

## Biology 102 – Introductory Biology of Cells

Biology 102 (Biol 102): Fall Term, 2016

**Instructors:** Dr. W.A. Snedden (co-ordinator), Dr. C. Moyes, Robert Snetsinger (lab and group-session coordinator)

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Instructor Contact Information: [chris.moyes@queensu.ca](mailto:chris.moyes@queensu.ca), Rm 3121, Bioscience Complex

Office Hours for the course instructors will be posted on onQ.

Course Lab and Tutorial Coordinator: Rob Snetsinger; [snetsing@queensu.ca](mailto:snetsing@queensu.ca)

Office Hours: Rob is best reached by email to arrange a meeting, but is usually in or around his office (Rm. 2322, Biosci) from 9:00 to 11:30am and 1:30 to 3:30pm Monday to Friday.

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

Biol102 Course website: via Bio 102 onQ site: <https://login.queensu.ca/idp/Authn/UserPassword>

**Course Text (required):** **Online subscription (hard copy is optional):** Campbell *Biology, Canadian Edition*, by Reece et al, 2014, published by Pearson (ISBN 10: 032191158X / ISBN 13: 9780321911582)

- Purchase your access code **online** for the textbook through the online Queen's Campus Bookstore (<http://www.campusbookstore.com/>): be sure to choose the ON CAMPUS version
- lab manual material will be made available in OnQ as needed
- An **iclicker** is also **required in class** – marks are associated with its use for interactive questions in class – and these are available at the campus bookstore
  - if you buy a used iclicker, make sure it has been unregistered before you register it – <https://www1.iclicker.com/register-clicker/>
  - 'Turning-Point' clickers will NOT work in Biol102, you must have an iclicker

**Website for textbook online material: this will be integrated into the OnQ site**

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

Biology Department Student Council: <http://www.queensbiology.com/>

<http://www.queensu.ca/biology/biologydsc.html>

### **Main Goals and 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 delivered through a combination of traditional lectures, guest speakers, independent online exercises, laboratory exercises, and group-learning sessions. As such, Biol102 is a blended learning (also known as active learning) course. 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 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 OnQ.

### **Academic Integrity**

Academic integrity is constituted by the five core fundamental values of honesty, trust, fairness, respect and responsibility (see [www.academicintegrity.org](http://www.academicintegrity.org)). These values are central to the building, nurturing and sustaining of an academic community in which all members of the community will thrive.

Adherence to the values expressed through academic integrity forms a foundation for the "freedom of inquiry and exchange of ideas" essential to the intellectual life of the University (see the Senate Report on Principles and Priorities: <http://www.queensu.ca/secretariat/policies/senate/academic-integrity-policy-statement>)

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. Information on Queen's policies on academic integrity is available at: <http://www.queensu.ca/artsci/students-at-queens/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.

### **Copyright of Course Materials**

All material presented from the course is designed for use as part of Biol102 at Queen's University and is the property of the instructor unless otherwise stated. Third party copyrighted materials (such as book chapters and articles) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying this material for distribution (e.g. uploading material to a commercial third-party website) can lead to a violation of Copyright law. Find out more about copyright here: <http://library.queensu.ca/copyright>.

### **Grading Scheme**

Laboratory Exercises and Group Sessions	35%	Various dates TBA
Midterm Exam	10%	Date TBA
Iclicker questions (in-class participation)	3%	Used most classes
Online Assignments, Quizzes	15%	Various Dates TBA
Final Exam	37%	Date TBA

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**

<b>Grade</b>	<b>Numerical Course Average (Range)</b>
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

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**

<b>Assignment mark</b>	<b>Numerical value for calculation of final mark</b>
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**

<b>Grade</b>	<b>Numerical Course Average (Range)</b>
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

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>

Calculator and electronic device policy

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

Textbooks/Readings

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

Course Outline: (see also expanded course content description on next page)

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.

Learning Hours: The table below provides an **estimate** of hours of study for Biol102. 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 Biol102 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.

Teaching method		Average hours per week	Number of weeks	Total hours
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)

## Expanded description of course content:

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.

### **Unit 1: The Chemistry of Life**

- 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: The Cell**

- 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

### **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