

BIOL 205

Mendelian and Molecular Genetics

Fall Term (2014-15)

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

Lecture 001: Monday 11:30-12:30pm, Tuesday 1:30-2:30pm, Thursday 12:30-1:30pm. BIOSCI AUD.
Lecture 002: Tuesday 11:30-12:30pm, Wednesday 1:30-2:30pm, Friday 12:30-1:30pm. BIOSCI AUD.

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|-------------------------------|--|
| Instructor | Dr. I. Chin-Sang and Dr. Wm. Bendena |
| Instructor Contact | (chinsang@queensu.ca – Phone 613-533-6124) (William.bendena@queensu.ca – Phone 613-533-6121) |
| Office Hours | E-mail instructors for appointments |
| TA: | See Course Website |
| TA Contact Information | See Course Website |
| Office Hours | See TA in assigned lab section |

Learning Objectives

The goals of Biology 205 is to make genetics understandable, demonstrate its relevance, and to improve students' critical thinking skills. We don't want students just memorizing concepts without understanding how experiments are done and why they are done that way. This is probably not your first exposure to genetics analysis, but there will be new concepts you haven't learned so we will provide the necessary background such that you can understand these concepts. The second half of the course will focus on the molecular mechanisms that explain genetic principles. Students are expected to read the assigned readings and are encouraged to ask questions in lectures.

Learning Hours

| <i>Teaching method</i> | | <i>Average hours per week</i> | <i>Number of weeks</i> | <i>Total hours</i> |
|------------------------|----------------|-------------------------------|------------------------|--------------------|
| In-class hours | Lecture | 3 | 12 | 36 |
| | Seminar | 0 | na | na |
| | Laboratory | 3 | 12 | 36 |
| | Tutorial | TBD | | |
| | Practicum | TBD | | |
| | Group learning | TBD | | |

| | | | | |
|---------------------|------------------------|-----|----|----|
| | Individual instruction | TBD | | |
| Other | Online activity | 1 | 12 | 12 |
| | Off-campus activity | TBD | | |
| | Private study | 1 | 12 | 12 |
| Total hours on task | | | | 96 |

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 (the truth behind how Woody Guthrie died)

Induced mutations, repair and cancer; chromosomal aberrations

Recombinant DNA

restriction enzymes; plasmids; phage blue/white screening; Northern; Southern; in situ, Microarrays

RNAi and PCR

technique and applications - from genetic testing, forensics, phylogenetics to multiplex PCR

Sequencing

Sanger method in depth; Human genome project - additional genome projects of interest; Pyrosequencing versus Illumina/Solexa sequencing

Transcription

RNA polymerase and transcription factor assemblages; DNA methylation; Splicing

Genes involved in developmental pattern formation**The highlights of protein synthesis and its regulation****Textbooks/Readings**

See course website

Grading Scheme

| Component | Weight (%) | Date |
|---------------------------|-------------------|--------------------|
| Midterm exam | 25 | See course website |
| Quizzes | 10 | See course website |
| Lab Report/Assignments | 30 | See course website |
| Lab Quizzes | 10 | 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

| 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.

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/>