



BIOC*2580 Introduction to Biochemistry

Fall 2017

Sections(s): C01

College of Biological Science

Credit Weight: 0.50

Version 1.00 - September 06, 2017

1 Course Details

1.1 Calendar Description

This course introduces students to the evolution, chemical structure, and biological roles of the major molecular components of the cell: including proteins, nucleic acids, lipids, and carbohydrates. Topics and processes integrated through understanding biological macromolecules include enzymology and intermediary metabolism, with emphasis on catabolic processes. Students will gain basic investigative skills through hands-on experiences in a laboratory setting.

Pre-Requisite(s): CHEM*1050

1.2 Timetable

Lectures

Section I: Tuesdays and Thursdays 8:30 AM to 9:50 AM, in ROZH 104

Section II: Tuesdays and Thursdays 11:30 AM to 12:50 PM, in ROZH 104

All material covered in lectures is the responsibility of the student, including announcements regarding midterms, labs, and exams.

1.3 Final Exam

Exam time and location is subject to change. Please see WebAdvisor for the latest information.

2 Instructional Support

2.1 Instructor(s)

Enoka Wijekoon

Email: ewijekoo@uoguelph.ca
Telephone: +1-519-824-4120 x56095
Office: SC1 3517
Office Hours: Monday & Tuesday 2:00-3:30 pm

John Dawson

Email: jdawso01@uoguelph.ca
Telephone: +1-519-824-4120 x53867
Office: SC1 2248
Office Hours: Monday & Tuesday 2:00-3:30 pm

2.2 Instructional Support Team

Lab Co-ordinator: Jaspreet Kaur
Email: jkaur@uoguelph.ca
Telephone: +1-519-824-4120 x58220
Office: SC1 3521
Office Hours: Email to book an appointment

3 Learning Resources

3.1 Recommended Resources(s)

Lehninger Principles of Biochemistry (Textbook)

The following text is highly **recommended**. The online quizzes associated with the course will be administered through the “Sapling Plus” Homework system that is linked to this textbook. The “Sapling Plus” program will be used in the second biochemistry course, BIOC*3560 Structure and Function in Biochemistry as well. The textbook (without Sapling Plus) is also used in several other senior biochemistry courses:

Lehninger Principles of Biochemistry; D.L. Nelson and M.M. Cox, 7th ed. (2017)

Multiple copies of this text book are on Reserve in the library.

There are three options, each containing the same information, but in slightly different formats:

1. The hardcover textbook bundled with Sapling Plus (Twelve-Month Access*)
2. The loose-leaf textbook bundled with Sapling Plus (Twelve-Month Access*)
3. Sapling Plus (Twelve-Month Access*) (The e-book is housed within Sapling plus and

you will have **24 months access** to the ebook)

*This gives you access to sapling Plus for 2 semesters, whether they are back-to-back or not.

Loose leaf versions cannot be resold as a used textbook at the Bookstore. **BE AWARE: With the eBook, you are purchasing access to the electronic version for a specific period of time; once this is over, you will not be able to access the eBook.**

3.2 Getting Help in BIOC*2580

Course Email: bioc2580@uoguelph.ca

You can make use of the course e-mail address to ask questions. Only use your @mail.uoguelph account when sending messages to this address. Enquiries regarding the laboratory should have the word LAB in the subject line. E-mail may not be answered outside of office hours.

Supported Learning Group (SLG)

SLGs are free study sessions led by students. These trained SLG Leaders sit in on lectures and run sessions that are informal, flexible, and fun. Students who make regular use of the SLG have a higher average grade on this course than those who do not. SLG information and schedules are available in CourseLink.

4 Learning Outcomes

4.1 Course Learning Outcomes

By the end of this course, you should be able to:

1. Describe the structures and the chemical properties of the 20 amino acids.
2. Describe the methods used in the separation of amino acids and proteins based on their chemical properties.
3. Describe the first three levels of protein structure and explain how protein structure is influenced by the amino acid sequence.
4. Explain how enzymes catalyze reactions and how enzyme activity is affected by inactivators

and inhibitors.

- Describe the structure and the chemical properties of carbohydrates (monosaccharides and disaccharides), lipids (fatty acids, triglycerides and glycerophospholipids) and nucleic acids (RNA and DNA).
 - Describe the chemical reactions involved in the generation of ATP through the oxidation of glucose and fatty acids.
 - Apply several of the knowledge outcomes in 1-6 by effectively working with a partner to carry out laboratory procedures to collect, properly record and analyse experimental data.
 - Manage time effectively and follow instructions to meet deadlines for course requirements.
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5 Teaching and Learning Activities

5.1 Lecture Schedule

Class	Date	Topic	Lehninger (6th ed)	Lehninger (7th ed)
1	Sept 7	Biological polymers; building blocks and hydrolyzable bonds. Amino acids, peptides and proteins.	11-15;76; 85-86	12-16;75-76;85-86
2	Sept 12	Amino acids, peptides and proteins (continued), Polarity and ionization of amino acids	75-85; 47-50;58-65	75-85; 47-50;58-65
3	Sept 14	Separation of amino acids and proteins by chromatography	89-96	47-50; 58-65
4	Sept 19	More analytical methods; Polypeptides and proteins: structural hierarchy, sequence. Basis of reactivity and hydrolysis	89-96; 96-102	89-96; 96-102
	Sep 20-26	Quiz 1		
5	Sept 21	Sequence determination, Secondary structure : α -helix, β -sheet,	96-102; 115-125	96-102; 115-125
6	Sept 26	Secondary structure : α -helix, β -sheet	115-125	115-125

(continued)

7	Sept 28	Principles of tertiary structure. Protein stability and function	125-140; 189-200	125-141; 187-198
8	Oct 3	Binding and recognition of substrates and specificity of enzymes; The basis of chemical and enzymatic catalysis.	189-200	187-198
	Oct 4-11	Quiz 2		
9	Oct 5	Mechanism of action of chymotrypsin, Enzyme assay and detection	214-208; 95-96; 204-205	213-217; 95-96; 203
10	Oct 12	Enzyme assay and detection (continued), Enzyme kinetics	200-213	198-213
11	Oct 17	Experimental enzyme kinetics: linear plots, Enzyme inhibition and regulation.	200-213	198-213
12	Oct 19	Enzyme inhibition and regulation (continued), REVIEW SESSION	200-213	198-213
	Oct 21	Midterm Examination 9:30 – 10:45 am (Roz 101, 103, 104)		
13	Oct 24	Lipids: fatty acids	357-360	361-364
14	Oct 26	Lipids: triacylglycerols, phospholipids; Analysis of lipids; Carbohydrate chemistry: simple sugars	360-364; 377-379; 243-245	364-369; 381-383; 241-243
15	Oct 31	Carbohydrate Chemistry: linear and ring structures, Reducing sugars	245-248; 251	243-247; 249

16	Nov 02	Carbohydrate chemistry: glycosides, di and polysaccharides, Nucleic acid chemistry (RNA & DNA): nucleotides and polynucleotides	252-254; 281-287	250-252; 279-285
Nov 3-9		Quiz 3		
17	Nov 07	The DNA double helix, ATP as cellular energy currency	287-290; 517-524	285-287; 507-514
18	Nov 09	ATP as cellular energy currency (continued), Introduction to metabolism; Redox reactions	517-524; 501-504; 528-538	507-514; 491-494; 517-522
19	Nov 14	Adenosine containing cofactors: Catabolism of Fats- fatty acid beta oxidation	635; 532-537; 667-675;	621; 522-526; 649-650; 652-659
20	Nov 16	Fatty acid beta oxidation contd.; Glycolysis: anaerobic energy generation	667-677; 543-555;	652-659; 533-545
Nov 17-23		Quiz 4		
21	Nov 21	Fates of pyruvate; Shuttle systems conveying cytosolic NADH to mitochondria, Pyruvate dehydrogenase complex, The Citric Acid Cycle	563-565 758-759; 633-635; 633; 638-650	619-624; 739-740; 553-558; 619; 624-636
22	Nov 23	Citric acid cycle cont.; The electron transport chain	638-647; 731-743	624-636; 7711-724

23	Nov 28	Chemiosmotic energy transduction; ATP synthase	743-747; 747-757	724-728; 728-739
24	Nov 30	ATP Synthase; Efficiency of oxidative phosphorylation	747-757; 675-676	728-739; 657-659
	Dec 14	Final Examination 7:00 – 9:00 pm		

5.2 Lab Schedule (Subject to Change)

LAB SCHEDULE-BIOC*2580 F'17 (subject to change)

Group A- All the odd number sections (eg: BIOC*2580*0101)

WEEK #	Dates	Activity
1	Sept 11-15	Sign-up-Second hour of the lab time
2	Sept 18-22	Lab 1: Amino Acids, Quiz 1
3	Sept 25-29	No Labs
4	Oct 2-6	Lab 2: Proteins, Quiz 2
5	Oct 9-13	No Labs
6	Oct 16-20	No Labs
7	Oct 23-27	Lab 3: Enzymes, Quiz 3

8	Oct 30- Nov 3	No Labs
9	Nov 6-10	Lab 4: Lipids, Quiz 4
10	Nov 13-17	No Labs
11	Nov 20-24	Lab 5: Carbohydrates, Quiz 5
12	Nov 27-Dec 1	No Labs

Group B -All the even number sections (eg: BIOC*2580*0102)

WEEK #	Dates	Activity
1	Sept 11-15	Sign-up-First hour of the lab time
2	Sept 18-22	No Labs
3	Sept 25-29	Lab 1: Amino Acids, Quiz 1
4	Oct 2-6	No Labs
5	Oct 9-13	No Labs
6	Oct 16-20	Lab 2: Proteins, Quiz 2
7	Oct 23-27	No Labs
8	Oct 30- Nov 3	Lab 3: Enzymes, Quiz 3
9	Nov 6-10	No Labs
10	Nov 13-17	Lab 4: Lipids, Quiz 4
11	Nov 20-24	No Labs

6 Assessments

6.1 Grade Assessments

Scheme I

Form of Assessment	Weight of Assessment (final)	(% of)	Due Date of Assessment	Course Content /Activity	Learning Outcome Addressed
Online Quiz #1	2.5%		September 20 - 26, 2017	Lectures 1-4	#1, 2, 8
Online Quiz #2	2.5%		October 4 - 11, 2017	Lectures 5-8	#2, 3, 8
Midterm	25%		October 21, 2017	Lectures 1-12	#1, 2, 3, 4, 8
Online Quiz #3	2.5%		November 9, 2017	3 - Lectures 13-16	#5, 8
Online Quiz #4	2.5%		November 17 - 23, 2017	Lectures 17-20	#5, 6, 8
Final Exam	40%		December 14, 2017	Cumulative, with emphasis on lectures 13-24	#1-6, 8
Laboratories	25%		Bi-Weekly	Laboratory experiments and write-up	#7, 8

Scheme II

Students who opt out of the Sapling Plus homework section will follow the following marking scheme.

Form of Assessment	Weight of Assessment (final)	(% of)	Due Date of Assessment	Course Content /Activity	Learning Outcome Addressed
Midterm	30%		October 21, 2017	Lectures 1-12	#1, 2, 3, 4, 8
Final Exam	45%		December 14, 2017	Cumulative, with emphasis on lectures 13-24	#1-6, 8
Laboratories	25%		Bi-Weekly	Laboratory experiments and write-up	#7, 8

Lecture Component: 75%

Laboratory Component: 25%

Total: 100%

6.2 Note

Students must pass the Lecture component on its own AND the Laboratory component on its own to pass the course as a whole (i.e. students need to achieve an overall grade of at least 37.5/75 for the 4 quizzes and the 2 exams and a minimum of 12.5/25 for the laboratory). This means that a high laboratory mark cannot be used to secure a pass if the lecture component is failed or vice versa. In cases where this standard is not achieved, the final grades assigned will either be the calculated grade or 47%, whichever is less.

6.3 Lecture Component

LECTURE COMPONENT

ONLINE QUIZZES:

Sep 20-26, Oct 4-11, Nov 3-9 and Nov 17-23

The online quizzes are administered through “Sapling Plus” associated with Lehninger Principles of Biochemistry 7th edition. They are meant to ensure that students keep up with and have a chance to assess their understanding of the lecture material. Although these assignments are online, **STUDENTS ARE EXPECTED TO ANSWER THE QUESTIONS BY THEMSELVES**. The goal of the quizzes is to have students review and reflect on the material, and facilitate studying for the midterm and final exam in a lower-stakes format. As such, students will be given **three attempts** at the quiz over a period of one week. The time limit per attempt will be one hour.

Access to grades, answers and feedback: Students will be granted access to the feedback and answers to the quiz questions on the day following the closing of the quiz. Questions about the grades must be made to the instructor within a period of one-week following that.

Deferrals policy: Students with medical or compassionate issues that **cover the entire one-week period the quiz is open** will be granted a changed mark weighting. The value of quizzes missed will be added to the value of the final exam. Accommodation forms from Program Counselors and documentation are **required** within one week of the end of the assignment deadline. Be sure you have access to a working computer with a stable Internet connection. **Technical problems are not grounds for a deferral.**

MIDTERM EXAM:

Saturday, October 21 (9:30 to 10:45 AM), in ROZH 101, 103 and 104

STUDENTS MUST NOTIFY THE INSTRUCTOR OF ANY ACADEMIC CONFLICTS BY Friday, September 22. Academic conflicts are courses or labs that are scheduled at the exact same time.

Access to grades, answers and feedback: Students will be granted access to their grades and answers to the midterm before the drop date. Questions about the grades must be made to the instructor within one week of the midterm being available for return.

Deferrals policy: Only medical or compassionate accommodations will be granted a missed midterm. Accommodation forms from Program Counselors and documentation are **required** within one week after the midterm. If a missed midterm is granted, the final exam will be reweighted to 65% if you follow marking scheme I or 75% if you follow marking scheme II.

FINAL EXAM:

Wednesday, December 14 (TIME: 7:00 pm – 9:00 pm) Room TBA

This exam will **cover the entire course (lectures 1-24)**, with strong emphasis on the material covered after the midterm examination. A **metabolic chart** will be posted on Courselink and provided at the final examination. The chart shows chemical structures organized into metabolic pathways, but it does not show compound or enzyme names, reaction stoichiometries and mechanisms, etc. Students are expected to be familiar with these, as outlined in the Learning Outcomes for the course.

Technology in all exams: Students may use a numerical calculator with In and log functions for exams. Advanced calculators, computers, tablets or smart phones may **not** be use

6.4 Laboratory Component

Laboratory sessions are designed to relate to the lecture content and to introduce students to proper scientific recording of data and analysis of results. Students are expected to be punctual, obey all safety instructions, cooperate with your lab partner and the lab demonstrator, follow good work habits in the lab, work efficiently and independently from your lab partner (where applicable), and wear proper apparel (lab coat, goggles, appropriate footwear).

Attendance:

Attendance at all laboratory periods is *mandatory*. Students missing **more than one lab without documentation** will not earn credit for the lab component of the course. Students missing **more than 2 laboratories, even with valid documentation (medical or compassionate), cannot pass the course**, and will earn a grade of 47% for the entire course. Please see your lab manual (page Intro-2) for details of these policies.

Laboratory sessions begin the week of September 11 (see Laboratory Schedule on Courselink and at the end of this document)

Location:

Science Complex 3110, 3111 and 3112. Each student must, in advance:

- Purchase a current laboratory manual; lab manuals will be sold in the Science Complex (room 2302) on September 7th, 8th & 11th (3 days only), from 9:30 am - 12pm and from 1 pm – 3:30 pm. The lab manual cost is \$10, cash only; please bring exact change.
- Have a lab coat and approved safety goggles; these are required in all biochemistry

Lab Quizzes and Write-up:

There will be a 10 min. quiz (2% each) at the start of each lab, in which you will be tested

on the theory behind the day's experiment. Once the experiments are done, you will complete the Lab write-up (3% each) for that experiment in the lab itself and hand it in before you leave.

Lab exemptions:

If you have earned a passing lab grade in a previous attempt at BIOC*2580 within the last 12 months, you may apply for a lab exemption. Send your request to bioc2580@uoguelph.ca (put *Lab exemption* on the Subject line). **You do not have a valid lab exemption unless you have received confirmation that it has been granted.**

Lab times:

Attend the section assigned to you by the registrar. If you are unassigned for a lab or have a conflict, WebAdvisor now handles all lab section assignments. You must be assigned in time for your first laboratory in the week of September 11. The last 3 digits on your class schedule are your section number; e.g. for BIOC*2580*0110, the section number is 110. Please follow the Lab Schedule given on the last page of this document.

7 Course Statements

7.1 Themes

There are three main themes that run throughout this foundational course in biochemistry:

1. The principles of Physics and Chemistry can explain Biology.
1. The Structure and Function of biological molecules are inextricably connected.
1. Biochemistry is the link between biological Metabolism and its underlying Chemistry

7.2 Statement on the use of animals:

No animals are used directly in the laboratory exercises for BIOC*2580. However it is in the nature of biochemistry that some enzymes or biochemical substances may be derived from animal sources. Efforts have been made to reduce the use of animal related products by using equivalent enzymes or substances derived from microbial or plant sources, but in some cases it may be necessary to use these products

8 College of Biological Science Statements

8.1 Academic Advisors

If you are concerned about any aspect of your academic program:

- Make an appointment with a program counsellor in your degree program. [B.Sc. Academic Advising](#) or [Program Counsellors](#)

8.2 Academic Support

If you are struggling to succeed academically:

- Learning Commons: There are numerous academic resources offered by the [Learning Commons](#) including, Supported Learning Groups for a variety of courses, workshops related to time management, taking multiple choice exams, and general study skills. You can also set up individualized appointments with a learning specialist.
- Science Commons: Located in the library, the Science Commons provides support for physics, mathematic/statistics, and chemistry. Details on their hours of operations can be found at: [Chemistry & Physics Help](#) and [Math & Stats Help](#)

8.3 Wellness

If you are struggling with personal or health issues:

- [Counselling Services](#) offers individualized appointments to help students work through personal struggles that may be impacting their academic performance.
- [Student Health Services](#) is located on campus and is available to provide medical attention.
- For support related to stress and anxiety, besides Health Services and Counselling Services, Kathy Somers runs training workshops and one-on-one sessions related to [stress management and high performance situations](#).

9 University Statements

9.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

9.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The regulations and procedures for [Academic Consideration](#) are detailed in the Undergraduate Calendar.

9.3 Drop Date

Courses that are one semester long must be dropped by the end of the fortieth class day; two-semester courses must be dropped by the last day of the add period in the second semester.

The regulations and procedures for [Dropping Courses](#) are available in the Undergraduate Calendar.

9.4 Copies of Assignments

Keep paper and/or other reliable back-up copies of all assignments: you may be asked to resubmit work at any time.

9.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required, however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance, and not later than the 40th Class Day.

More information: www.uoguelph.ca/sas

9.6 Academic Misconduct

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection. Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor. The Academic Misconduct Policy is detailed in the Undergraduate Calendar.

9.7 Resources

The [Academic Calendars](#) are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs.

9.8 Recording of Materials

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.
