Biochemistry
CHMB62 2017
Course Outline

This document contains important information and should be kept in a safe place where you can refer to it throughout the semester.

Welcome to the CHMB62H3: Biochemistry. This course studies the cellular functions and their interrelationships. It introduces topics including thermodynamics, membrane structure and function, transport mechanisms, basic metabolic pathways, energy production and utilization, communications between cells.

LEC01: TH 17:00-19:00, MW-140

TUT: TH 19:00-20:00, MW-140.

Lecturer and Tutorial Coordinator: Dr. Lana Mikhaylichenko
Contact: mikhay@utsc.utoronto.ca
(416) 287-7207, EV556 or EV107 (during the lab)

Office hours: Thu. 3-4 pm EV556; Tue. 3-4 pm and Wed. 3-4 pm EV107(if not busy)

Required Text Books:
J. Tymoczko, J. Berg, L. Stryer. Biohemistry: A Short Course. 2nd or 3rd. ed., W.H. Freeman and Company.

Recommended Websites:

Please check the External links section on the course Blackboard page.

Method of Evaluation:
Tutorial quizzes: 5%
Online homework: 5%
Literature Assignment: 10% (will be given to you during second week of classes)
Midterm Test: 30%
Final Exam: 50% (April exam period)

Course Website: course site on Blackboard
Communication: via email and office hours

Learning Outcomes for Course:
By the end of this course, students will be able to:

- Describe the key classes of biomolecules and differentiate between them.

- Understand the principles of the chemistry connected to living systems. The principles of biosynthesis and metabolism of compounds such as: steroids, lipids, amino acids, peptides, proteins, vitamins, carbohydrates and nucleic acids.
- Use the vocabulary on organic chemicals and reactions in metabolism and other biochemical applications.
- Explain the role of enzymes in metabolism.
- Describe how dietary proteins, carbohydrates, and lipids are digested.
- Describe the genetic code and identify steps in protein synthesis.
- Students who successfully complete this course will demonstrate a broad knowledge of biochemical concepts, paradigms, and vocabulary as well as be able to critically review experimental evidence in the scientific literature.

Lecture Schedule: This is a rough guide only and may change throughout the term.

Lec #	Week of	Subject	Book Chapter
1		**Introduction to Biochemistry. Protein Composition and Structure.**	1,2
2		**Amino Acids and Proteins.**	3,4
3		**Basic Concepts of Enzyme Action. Kinetics and Regulation.**	6,7
4		**Mechanisms and Inhibitors. Hemoglobin.**	8,9
5		**Carbohydrates and Lipids.**	10,11
6		**Membrane Structure and Function. Signal-Transduction Pathways.**	12,13
Reading week – week of February 21st (no classes)			
Midterm – date and location TBA			
7		**Nucleic Acid Structure and DNA Replication**	33,34
8		**RNA Synthesis and Regulations. The Genetic Code.**	36,39
9		**The Organic Mechanisms of the Coenzymes**	16,17
10		**The Citric Acid Cycle.**	18,19
11		**Oxidative Phosphorylation.**	20,21
12		**Fatty Acid and Lipid Metabolism.**	27,29
Winter Term Exams	April exam period	**Tree hour term test (TBA).**	

Assigned problems will be posted with the every lecture material.

Expectations of CHMB62H3 Students

I expect you to exhibit self-regulated, autonomous learning behavior. Simply put, I expect you to extend your study of biochemistry outside of the classroom and laboratory. For example, the exams will not only test your knowledge of the factual data presented in lecture, but also your synthesis of the information into a logical whole –the big picture. I expect you to consider biochemistry in your other courses and to discover how the concepts presented during the semester impact your health, the environment, and the biological world as a whole. Your success as a student of biochemistry depends upon your ability to think creatively and critically. Therefore, I intend to foster and expand the creative intellect already resident in your everyday

thoughts and expect you to be open to new ways of thinking and to challenge old ways of thinking.

Expectations of the professor

The instructor's role is to facilitate learning (by lecturing, answering questions, etc.) and to evaluate learning (by tutorials, exams, etc.). Remember that you are doing this work for yourself (to prepare for future endeavors), not for the instructor. What can you expect from me? You can expect me to be prepared for class with both knowledge and enthusiasm. You can expect patient and thoughtful teaching and help both within and outside our scheduled time together. You can expect that I will utilize all reasonable resources to help you succeed in this class. Don't be afraid to seek help when needed – from me or from your tutorial TA. I am here to help you learn the material covered in this course and to provide an impartial evaluation of your performance.

Literature assignment

Assignment will be given to you during second tutorial. The detailed explanation of my expectations for the good literature assignment will be posted on a course Blackboard page. We will also have a guest lecturer who will let you know about UTSC writing centre and all the help available there. You will submit your literature assignment through Turnitin program. This is a U of T statement about this program:

"Normally, students will be required to submit their course essays to Turnitin.com for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their essays to be included as source documents in the Turnitin.com reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of the Turnitin.com service are described on the Turnitin.com web site".

I will post a detailed explanation of how to submit your assignment later on a course page. Link to Turnitin program will be also posted in External Links section on a course Blackboard page.

Study Hints:

Biochemistry is, in simplest terms, the study of the chemistry of living things. The general aim of this course, therefore, is to train students to understand biological processes and events by learning the logic of chemistry. It is far more than simply memorizing structures and pathways; the fascination of the field is to see how and why biological molecules are built the way they are and how this makes life possible – on many levels and with an amazing degree coordination and control. The degree of biological sophistication that allows you to read this document and (hopefully) make sense of it is truly amazing!

Biochemical systems are very complex and can be confusing and difficult to grasp. If you find yourself confused about a topic – it often helps to ZOOM OUT. Look at the big picture to see common patterns; then once you have that clear, you can focus in on more of the details. There is an architecture in nature, and if you organize and build learning by moving from the simple to the more complex – your neurons will thank you!

Class notes:

Sets of *incomplete notes*, including figures discussed in class, will be available on the class Blackboard page prior to the corresponding lecture. You are responsible for printing these notes and bringing them with you to class. **You will be responsible for all material covered in lecture, even if it is not included in the online notes**; you must attend lecture in order to get additional information.

Steps toward Success in Biochemistry:

1. **Look through the chapter before lecture.** It is not necessary to read the whole chapter before class, but look at headings and schemes, specifically trying to find similarities to topics that you already know. Much of organic chemistry follows the same trends, and identifying common themes will make studying and leaning the material much easier.
2. **Go to class.** Go to class every time and pay attention during class.
3. **Do practice problems!** This is the most important and most productive way to study and ESSENTIAL to you success in the class. Work as many problems as you can, but realize that reading the solution manual is not the same as solving a problem on your own. If you have a difficult time with the problem, it will be much more beneficial to you if you reread the appropriate section of the textbook (and online text if you need additional explanations) than if you simply read the answer.
4. **Ask questions!** Attend office hours and discussion sessions.
5. **In order to make sense of the material** in this course, you should be asking at least some of the following questions ALL of the time:

- HOW is this built or HOW does this work (structure/order)?
- WHY is it built or WHY does it work this way (function)?
- WHAT IF it worked a different way (order)?
- HOW does this allow it to perform its role in the cell (context)?
- HOW does this interact with other molecules or processes (cross---talk)?
- HOW is this molecule or process activated or inhibited (regulation)?
- HOW well does this work (redundancy)?
- HOW can I know if this is happening (detection)?
- HOW can I measure this (quantitative/qualitative analysis)?

Extra Credit Activities:

I am introducing extra credit activities in order to give you a chance to improve your class performance and also to let you learn some extra material related to the class but outside of the lecture material. These are two projects that you can perform and earn up to two extra grades on top of your final course mark. Each project worth one extra mark.

Molecule of the Week Project:

It will be supervised by Service Learning student Cheryl Chan.

You can do this project as a group (**not more than two students** allowed to participate in one group). Each of you will be given one extra mark. In general, please take a close look at the lecture material and pick some molecule or group of molecules and then try to

see of how much information you can find on them. Please be aware that once somebody picks the topic it is not available anymore. There will be no duplication of topics. You need to get Cheryl's approval before you will start working on a topic! Presentation must contain interesting and challenging material. You should submit your presentation no later when Friday, March 27th (this may be changed later on). We would recommend submitting it a little bit earlier (at least up to three days before deadline). You will have time to fix your mistakes in this case. You will be expected to make a short (up to 7 min) presentation at the end of the term in order to receive a full mark. It will be done outside the class time and no more that 10-15 people will be your audience. You should submit your ready presentation to Cheryl at cherylmelanie.chan@mail.utoronto.ca and cc it to me as well.

In general, your presentation should have information about discovery, physical and chemical properties of that molecule, its practical application and interaction with biological system (human body, plant, etc.). Please do not forget to include references into your presentation. The best way to do it – list them as foot notes on each slide. Wikipedia will not be considered as a reference; you must look at the original paper and refer to it.

Here are some molecules which we would like to introduce to our class:

1. Aspirin (discovery, commercial method of preparation, practical application)
2. Cinnamaldehyde (natural sources, synthesis, practical application)
3. Vanillin (natural sources, synthesis, practical application)
4. Muscone (natural sources, synthesis, practical application)
5. Carvone (natural sources, synthesis, practical application)
6. Strawberry or raspberry ketones (natural sources, synthesis, practical application)
7. α-Damescone (natural sources, synthesis, practical application)
8. Z-Jasmone (natural sources, synthesis, practical application)
9. DIBAL-H (structure, importance in synthesis, usage in synthesis of natural compounds such as ciguatoxin, etc.)
10. NADH – natural reducing agent
11. α-Sinesal – structure, simple chemistry, appearance in nature.
12. Ninhydrin (natural sources, synthesis, practical application)
13. DNA (discovery, chemical properties, practical application)
14. Nicotine (natural sources, synthesis, practical application)
15. Coumarin (natural sources, synthesis, practical application)
16. D-Ribose (natural sources, synthesis, practical application)
17. Estradiol (natural sources, synthesis, practical application)
18. Anabolic Steroids (classification, synthesis, practical applications)
19. D-Glucose (natural sources, synthesis, practical application)
20. Caffeine (natural sources, synthesis, practical application)
21. Acetaminophen (synthesis, chemical properties, practical application)
22. Procaine (synthesis, chemical properties, practical application)

These are just a few ideas and we will be very happy if you will come out with your own topic.

Dietary or Body Building Supplements Discovery Project:

Supplements are everywhere. Dietary supplements and bodybuilding supplements – proteins, amino acids, cofactors, hormones, fat burners, antioxidants and multivitamins. These supplements are being sold based on what we know they do naturally in the human body. How efficacious these isolated, purified and sometimes synthesized supplements are, is a discussion for another time.

Your mission:

I want you to choose any supplement and make a short investigation on this supplement which will include:

1. A picture of the supplement
2. State what the manufacturer is claiming this supplement is doing.
3. By identifying the active ingredient(s) in the supplement justify the manufacturer's claims using your biochemical knowledge of human metabolism.

Be creative with your responses. It could be in the form of a blog post reply or a video reply. If you are using text then a minimum of **250 words** should be used and for videos the time limit is **5 mins**.

More details about this assignment will be posted on a course Blackboard page. **Please use this opportunity to improve your mark in the course!**

Accessibility:

Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach me and/or the Access*Ability* Services Office as soon as possible. I will work with you and Access*Ability* Services to ensure you can achieve your learning goals in this course. Enquiries are confidential. The UTSC Access*Ability* Services staff (located in SW302) are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations (416)287-7560 or ability@utsc.utoronto.ca.

ACADEMIC INTEGRITY STATEMENT

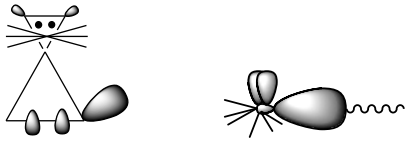
Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student's individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously. The University of Toronto's Code of Behaviour on Academic Matters (http://www.governingcouncil. utoronto.ca/policies/behaveac.htm) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences. Potential offences include, but are not limited to:
IN PAPERS AND ASSIGNMENTS: Using someone else's ideas or words without appropriate acknowledgement. Submitting your own work in more than one course without the permission of the instructor. Making up sources or facts. Obtaining or

providing unauthorized assistance on any assignment.
ON TESTS AND EXAMS: Using or possessing unauthorized aids. Looking at someone else's answers during an exam or test. Misrepresenting your identity. **IN ACADEMIC WORK**: Falsifying institutional documents or grades. Falsifying or altering any documentation required by the University, including (but not limited to) doctor's notes. All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behavior on Academic Matters. If you have questions or concerns about what constitutes appropriate academic behavior or appropriate research and citation methods, you are expected to seek out additional information on academic integrity from your instructor or from other institutional resources (see http://www.utoronto.ca/academicintegrity/resourcesfor students.html).

Please also note this:

The Department of Physical and Environmental Sciences at UTSC provides state-of-the-art education in chemistry. Chemistry being an experimental science makes learning in a laboratory setting critical. In order to provide the latest technology to enhance the student learning experience, UTSC will be charging ancillary fees for all chemistry courses that have a laboratory component. Those fees are used to recover the cost of materials and services used during the lab and to maintain and upgrade the equipment used by students. To view a complete list of those fees, students are encouraged to visit the following link:
http://www.planningandbudget.utoronto.ca/Assets/Academic+Operations+Digital+Assets/Planning+$!26+Budget/2012-13+Category+5+Ancillary+Fees.pdf

I am looking forward to see you all and work with you!



P.S. This picture was made for fun using ChemDraw program but it is very useful tool in organic chemistry labs. Please download it through U of T library website. It is free for U of T students and you will be using it a lot during this course. Your literature assignment must have all structures and diagrams done using this program.