

# BIOL 205

Fall Term (2017)

## CALENDAR DESCRIPTION

An introduction to Mendelian and Molecular Genetics covering the basic mechanisms of genetic transmission, gene structure and function, as well as the application of molecular genetics in medicine and biotechnology.

PREREQUISITE A GPA of 1.90 in BIOL 102/3.0 and BIOL 103/3.0.

## SCHEDULE

Please refer to the University Timetable for scheduling details.

<b>Instructor</b>	Ian Chin-Sang
<b>Instructor Contact</b>	chinsang@queensu.ca
<b>Office Hours</b>	TBA
<b>TA:</b>	See Course Website
<b>TA Contact Information</b>	See Course Website
<b>Office Hours</b>	TBA

## Learning Objectives

The Learning objectives of BIOL205 are to:

- Explain the way in which modern genetics developed and how it has influenced modern medicine, agriculture and evolution to gain an understanding of how the scientific method is applied to biological problems.
- Explain inheritance ratios in terms of chromosome behaviour at meiosis to be able to infer genetic interaction of different genes based on modified Mendelian ratios.
- Perform a quantitative analysis of test crosses to assess genetic linkage and mapping of multiple genes.
- Predict the effects of various types of mutations on gene function to propose reasonable hypotheses to explain dominance and recessive phenotypes at the molecular level.
- Explain and differentiate the key features of DNA replication and repair, transcription and protein translation, including cellular constituents involved, in both prokaryotes and eukaryotes to gain an understanding of how genes function.
- Apply knowledge of various molecular genetics methodologies used to analyse DNA, RNA and protein to demonstrate how these molecular techniques are used to understand gene function.

## Learning Hours

<i>Teaching method</i>		<i>Average hours per week</i>	<i>Number of weeks</i>	<i>Total hours</i>
In-	Lecture	3	12	36
	Seminar	NA		

	Laboratory	3	6	18
	Tutorial	3	6	18
	Practicum	NA		
	Group learning	NA		
	Individual instruction	NA		
Other	Online activity	1	12	12
	Off-campus activity	NA		
	Private study	3	12	36
Total hours on task				120

### **Course Outline**

Please see course website for details

#### **Genetics and the questions of biology**

- The molecular basis of genetic information
- The program of genetic investigation
- Methodologies used in genetics
- Model organisms
- Genes, the environment, and the organism

#### **Genes and chromosomes**

- Single-gene inheritance patterns
- The chromosomal basis of single-gene inheritance patterns
- Discovering genes by observing segregation ratios
- Sex-linked single-gene inheritance patterns, Human pedigree analysis

#### **Mendel's law of independent assortment**

- Working with independent assortment
- The chromosomal basis of independent assortment
- Polygenic inheritance
- Organelle genes: inheritance independent of the nucleus

#### **Diagnostics of linkage**

- Mapping by recombinant frequency
- Mapping with molecular markers
- Centromere mapping with linear tetrads
- Using the chi-square test for testing linkage analysis
- Accounting for unseen multiple crossovers
- Using recombination-based maps in conjunction with physical maps

#### **Working with microorganisms**

- Bacterial conjugation
- Bacterial transformation
- Bacteriophage genetics, transduction
- Physical maps and linkage maps compared

#### **Interactions between genes**

- Interactions between the alleles of a single gene: variations on dominance
- Interaction of genes in pathways, Inferring gene interactions
- Penetrance and expressivity

### **Introduction to molecular genetics**

- Molecular developmental genetics
- Why are emerging (bio)technologies often controversial?

### **DNA**

- Structure, replication
- Mutation, repair and recombination
- Induced mutations, repair and cancer, chromosomal aberrations

### **RNA**

- Transcription and Processing
- RNA polymerase and transcription factor assemblages
- Splicing, and non coding RNAs

### **Protein**

- Protein and their synthesis, tRNA, Ribosomes
- The proteome

### **Regulation of Gene Expression**

- Gene regulation in Bacteria, viruses, and Eukaryotes
- Epigenetics, Chromatin remodelling and DNA methylation

### **Recombinant DNA**

- Gene isolation and Manipulation, restriction enzymes, plasmids, restriction enzyme independent cloning, next generation sequencing, RNA Seq.,
- Genome Editing with Crispr Cas9,
- Techniques and applications

### **Genomes and Genomics**

- The Genomics revolution
- Bioinformatics
- Comparative genomics and Human medicine

### **Textbooks/Readings**

Please see course website (onQ)

### **Grading Scheme**

<b>Component</b>	<b>Weight (%)</b>	<b>Date</b>
Midterm Exam	25%	See course website

Quizzes/ In Class response	10%	See course website
Lab, Quizzes and Assignments	40%	See course website
Final Exam	25%	See course website

### **Grading Method**

- In this course, some components will be graded using numerical percentage marks. Other components will receive letter grades, which for purposes of calculating your course average will be translated into numerical equivalents using the Faculty of Arts and Science Letter Grade Input Scheme.

When letter grades are employed, the following scale will be employed for purposes of calculating your course average:

#### ***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

### **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.

Students may apply to write a make-up or deferred exam if they have an exam conflict as defined in the Academic Regulations of the Faculty (See Arts and Science Calendar Regulation 8 - <http://www.queensu.ca/artsci/academic-calendars/regulations/academic-regulations>). In this case, the student should report to the Exams Office first to verify that there is a genuine exam conflict. Biology professors will not consider your situation to be a conflict unless it meets the criteria set out by the Faculty of Arts and Sciences.

Students may request a make-up or deferred exam if they have an exam conflict with off-campus travel associated with a field course (e.g BIOL-307/3.0 or 407/3.0) that is held during the fall or winter terms.

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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/>*