311H (Biochemistry II):** Interested in the second half of Biochemistry? BCH311H is offered in the 2019 winter session and eligibility for the course is successful completion of BCH210H: Biochemistry I. In BCH311H, nucleic acids and flow of information in biological systems will be discussed.

You can find more information regarding BCH311H by contacting Dr. Andreopoulos and/or viewing the following url: http://biochemistry.utoronto.ca/courses/bch311h-biochemistry-2-nucleic-acids-and-biological-information-flow/

RECOMMENDED TEXTBOOK READING LIST AND END OF CHAPTER QUESTIONS - BCH210H 2018

INSTRUCTOR	CHAPTER	END OF CHAPTER QUESTIONS
Dr. Reithmeier	1 (1.1-1.4)	Q. 9
	2	Qs. 1a,b,c; 2a,b,c; 3, 4, 19b
	4	Qs. 6, 7, 17, 20
	5 (5.1-5.8)	Qs. 2-11
	6	Qs. 3, 4, 7-12, 15
Dr. Melnyk	8 (8.1-8.4, 8.7-8.8)	Qs. 2, 3
	10	Qs. 15, 20-23
	11 (11.4)	Q. 11
Dr. Andreopoulos	12 (All except for non-linear LB plots, 12.5, 12.7, 12.8)	Qs. 1, 2, 4, 12a, b
	13: (13.5 Covalent Catalysis, 13.6 only)	N/A
	14 (14.1 Allosteric Regulation pgs 479-481, 14.2-14.6)	Q. 2
Dr. Patterson	3 (3.1-3.3)	Qs. 8, 11, 20
	7 (7.1-7.5)	Qs. 1, 4, 14, 20
	6 (p.185)	N/A
	9 (9.1, 9.4, 9.5)	Qs. 1, 2
	11 (11.1-11.4)	Qs. 5, 6, 12
	14 (14.1, 14.4, 14.5)	Qs. 1, 6, 8
	16 (16.1-16.3)	Qs. 6, 8, 9
	17 (17.1-17.7)	Qs. 1, 3, 9, 11, 13
	18 (18.1-18.5, 18.7, 18.8)	Qs. 2, 3, 4, 12
	19 (19.1-19.7)	Qs. 1, 2, 4, 5, 12
	21 (21.1-21.5)	Qs. 1, 4, 7, 9
	22 (22.1-22.2, 22.6)	Q. 8a, b only
	33 (33.1-33.5)	Qs. 1, 11, 15

****INFORMATION REGARDING AUDIO RECORDING OF LECTURES AND TUTORIAL SESSIONS****

INSTRUCTORS PERMIT AUDIO RECORDINGS WITH NO DISTRIBUTION RIGHTS

Students may create audio-recordings of the lectures for their own personal use. Recordings are intended to permit lecture content review so as to enhance understanding of the topics presented. Audio-recordings are not substitutes for attending class, nor does the transcription of lecture content constitute learning. You are responsible for using all of the resources, including textbook and review questions to assist with your learning.

Students should note that since audio recordings are to be permitted, their voice may be recorded by others during the class. Please speak to the instructor if this is a concern for you.

In accordance with the Accessibility for Ontarians with Disabilities Act, 2005, persons have special needs will be accommodated.

Students agree to the following terms when creating audio recordings of lectures:

- Recordings are not to be distributed without the permission of the instructor via the Internet (social media such as Facebook), peer-to-peer file sharing (services such as OneDrive or Dropbox), or other distribution channels.
- Recordings are not to be shared with other classmates unless they are to be used in collaborative assignments, or if the instructor permits for other reasons.

Non-compliance with these terms violates an instructor's intellectual property rights and the Canadian Copyright Act. Students violating this agreement will be subject to disciplinary actions under the Code of Student Conduct.

BCH210 Fall 2018 Lecture Schedule

Lec #	DATE	TOPIC	LECTURER
		SECTION I: ***Introduction to Proteins and Protein Structure***	
1	Sept. 06	Elements of Protein Structure	Reithmeier
2	Sept. 07	Forces Stabilizing Proteins	Reithmeier
	Sept. 09-10	***SELF ASSESSMENT QUIZ 1* (0.5%, Lectures 1&2)**	
3	Sept. 11	Protein Composition and Conformation	Reithmeier
4	Sept. 13	Protein Backbone; Peptide Bonds	Reithmeier
5	Sept. 14	Fibrous and Globular Proteins; Membrane Proteins	Reithmeier
	Sept. 16-17	***SELF ASSESSMENT QUIZ 2* (0.5%, Lectures 3-5)**	
6	Sept. 18	Protein Folding; Anfinsen's Experiment	Reithmeier
7	Sept. 20	Protein Engineering: Molecular Biology, Mutagenesis	Reithmeier
8	Sept. 21	Protein Engineering: Mutagenesis of Subtilisin	Reithmeier
	Sept. 23-24	***SELF ASSESSMENT QUIZ 3* (0.5%, Lectures 6-8)**	
9	Sept. 25	Prediction of Protein Structure I	Reithmeier
10	Sept. 27	Prediction of Protein Structure II	Reithmeier
11	Sept. 28	Analysis of Proteins: Chromatography, Sequence	Reithmeier
	Sept. 30-Oct.01	***SELF ASSESSMENT QUIZ 4* (0.5%, Lectures 9-11)**	
12	Oct. 02	Analysis of Proteins: Spectroscopy	Reithmeier
		SECTION II: ***Lipids, Enzymes and Carbohydrates***	
13	Oct. 04	Biological Lipids: Structures and Functions	Melnyk
	Oct. 04	***TERM TEST I * 6-8pm (31%)**	
14	Oct. 05	Membrane Lipids: Assembly and Dynamics	Melnyk
	Oct. 07-08	***SELF ASSESSMENT QUIZ 5* (0.5%, Lectures 13-14)**	
15	Oct. 09	Membrane Protein Properties	Melnyk
16	Oct. 11	Membrane Protein Structures	Melnyk
17	Oct. 12	Membrane Protein Functions	Melnyk
	Oct. 14-15	***SELF ASSESSMENT QUIZ 6* (0.5%, Lectures 15-17)**	
18	Oct. 16	Introduction to Enzymes: Enzyme Classification and Specificity	Andreopoulos
19	Oct. 18	The Active Site and Enzyme Regulation	Andreopoulos
20	Oct. 19	Enzyme Reactions and Kinetics	Andreopoulos
	Oct. 21-22	***SELF ASSESSMENT QUIZ 7* (0.5%, Lectures 18-20)**	
21	Oct. 23	Enzyme Inhibition and Enzyme Mechanisms	Andreopoulos
22	Oct. 25	Hemoglobin	Andreopoulos
23	Oct. 26	Carbohydrates I	Patterson
	Oct. 28-29	***SELF ASSESSMENT QUIZ 8* (0.5%, Lectures 21-22)**	
24	Oct. 30	Carbohydrates II	Patterson
		SECTION III: ***Metabolism and Bioenergetics***	
25	Nov. 01	Introduction to Metabolism	Patterson
	Nov. 01	***TERM TEST II* 6-8pm (26%)**	
26	Nov. 02	Hormone Signalling	Patterson
	Nov. 05	**Last Day for Dropping Course Without Academic Penalty**	
	Nov. 05-09	***READING WEEK***	
	Nov. 11-12	***SELF ASSESSMENT QUIZ 9* (0.5%, Lectures 23-26)**	
27	Nov. 13	Glycolysis	Patterson
28	Nov. 15	Mitochondrial Bioenergetics	Patterson
29	Nov. 16	Electron Transport	Patterson
	Nov. 18-19	***SELF ASSESSMENT QUIZ 10* (0.5%, Lectures 27-29)**	
30	Nov. 20	ATP Synthesis	Patterson
31	Nov. 22	Gluconeogenesis	Patterson

32	Nov. 23	Fat Catabolism	Patterson
	Nov. 25-26	***SELF ASSESSMENT QUIZ 11* (0.5%, Lectures 30-32)**	
33	Nov. 27	Fat Synthesis	Patterson
34	Nov. 29	Lipoproteins	Patterson
35	Nov. 30	Ketogenesis	Patterson
	Dec. 02-03	***SELF ASSESSMENT QUIZ 12* (0.5%, Lectures 33-35)**	
36	Dec. 04	Application and Review	Patterson
	Dec. 04	**Assignment Due (2%)**	
	Dec. 08-21	**FINAL EXAM (3 hours, 35%)**-Date and Location to be Announced by A & S	