

MGY314H

Principles of Genetic Analysis I

Bacterial Genetics



Sep. 5 to Nov. 28, 2019

Genetics is an experimental science. MGY314H is a laboratory course in bacterial genetics; you will perform several experiments over the 12-week period. You will carry out a variety of crosses, mutant hunts, and phenotypic characterization in bacteria, and learn to analyze and interpret the genetic data that you obtain. Most of your time will be in the lab, with some informal tutorials to discuss experimental results and to supplement your understanding of genetics.

The emphasis in MGY314H is to learn the concepts of genetics; how to apply them and how to interpret them. The model we use in this course is *Escherichia coli*, which is the best studied gram-negative bacterial species. It is often the model of choice in the study of more harmful bacterial species because many principles of its biology apply to all bacteria (and in fact, to all organisms). It is also the organism that the scientific world uses for molecular biology, and much of the original genetics defined in *E. coli* has led to important tools for diagnosis and scientific research.

Date, Time and Location:

Thursdays, 1:10 - 5 pm.

Medical Sciences Building (MSB), Rm 3280, 3282 & 3379

Instructor:

Prof. Barbara Funnell
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Rm 1632, MaRS West Tower (661 University Ave)
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Prerequisites: BIO230H/BIO255H, BIO260H/HMB265H (or equivalents)

Required Textbook: Because MGY314 is a lab course with no lectures (there are some informal tutorials), the genetics textbook is essential to understand the biology and concepts behind the experiments you will perform. It also helps to keep your lecture notes from BIO260/HMB265 handy. The textbook should be available from the U of T bookstore or (used) from former students, and e-versions from ASM:

Molecular Genetics of Bacteria, 4th edition, Snyder, L., Peters, J.E., Henkin, T.M., and Champness, W. American Society for Microbiology (ASM) Press, 2013.

Schedule 2019

<u>LAB</u>	<u>DATE</u>	<u>DESCRIPTION</u>
1.	Sept. 5	Orientation & Experiment #1: <u>Experiment 1:</u> Genetic Suppression: analysis of bacteriophage mutants on different hosts
2.	Sept.12	<u>Experiment 1,</u> conclusion: data collection <u>Experiment 2:</u> Measuring Genetic Distance: Genetic crosses by transduction
3.	Sept. 19	<u>Experiment 2,</u> continued: purification of transductant progeny <u>Tutorial:</u> genetic concepts and definitions, revisited
4.	Sept. 26	<u>Experiment 2,</u> continued: linkage analysis (cotransduction tests) <u>Experiment 3:</u> Mutations in <i>E. coli</i> affecting β -galactoside metabolism and infection by bacteriophage λ : Isolation of transposon insertion mutations and mutant selection
5.	Oct. 3	<u>Experiment 2,</u> conclusion: data collection <u>Experiment 3,</u> continuation: Isolation of Lac^- and λ^r mutations
IMPORTANT: FRIDAY Oct. 4: isolation of Lac^- mutations, continued (approx. 30-60 min)		
6.	Oct. 10	<u>Experiment 3,</u> continued: isolation of pure mutant colonies <u>Experiment 4:</u> Part I - genetic complementation: phage isolation Tutorial (pre-quiz review)
7.	Oct. 17	Quiz: 1 hr, 15% of final mark <u>Experiment 3,</u> continued: phenotype tests and marker confirmation
8.	Oct. 24	<u>Experiment 3,</u> conclusion: data collection <u>Experiment 5:</u> Conjugal genetic transfer in <i>E. coli</i> K12: Mapping chromosomal markers by assay of recombinants after disruption of donor and recipient cell mating pairs
9.	Oct. 31	<u>Experiment 4,</u> part II: complementation of mutant phage by recombinant plasmids <u>Experiment 5:</u> conclusion: data collection and data analysis <u>Tutorial:</u> test review session
Reading week, no lab: Nov.8		
10.	Nov. 14	<u>Experiment 4:</u> conclusion: data collection <u>Experiment 6:</u> Regulation of β -galactosidase synthesis in wild-type and mutant <i>E. coli</i> . <i>Part I:</i> the lac operon

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| 11. | Nov. 21 | <u>Experiment 6, conclusion</u> : Regulation of β -galactosidase synthesis.
<i>Part II</i> : Using <i>lacZ</i> as a reporter for gene expression |
| 12. | Nov. 28 | Data analyses, problem set and review for final exam |
| Dec exam period
(Dec 7-20) | | Final exam: (35% of final mark)
date TBA |

MGY314H 2018 Marking Scheme

Lab Reports	40%
Participation	10%
Quiz (Oct. 17 in class)	15%
Final exam (2 hr) (Dec 7-20)	35%

(last day to drop MGY314H is Monday, Nov. 4, 2019)

Lab manual

You are required to purchase the lab manual from us (the photocopying cost), which will be available at the first lab. The exact price will be posted several days ahead of the lab, but should be approx. \$8.

Work Load

The lab periods are scheduled for 4 hours per week (1 – 5 pm Thursdays). This includes the experiments as well as some tutorials and problem sessions to discuss the genetics. We assume that all of you took genetics last year or in a previous year: for most of you this will have been either BIO260H1 or HMB265H1. The information you learned in these courses will be essential to understanding the biology of MGY314H, so keep your lecture notes handy. They will be an essential resource.

Students work in pairs and perform most of the experiments jointly unless instructed otherwise, but each individual is responsible for the preparation of his or her own lab report. There will be occasions when students are expected to come to the laboratory for a brief period outside of the lab period (see the schedule), to carry out the next step in an experiment.

You must prepare for each lab by reading the appropriate section in this lab manual *before* you come to the lab. In addition, there will be readings in the textbook (specific parts will be listed at the start of each experiment in the lab manual), and you must read these also. If you are prepared, you will be able to complete each exercise in the lab period.

Each student will be required to submit a report on each of the experiments completed in class. Lab reports are usually due one week after the experimental results have been obtained (due dates will be listed in the lab manual).