BIOC*4520 Metabolic Processes

Fall 2018
Section(s): C01

Department of Molecular and Cellular Biology
Credit Weight: 0.50
Version 2.00 - September 05, 2018

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1 Course Details

1.1 Calendar Description

This course is an in-depth study of the role of bioenergetics, regulation, and chemical mechanisms in carbohydrate, lipid, and nitrogen metabolism.

Pre-Requisite(s): BIOC*3560 or BIOC*3570

1.2 Course Description

Objectives:

This course will provide a detailed study of the key metabolic pathways which provide the essential foundations for life, and consider the biochemical, molecular and cellular mechanisms which contribute to their regulation. Examples will be taken from mammals, micro-organisms and plants to demonstrate the underlying principles on which carbon, nitrogen, hydrogen and oxygen are acquired and utilised. Principles of organic reaction mechanisms will be used to demonstrate the chemical logic governing the synthesis and turnover of carbohydrates, amino acids and lipids as the organic building blocks for energy storage, transfer and homeostasis. An integrated approach will be adopted, linking metabolism and regulatory mechanisms at the cellular level to processes within the whole organism. A basic organic chemistry background (nucleophiles, electrophiles, electron pushing) is assumed.

1.3 Timetable

Lectures: Monday Wednesday Friday 12:30 - 1:20, RICH 2529.

1.4 Final Exam

Wednesday December 5 2018 from 7 to 9pm, location TBD. Exam time and location is subject to change. Please see WebAdvisor for the latest information.

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2 Instructional Support

2.1 Instructor(s)

Laura Graham

Email:	BIOC4520@uoguelph.ca
Office:	SSC 4472
Office Hours:	E-mail me at the course e-mail for an appointment

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3 Learning Resources

Very Highly Recommended Texts (not required).

Detailed and comprehensive texts, esp. for metabolism, regulation and mechanisms.

You need not buy a new book, if you already have any of these (including earlier editions). These books are on reserve at the library.

3.1 Recommended Resource(s)

Biochemistry (Textbook)
Very Highly Recommended:

Nelson and Cox, *Lehninger's Biochemistry* - 6th Edition, 2013 or 7th Edition, 2017

Biochemistry (Textbook)
Very Highly Recommended:

Voet and Voet, Biochemistry - 4th Edition, 2011 or 5th Edition, 2016

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4 Learning Outcomes

4.1 Course Learning Outcomes

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

1. Explain the role of entropy and enthalpy, Gibbs free energy change, equilibrium constants, coupled reactions and redox reactions in biochemical processes.
2. Comprehend the complex nature of metabolic networks and how flux through pathways is regulated, including by application of Metabolic Control Analysis as well as through understanding the properties of individual enzymes.
3. Understand the detailed mechanisms by which ATP is produced through primary photochemistry, oxidative phosphorylation and substrate level phosphorylation.
4. Describe the principle pathways and regulation of carbohydrate metabolism including: glycogen metabolism in humans and starch metabolism in plants; glycolysis; the TCA cycle and Calvin cycles; the oxidative pentose phosphate pathway; alternative pathways of respiration.
5. Understand the process of primary nitrogen fixation, nitrate assimilation and amino acid biosynthesis and turnover in microorganisms, plants and animals in the context of the global nitrogen cycle.
6. Describe the mechanism of fatty acid synthesis and degradation, triglycerides, cholesterol

and the effects of diet on metabolism.

7. Explain how disorder of metabolic regulation results in important medical consequences, such as increased glycolysis in tumours, insulin resistance and diabetes in obesity, reactive oxygen species and free radical damage in electron transport disruption, atherosclerosis in high cholesterol states and neurotransmitter imbalance in amino acid metabolic dysfunction.

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5 Teaching and Learning Activities

5.1 Lecture

Topic(s):	There will be three lectures a week. There are no labs or assigned readings, but you are expected to maintain a sufficient record of the material presented in lectures to be able to handle questions on quizzes, mid-term and final examinations. Suggested readings from Lehninger Principles of Biochemistry 7th edition wil be provided in lecture when appropriate.

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6 Assessments

6.1 Course Evaluation

The course grade will be based on performance on two online quizzes (5% each), 2 midterms (in class, 20% each), and a cumulative final examination (50%).

6.2 Midterm Examinations

There will be 2 in-class midterm exams, using a combination of multiple choice and short-answer questions. The first midterm is scheduled for 10th October, just after the Fall break, to allow ample time for revision and will be based on classes 1-11, approximately. A 2nd midterm is scheduled for 29th October and will be based on classes 12-21. This should leave ample time for students to decide whether to drop the course by the 40th Day (2nd Nov.) based on performance in both midterms and quizzes. Persons with a scheduled academic conflict should inform the instructor immediately via the course e-mail.

6.3 Final Examination

The final exam will be based on the whole course, but with emphasis on material not covered in the midterms. The final examination will consist of multiple choice, short-answer and long-answer questions.

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7 Course Statements

7.1 Policy on Missed Examinations

If you miss an exam or assignment, you must have documentation. Only valid excuses (medical or compassionate reason) will prevent a grade of zero for any missed test. It is the student's responsibility to arrange for the necessary verification from the Medical or Psychological

Services or the Director of Student Affairs. *Make-up tests will not be given.*

7.2 Exam Aids

No materials may be brought to the exam except for pencils, pens and an eraser. NO ELECTRONIC DEVICES SUCH AS PHONES, SMART WATCHES OR TABLETS, pencil cases, purses, bags, tissue boxes or other containers may be present. Calculators are allowed. All materials are subject to inspection.

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8 Department of Molecular and Cellular Biology 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. http://www.learningcommons.uoguelph.ca/
- 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: http://www.lib.uoguelph.ca/get-assistance/studying/chemistry-physics-help and http://www.lib.uoguelph.ca/get-assistance/studying/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. https://www.uoguelph.ca/counselling/
- Student Health Services is located on campus and is available to provide medical attention. https://www.uoguelph.ca/studenthealthservices/clinic
- 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. http://www.uoguelph.ca/~ksomers/

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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 Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class 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 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.

9.8 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.
