

## 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

### What *You Can Do To Learn The Most From This Section*

- Attend the regular lectures and lab lectures.
- Read the textbook material assigned for a lecture *before* the lecture.
- Focus on the material being presented during lectures and lab lectures.
- Take *good* notes on the material presented in lectures and lab lectures.
- Review your lecture notes 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.

Basically, you need to build your knowledge and mastery of genetics/molecular genetics as we go through the section. Material presented in one lecture is a foundation for the next lecture and so on—lectures are *not* a string of unconnected topics. Hence, it is important that you come to that next lecture with a clear understanding of the previous lecture or lectures. A lot of material—several chapters' worth—is covered in this four-week section of the course. Cramming for the 'exam' will not substitute for progressive learning of the material throughout the section.

### 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. 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.
- There will be no document summarizing what you should review for the exam. Simply stated, you need to understand the material I present in lectures and in lab lectures plus the coverage of the same material in the textbook.

### Topics and Textbook Reading

All reading assignments for this section will be from:

**BIOLOGY: THE DYNAMIC SCIENCE**, Volume 1 by Peter Russell, Stephen Wolfe, Paul Hertz, Cecilie Starr, and Beverly Macmillan © 2008, Thomson-Brooks/Cole. Volume 1 is the first 18 chapters of the complete book.

Each of you has been loaned a copy of the book to use during the section, and in your preparation for the final. *We will collect the book from you at or before the time of the final so that students next year can use it.*

### Reviewing Previously Presented Topics

Topics have been presented in previous sections of the course that are also traditionally part of the coverage of genetics. Please review those topics from your lecture notes and from a textbook as necessary to be confident that you understand them and so that we can build on them. The topics were as follows with chapter and pages for BIOLOGY (Russell 1E) and for LIFE (Sadava 8E)—RK = R. Kaplan, KK = K. Karoly, and JM = J. Mellies:

- Cell structure (animal and plant) [KK]: Ch 5, pp. 92-104 (Sadava, Ch 4, pp. 72-86)
- Mitosis [KK]: Ch 10, pp. 203-208 (Sadava, Ch 9, pp. 181-193)

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| - Meiosis [KK]:                            | Ch 11, pp. 222-227 (Sadava, Ch 9, pp. 195-202)            |
| - Basic gene segregation principles [RK]:  | Ch 12, pp. 236-239 & 243-245 (Sadava, Ch 10, pp. 207-215) |
| - DNA structure [KK, JM]:                  | Ch 14, pp. 281-284 (Sadava, Ch 11, pp. 234-241)           |
| - Transcription, translation [RK, KK, JM]: | Ch 15 (Sadava, Ch 12)                                     |

In my section, I will cover gene segregation principles, DNA structure, transcription, the genetic code and translation with the assumption that you have learned *some* of the material in those previous sections, although you may not remember all the key concepts. Some overlap with the presentations made in those sections will be necessary.

### 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 a 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.

#### Topic

#### Reading from Russell BIOLOGY

##### Lab Lecture 1 + Lectures 1 and 2

|   |                |
|---|----------------|
| Mendel, Genes, and Inheritance: 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

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|--|---|
| Cell structure and function (brief review)   | Ch 5, pp. 92-104                            |
| DNA Structure, Replication, and Organization | Ch 3: pp. 64-67<br>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)                    |
| Control of Gene Expression                   | Ch 16: all (pp. 329-350)                    |

##### Lecture 8

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|--|------------------|
| Applications of DNA technologies (some) and genomics | Ch 18: p. 379 on |
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##### Lab Lectures 2-4

|   |  |
|---|--|
| DNA Technologies and Genomics—cloning and analysis of genes | Ch 18: first section, plus some of 2nd |
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If you wish also to read the equivalent material in Sadava 8e, use the Table of Contents in the front of the book and the Index at the back of the book to find it.

### **Recommended Web Sites with Genetics-Related Material**

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

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

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

[http://morgan.rutgers.edu/MorganWebFrames/How\\_to\\_use/HTU\\_Frameset.html](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 at

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

"Virtual Library on Genetics" – many links at [http://www.ornl.gov/sci/techresources/Human\\_Genome/genetics.shtml](http://www.ornl.gov/sci/techresources/Human_Genome/genetics.shtml)