

BIOL 205

Fall Term (2022)

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.

Instructor	Dr. W. Bendena
Instructor Contact	bendenaw@queensu.ca
Office Hours	TBA
Tutorial Instructor	Dr. H. Teresinski
Tutorial Instructor Contact	hjt@queensu.ca
Office Hours	TBA
TA:	See Course Website
TA Contact Information	See Course Website

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 behavior 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	NA		
	Tutorial	1.5	8	12
	Practicum	NA		
	Group learning	NA		
	Individual instruction	NA		
Other	Online activity	1.5	12	18
	Off-campus activity	NA		
	Private study	4.5	12	54
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

Component	Weight (%)	Date
Midterm Exam	30%	See course website
Quizzes/ In Class response	15%	See course website
Tutorial Assignments	25%	See course website
Final Exam	30%	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

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 - <https://www.queensu.ca/academic-calendar/arts-science/admission-regulations/>), on the Arts and Science website (see <https://www.queensu.ca/artsci/undergrad-students/student-services/academic-integrity>), 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.

Consideration Policy, Exam Conflicts, and Other Conflicts

Queen's University is committed to providing academic consideration to students experiencing extenuating circumstances that are beyond their control and are interfering with their ability to complete academic requirements related to a course for a short period of time. For more information, please see the [Senate Policy on Academic Consideration for Students in Extenuating Circumstances](#).

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 - <https://www.queensu.ca/academic-calendar/arts-science/admission-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.

Each Faculty has developed a protocol to provide a consistent and equitable approach in dealing with requests for academic consideration for students facing extenuating circumstances. Arts and Science undergraduate students can find the Faculty of Arts and Science protocol and the [portal where a request can be submitted](#). Students in other Faculties and Schools who are enrolled in this course should refer to the protocol for their home Faculty. For this course, please be sure to use the following email address: biol205@queensu.ca when submitting a consideration request. For further guidance on submitting requests, please see refer to the Resource Guides available on the [Academic Consideration website](#) under "Applying for Academic Consideration."

Copyright

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Academic Accommodation Policy

Queen's University is committed to achieving full accessibility for all students. 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. The Senate Policy for Accommodations for Students with Disabilities was approved at Senate in November 2016.

If you are a student with a disability and think you may need academic accommodations, you are strongly encouraged to contact the Queen's Student Accessibility Services (QSAS) and register as early as possible. For more information, including important deadlines, please visit the QSAS website ([click here](#)).