

BIOL 102

Introductory Biology of Cells

Fall Term (2014-15)

CALENDAR DESCRIPTION

An introduction to the basic themes and concepts of modern biology spanning organizational levels from molecules to cells in an evolutionary context.

LEARNING HOURS 123 (24L;6Lb;9G;12O;72P)

RECOMMENDATION 4U Biology and Chemistry, or equivalent high school background, are highly recommended.

SCHEDULE

Lecture Section 001- Tuesdays 12:30pm-1:30pm and Thursdays 11:30am-12:30pm. BIOSCI AUD

Lecture Section 002 – Tuesdays 9:30am-10:30am and Thursdays 8:30am-9:30am. BIOSCI AUD

Lecture Section 003 – Tuesdays 3:30pm-4:30pm and Thursdays 2:30pm-3:30pm. BIOSCI AUD

Labs: Various days and times in BIOSCI, refer to SOLUS for scheduling details.

Instructor	Dr. W. Snedden (co-ordinator) and Dr. D. Lefebvre
Instructor Contact	Dr. Snedden (wayne.snedden@queensu.ca Phone: 613-533-6154), Rm. 3509, Bioscience Dr. Lefebvre (lefebvre@queensu.ca Phone: 613-533-6141), Rm. 2513, Bioscience
Lab/Tut Co-ordinator	Rob Snetsinger: contact by e-mail for appointment. Normal office hours: 9:00 to 11:30 and 1:30 to 3:30 snetsing@queensu.ca

Contact the course instructors if you have a question about lecture content. All other questions (e.g., missed tests, illness, on-line access problems) should be directed to Rob Snetsinger

Learning Objectives

To help students develop an understanding of the main concepts of modern cell biology in an evolutionary context. Material is delivered through a combination of traditional lectures, guest speakers, independent online exercises, laboratory exercises, and group-learning sessions. Course topics span organizational levels of biological systems from molecules to whole cells. The course objectives, broadly speaking, are to help students:

- (i) understand the scientific method and how it facilitates discovery and advancement of knowledge about the living world and the application of that knowledge through technology
- (ii) understand the relationship between structure and function as it relates to the various components of cells and whole organisms

Learning Outcomes: Expected and specific learning outcomes are associated with each topic covered in the course and are provided separately and posted on the course website on Moodle.

Learning Hours

The table below provides an **estimate** of hours of study for BIOL 102. This is for general reference purposes only and is not intended to describe the precise duration of time the course will require. The nature of assignments will vary year to year and thus the allocation of time to various activities will change accordingly. A 3.0-unit course would normally require a total of 110 to 130 total learning hours (or hours on task) and BIOL 102 will fall within that window on any given calendar year. It is prudent to keep in mind however that time commitment to tasks will vary widely among students depending upon individual aptitude, level of background, etc.

<i>Teaching method</i>		<i>Average hours per week</i>	<i>Number of weeks</i>	<i>Total hours</i>
In-class hours	Lectures	2	12	24
	Laboratories	1.5 (alternate weeks)	4	6
	Group learning	1.5 (alternate weeks)	6	9
Other	Online activities	1-4 (avg 2)	12	24
	Private study	3-7 (avg 5)	12	60
Total learning hours				~123 (typical range 110-130)

Course Outline

Topics: Course content is divided into three main units. Each unit builds upon the concepts presented in the previous one as we progress through the hierarchy of organization in living systems, from molecules to organisms.

- (i) *Introduction and basic biological chemistry.* Unit 1 presents an introduction to biology as a scientific discipline, emphasizes the importance of the experimental method for hypothesis testing, and explores the structure and function of the main classes of molecules found in biological systems.
- (ii) *Fundamental cell biology.* Unit 2 presents an overview of the organization and structure/function relationship of the main components of prokaryotic and eukaryotic cells. This unit also explores primary metabolism, enzymology, and the basic principles of photosynthesis. In addition, the mechanisms of intra- and intercellular communication are also studied in this unit.
- (iii) *Molecular and Classical Genetics:* Unit 3 examines how DNA functions as the heritable blueprint of the cell. Topics range from the regulation of gene expression and cell division to the molecular mechanisms of inheritance and the application of molecular genetics to biotechnology.

Note: This is a general and abbreviated description. Course content will vary somewhat year to year but, generally speaking, will cover the topics listed below.

Course Details

UNIT 1: Introduction and basic biological chemistry

- An Introduction to Biology: exploration and overview of biology as a natural science, hypothesis testing, the experimental method, evidenced-based development of theory
- Biological Chemistry: review of basic atomic and molecular structure, importance and chemistry of water in biological systems, biological chemistry of carbon, structure/function of biological macromolecules: lipids, carbohydrates, nucleic acids, proteins

UNIT 2: Fundamental cell biology

- Cell Structure and Organization: overview of cell ultrastructure, comparisons of prokaryotic and eukaryotic cells, organelle structure/function, genome and proteome function
- Systems Biology: organization of cellular components into coordinated systems, sorting of cellular components, proteasome function, extracellular matrix structure/function
- Structure/Function of Biological Membranes: membrane composition including membrane protein structure/function, transport across membranes (including exploration of tonicity, diffusion, osmosis, active vs passive transport, endo- and exocytosis), environmental impact on structure/function of membranes
- Enzymology and Metabolism: energy, chemical reactions, enzyme structure/function, primary metabolism and cellular respiration (glycolysis, citric acid cycle, electron transport), anaerobic respiration and fermentation, introduction to secondary metabolism
- Photosynthesis: chloroplast structure/function, light reactions, Calvin cycle, variations on photosynthesis (C3, C4, CAM reactions), environmental aspects of photosynthesis
- Cell Communication: fundamental concepts in information processing by cells, cell receptors, general properties of signal transduction pathways, basic concepts of hormone signalling, apoptosis

UNIT 3: Molecular and Classical Genetics

- DNA Structure: structure of nucleotides, DNA strands, and the DNA double helix, replication of DNA, telomere structure and function
- Gene Expression at the Molecular Level: gene categories, encoding polypeptides, central dogma of genetics, polypeptides determine phenotypes, transcription, types of RNA, the genetic code, ribosomes, translation
- Gene Regulation: benefits of gene regulation, transcription factors, *lac* operon, negative and positive control, *trp* operon, eukaryotic transcription, combinatorial control, core promoter, transcription factors, DNA methylation, regulation of RNA processing and translation
- Mutation and Cell Cycle Regulation: mutation, DNA repair, cell cycle, checkpoint control, cancer, oncogenes, tumour-suppressor genes
- Chromosomes and Cell Division: Eukaryotic chromosome structure and function, DNA associated proteins, effects of chromosome condensation, mitotic cell cycle, karyotyping, phases of meiosis, synapsis
- Inheritance and Phenotype Determination: Mendel's laws of inheritance, dominance and recessiveness, genotype and phenotype, gene linkage, molecular basis of phenotypic ratios, gene product interactions, organelle genomes, epigenetic effects
- Developmental Genetics: Mutational analysis of animal development, homeotic genes
- Genetic Technology: Gene cloning, gene vectors, genomic and complementary DNA libraries, gel electrophoresis of DNA, polymerase chain reaction (PCR), genomics, proteomics, 2-dimensional electrophoresis of proteins, DNA sequencing, biotechnology and its applications, transgenic organisms, bioremediation, cloning of mammals, DNA fingerprinting, gene therapy in medicine

Textbooks/Readings

Biol102 Course website: via Bio 102 Moodle site: <https://moodle.queensu.ca/>

Course Text (required): *TBA*

Note: Students will also require access to the publisher's website associated with the text.

Department of Biology website: <http://www.queensu.ca/biology/index.html>

Dates and details of readings and assignments will be announced in class and/or posted on the course website in Moodle. Dates and details for lab and/or group activities session assignments will be presented in the labs or the group-learning sessions.

Grading Scheme

Component	Weight (%)	Date
Laboratory Exercises	25%	Various dates TBA
Group Session/Tutorial Assignments	12%	Various dates TBA
Midterm Exam	10%	TBA
IClicker Participation	3%	Used most classes
Online Assignments, Quizzes	13%	Various dates TBA
Final Exam	35%	TBA
Participation (surveys, pretest, etc.)	2%	TBA

Calculator and electronic device policy

No electronic devices (e.g. calculators, cell phones, computers, tablets, etc.) are permitted for the final exam.

Grading Method

Some components (e.g. exams, online quizzes) of this course will receive numerical percentage marks. The final grade you receive for the course will be derived by converting your numerical course average to a letter grade according to Queen's Official Grade Conversion Scale:

Queen's Official Grade Conversion Scale

Grade	Numerical Course Average (Range)
A+	90-100
A	85-89
A-	80-84
B+	77-79
B	73-76
B-	70-72
C+	67-69
C	63-66
C-	60-62
D+	57-59
D	53-56
D-	50-52

F	49 and below
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Other components will receive letter grades, which will be translated into numerical equivalents using the Faculty of Arts and Science approved scale:

Arts & Science Letter Grade Input Scheme

Assignment mark	Numerical value for calculation of final mark
A+	93
A	87
A-	82
B+	78
B	75
B-	72
C+	68
C	65
C-	62
D+	58
D	55
D-	52
F48 (F+)	48
F24 (F)	24
F0 (0)	0

Your course average will then be converted to a final letter grade according to Queen's Official Grade Conversion Scale:

Queen's Official Grade Conversion Scale

Grade	Numerical Course Average (Range)
A+	90-100
A	85-89
A-	80-84
B+	77-79
B	73-76
B-	70-72
C+	67-69
C	63-66
C-	60-62
D+	57-59
D	53-56
D-	50-52
F	49 and below

Academic Integrity and Queen's Code of Conduct

Students are responsible for familiarizing themselves with the regulations concerning academic integrity and for ensuring that their assignments and conduct conform to the principles of academic integrity. Information is available in the Arts and Science Calendar (see Academic Regulation 1 - <http://www.queensu.ca/artsci/academic-calendars/regulations/academic-regulations>, on the Arts and Science website (see <http://www.queensu.ca/artsci/academics/undergraduate/academic-integrity>), and at Biology's website (<http://www.queensu.ca/biology/undergrad/integrity.html>) and from the instructor of this course. Departures from academic integrity include plagiarism, use of unauthorized materials, facilitation, forgery and falsification, and are antithetical to the development of an academic community at Queen's. Given the seriousness of these matters, actions which contravene the regulations on academic integrity carry sanctions that can range from a warning or the loss of grades on an assignment to the failure of a course to a requirement to withdraw from the university.

Accommodation Policy, Exam Conflicts, and Other Conflicts

Students who feel they need accommodations for disabilities or extenuating circumstances, or have a conflict between exams or other commitments should consult the Biology Department's website for details about how to proceed (<http://www.queensu.ca/biology/undergrad/integrity.html>). In general, the earlier a course coordinator is apprised of an extenuating circumstance, the more likely an accommodation can be made. Students are encouraged to be proactive in anticipating difficulties, when it is possible to do so.

Late Policy

Late assignments will be penalized at 5% per day. Consult the Biology Departmental Policy on missed exams and assignments: <http://www.queensu.ca/biology/undergrad/integrity/missexams.html>

Copyright

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Accommodation of Disabilities

Queen's University is committed to achieving full accessibility for persons with disabilities. Part of this commitment includes arranging academic accommodations for students with disabilities to ensure they have an equitable opportunity to participate in all of their academic activities. If you are a student with a disability and think you may need accommodations, you are strongly encouraged to contact the Disability Services Office (DSO) and register as early as possible. For more information, including important deadlines, please visit the DSO website at: <http://www.queensu.ca/hcds/ds/>