Biology 102 – Introductory Biology of Cells
Fall Term (2019)

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

Note:

- Also offered online. Consult Continuing and Distance Studies (CDS).
- Also offered at the Bader International Study Centre, Herstmonceux.
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Prerequisite Recommendation: 4U Biology and Chemistry, or equivalent high school background.

Professors	Dr. W.A. Snedden (co-ordinator) Dr. S. Regan
Lab Instructor	Dr. B. Vanderbeld
Office Hours	Posted in onQ.
Please direct all inquiries to biol102@queensu.ca. For questions about lecture or lab content, please attend the posted office hours (see onQ).	

Learning Objectives

The main goal of Biol102 is to help students develop an understanding of the principle concepts of modern cell biology in an evolutionary context. Material is presented through traditional lectures, guest speakers, independent online exercises, and group-learning sessions (labs). As such, Biol102 is a blended learning course (also known as active learning). For more on blended learning see http://www.queensu.ca/artsci/staff-and-faculty/initiatives/blended-learning. Course topics span organizational levels of biological systems from molecules to whole cells. The course objectives, broadly speaking, are intended to help students understand:

(i) 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) 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 OnQ.

Learning Hours

The table below provides an estimate of hours of study. This is for general reference purposes and is not intended as a precise time allocation, because the nature of course instruction will vary from year to year. A 3.0-unit course normally requires a total of 110 to 130 learning hours (or hours on task) and Biol102 will fall within that window on any given calendar year. It is prudent to keep in mind that time commitment will vary among students depending upon individual aptitude, level of background, etc.

Teaching method	Avg. hours/week	Number of weeks	Total hours
Lecture	2	12	24
Group learning	1.5	8	12
Online activity	1 to 4 (average 2)	12	24
Private study	3 to 7 (average 5)	12	60
Total	**Within typical range of 110 to 130**		

Required Course Material Purchases

The on-line Campbell Biology textbook subscription is **required** (buying the hard copy is **optional**): Campbell Biology, 2nd Canadian Edition, by Reece et al, 2017, published by Pearson. A used copy of the textbook will **NOT** provide you with online access to the textbook website where some quizzes are posted.

- Purchase your online textbook access code through the Queen's Campus Bookstore (https://www.campusbookstore.com/textbooks/textbooks-home). Be sure to choose BIOL 102 (FALL19), which uses the **Campbell** textbook**, AND NOT** BIOL102-700 (SPSU19), which uses the Freeman textbook.
- Lab material (case studies, relevant reading, etc) will be available in OnQ as needed.

Resources

Lecture and Lab material in onQ: https://onq.queensu.ca/d2l/home
Department of Biology website: http://biology.queensu.ca/
Biology Department Student Council: http://www.queensbiology.com/

Course Outline

Course content is divided into three sections, with each section comprised of units/chapters that build upon concepts as we progress through the hierarchy of organization in living systems, from molecules to organisms.

Section 1: Introduction and basic biological chemistry. 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. Potential details are as follows:

- 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, and proteins.

Section 2: Fundamental Cell Biology. Presents an overview of the organization and structure/function relationship of the main components of prokaryotic and eukaryotic cells. This section 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 section. Potential details are as follows:

- Cell Structure and Organization: overview of cell ultrastructure, comparisons of prokaryotic and eukaryotic cells, organelle structure/function, genome and proteome 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.

Section 3: Molecular and Classical Genetics. 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. Potential details are as follows:
- 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.

Late Policy/Missed Tests: Late assignments will be penalized at 5% per day. Follow the procedures outlined in the Biol102 onQ site for additional information.

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

Textbooks Readings/Deadlines: Dates and details of readings and assignment deadlines will be announced in class and/or posted in OnQ.

Grading Scheme

Component	Weight (%)	Date
Labs (includes pre-lab online quizzes and in-lab case studies)	34	TBA
qclicker participation	2%	Used most classes
In-class Group Quizzes	10 (2 x 5%)	TBA
Online Dynamic Study Modules (participation, not graded)	8	weekly
Online Graded Quizzes	12 (4 x 3%)	TBA
Final Exam	34	TBA

Grading Method

All components of this course will receive numerical percentage marks. The final course grade 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)	Grade	Numerical Course Average (Range)	Grade	Numerical Course Average (Range)
A+	90-100	B-	70-72	D+	57-59
A	85-89	C+	67-69	D	53-56
A-	80-84	C	63-66	D-	50-52
B+	77-79	C-	60-62	F	49 and below
B	73-76				

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 conform to the principles of academic integrity. Departures from academic integrity include (but are not limited to) 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 regulation 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.

For more information, please see http://www.queensu.ca/artsci/students-at-queens/academic-integrity

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