

GENETICS

Objectives

- Learn the principles of genetic segregation
- Learn how to analyze genetic segregation data
- Learn the concepts of molecular genetics and how molecular approaches are furthering our knowledge and understanding of gene function
- Learn about the applications of molecular genetics techniques to genomics, genetic engineering, and medicine

The Easiest Route to Success

- Attend the lectures and lab lectures.
- Read the textbook material assigned for a lecture *before* the lecture.
- Take *good* notes on the material presented in lectures and lab lectures.
- Review your lecture notes soon after each lecture to be sure you understand the material; if not, try to clarify your understanding either from the text or by asking questions of me, Carey, or the biology tutors.
- Review the assigned textbook material after the lectures and integrate your understanding of that material with what you have learned in the lectures.
- Form study groups to discuss the material.
- Test your understanding by answering questions at the backs of the assigned chapters.
- Understand that you cannot learn this block of material by cramming in the days before the exam.

Talking With Me

Office is B106—enter through my lab., B104. I have no specific office hours but am here all day every weekday and am happy to have you drop in to ask questions. If you want a specific appointment, we can do that too. Times I am never available due to other teaching duties and other activities are Mon 800am–1000am, and each weekday ~1100am–130pm.
email is yeast@reed.edu—I will answer your questions as quickly as possible

Exams

- The midterm and final exams for the genetics component of this course will consist mostly of problem-solving questions (a traditional way to test understanding of genetics and molecular genetics, particularly of the gene segregation material), and shortish answer questions seeking your understanding of genetic and molecular processes and their applications.
- There will be no multiple choice, odd-one-out, or compare/contrast questions.
- No document will be available summarizing what you should review for the exam. In other words, the "Study Guide" for the exams for this section is the material I present in lectures and lab lectures (i.e., your lecture notes) plus the coverage of the same material in the textbook.

Topics and Textbook Reading

All reading assignments for this section are from:

BIOLOGY: THE DYNAMIC SCIENCE (1e) by Peter Russell, Stephen Wolfe, Paul Hertz, Cecilie Starr, and Beverly Macmillan © 2008, Brooks/Cole.

PREVIOUSLY PRESENTED TOPICS

Material in this section builds on facts and concepts presented in the fall semester of the course. If you do not remember that material, you should review it from the book. The key topics I am talking about here are:

- Cell structure: prokaryotic cells; eukaryotic cells (nucleus, organelles, endomembrane system, mitochondria, microbodies, cytoskeleton, flagellae, cilia); specialized features of plant cells
- Reading: the above topics in Ch 5
- Membranes and transport: membrane structure; passive transport; active transport; exocytosis and endocytosis
- Reading: the above topics in Ch 6
- Mitosis
- Reading: Ch 10, pp. 203-208
- Meiosis
- Reading: Ch 11, pp. 222-227
- Molecular genetics: Jay Mellies covered some core material in molecular genetics, namely evidence that DNA is genetic material, DNA structure, DNA replication, transcription, genetic code, and translation. I will revisit these topics in this section as part of our focus on gene structure and function. My coverage overlap Jay's to some extent. The readings for this material are below.

LECTURE INFORMATION AND READING ASSIGNMENTS

We will go through most of the core genetics/molecular chapters in the book. *To prepare for the recombinant DNA labs in weeks 2-4, some material in Chapter 18 will be presented mostly in the lab lectures.* It is impossible to tell you *exactly* which topics will be in each lecture day. Therefore, the list below is an approximate guide. Assume that we are moving through the chapters in order (with the above-mentioned exception) and then you can read ahead with that in mind. The index of the textbook is also a useful resource for finding specific topics.

Note that lecture PowerPoint slides will not be put on the Courses Server. Most of the images are from the textbook so it might be helpful to note in your lecture notes the sources of the slides when they are shown.

<u>Topic</u>	<u>Reading</u>
<u>Lab Lecture 1 + Lectures 1 and 2</u>	
Mendelian genetics: single-gene and two-gene inheritance; genes and chromosomes	Ch 12: 235-245
Genetic linkage and sex-linked genes	Ch 13: 255-266
Additions and modifications to Mendel's principles: incomplete dominance; codominance; multiple alleles; epistasis; polygenic inheritance; pleiotropy	Ch 12: 245-252
Chromosomal alterations that affect inheritance	Ch 13: 266-269
Human genetics	Ch 13: 269-272
X chromosome inactivation in female mammals	Ch 13: 264-266

Nontraditional patterns of inheritance: cytoplasmic inheritance;
genomic imprinting

Ch 13: 272-274

Lectures 3-7

DNA Structure, Replication, and Organization

Ch 3: pp. 64-67

Ch 14: all (pp. 277-300)

Protein structure

Ch 3: pp. 55-64

From DNA to Protein (Gene Expression)

Ch 15: all (pp. 301-328)

Regulation of Gene Expression in Prokaryotes

Ch 16: pp. 329-335

Regulation of Transcription in Eukaryotes

Ch 16: pp. 335-345

Developmental Genetics

Ch 48: pp. 1115-1122

Genetics of Cancer

Ch 16: pp. 345-348

Lecture 8

Applications of DNA technologies (some) and genomics

Ch 18: p. 379 on

Lab Lectures 2-4

DNA Technologies and Genomics—cloning and analysis of genes

Ch 18: first section, plus some of 2nd

Recommended Web Sites with Genetics-Related Material

"DNA From The Beginning" – an animated primer on the basics of DNA, genes, and heredity

<http://www.dnafb.org/dnafb/>

"Morgan: A Genetics Tutorial" – a multimedia tutorial on the principles of genetics, including molecular genetics

http://morgan.rutgers.edu/MorganWebFrames/How_to_use/HTU_Frameset.html

"Online Mendelian Inheritance in Man (OMIM)" - a very current catalog of human genes and genetic disorders

<http://www.ncbi.nlm.nih.gov/omim>

"Virtual Library on Genetics" – many links

http://www.ornl.gov/sci/techresources/Human_Genome/genetics.shtml

"Genetics News" – a daily update of advances in genetics research; basically reporter-written summaries of just published research papers.

http://www.sciencedaily.com/news/plants_animals/genetics/

Peter Russell, Jan 2010