Chapter 13: Meiosis and Sexual Life Cycles

The big picture: we are embarking on the study of genetics. Therefore, it is important to to begin with a basic understanding of the mechanisms by which genes are passed from one generation to another. In the case of sexually reproducing organisms, these mechanisms take place during the production of reproductive cells by meiosis.

Look at Fig 46.12 (p. 1006-7) to see meiosis in the context of the human sex organs.

13.1 Offspring acquire genes

- This is basic foundation. All of it is important.

13.2 Fertilization and Meiosis alternate

- In Figure 13.6, disregard b) and c) for now. We'll return to this later in the course
- Notice that Fig 13.5 is meant to represent the same thing as Fig 13.6 a)
- All of this vocabulary is important (except *alternation of generations*--this is for later). If you do not use the words correctly, you will not communicate understanding of concepts. Practice.

13.3 Meiosis reduces the number of chromosome sets
An animation recommended by Ms. Purdy http://www.youtube.com/watch?v=D1_-mQS_FZ0

- I am not a big fan of Fig 13.9. Think of it this way:
    - Meiosis I is unique in comparison to mitosis.
    - The purpose of meiosis I is to reduce the chromosome number from diploid to haploid
    - Meiosis II is exactly the same process you learned in mitosis
    - The purpose of meiosis II is to separate sister chromatids

13.4 Genetic Variation

- All of this is important.
- Be able to talk yourself through a comparison between possibility 1 and 2 in fig. 13.10.
- For fig 13.11 be able to use some additional vocabulary: tetrad, chiasma
- recognize that crossing over involves enzymatic "cutting and pasting" of the DNA strands to achieve new combinations of genes on each member of a homologous pair of chromosomes.

Chapter 14: Mendel and the Gene Idea

14.1 Mendel's Laws

- All of the vocabulary is essential
- Distinguish clearly between the Law of Segregation and the Law of Independent Assortment:
    - The Law of Segregation is describing the distribution of two allele for *a single trait*

to separate gametes in the course of meiosis
    - The Law of Independent Assortment is describing the distribution of alleles for *different traits* located on *different chromosomes* to separate gametes in the course of meiosis
- Note that if two genes are on the same chromosome and crossing over occurs between them, the inheritance of traits in the next generation may suggest independent assortment, **however**, the ratio of phenotypes will not match that predicted by true independent assortment

14.2 Laws of Probability

Do not try to memorize the law of probability unless they are logical and useful to you. Any genetics problem that you face can be solved by reasoning through the process of meiosis and random fertilization. Choose the problem solving method that is most intuitive for you.

14.3 Inheritance Patterns

All of this is important.

14.4 Human Traits

- It is not necessary to memorize the inheritance patterns of the human traits that are discussed here. However, if you are able to learn them, it may make you more time efficient when it comes to answering questions are the unit test and on the AP exam.
- Make sure you are comfortable interpreting pedigrees such as those in fig 14.15. Notice that the shading of the circles and squares shows phenotype, not genotype. Try the practice problem on p. 285.

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There is a very useful summary table of inheritance patterns in the chapter review on p. 282. Don't overlook it.

Chapter 15: The Chromosomal Basis of Inheritance

Big Picture: We have been talking about chromosomes all along, so much of this chapter will come across as a review or an extension of what has already been discussed. Don't rush through this. Use it as an opportunity to identify misconceptions, correct them and deepen your understanding.

15.1 Mendelian Inheritance

- Fig 15.2 shows the diagrams I asked you to produce for homework last week.
- notice that when we changed model organisms from peas to flies we got a new system for abbreviating traits
    - the letter (or letters) represents a mutant phenotype observed
    - if the letter is lowercase, the mutant is recessive to wild type
    - if the letter is uppercase, the mutant is dominant to wild type (notice that a mutant is not *always* recessive)

    - wild type is represented as a + superscript to the letter for the first mutant phenotype observed
    - Example: w^+ represents red eyes (wild type) in fruit flies. White eyes were the first mutant and they are recessive to wild type

15.2 Sex-linked Inheritance

- The only pattern of sex determination that you have to know is human. However, it is important to know that there is variety among all animal species.
- Though we refer to all of the genes on the X chromosome as 'sex-linked', realize that this is not meant to imply that only the X chromosome bears genetic information. It's just that there is nothing interesting to discuss about the inheritance pattern of genes on the Y chromosome: 100% of the genes on the Y are passed from the father to all of his sons and none of his daughters.
- As with classically inherited human traits, it is not necessary to memorize the sex-linked disorders, but if you do, it might help you answer questions faster
- the phenomenon of X inactivation is worth knowing something about

15.3 Linked genes

- To my knowledge, no one uses recombination frequency to determine the order of genes on a chromosome any more. However, I think you should understand how this works in order to develop an understanding of the implication of crossing over for generating diverse combinations of phenotypes in the offspring
- The most challenging thing to do is to reliably identify the recombinants: recombinants are offspring with combinations of traits that were not observed in either parent

15.4 Alterations of chromosome number or structure

- Although the emphasis here is on disorders, it is important to know that when such changes are not severely detrimental to an individual, these mechanisms can be yet another way to introduce variation into a population

15.5 Some inheritance patterns are exceptions

- Worth knowing. In my opinion, both of these topics are understudied and there is far more to learn than what is presented in these few paragraphs.