CONCEPTS (last time):

1. MEIOSIS SPLITS NUMBER OF CHROMOSOMES IN HALF "**HOMOLOGOUS CHROMOSOMES**"
2. GENETIC VARIATION DUE TO **CROSSING OVER** AND **INDEPENDENT ASSORTMENT** OF CHROMOSOMES

Meiosis splits # of chromosomes in half:DNA is replicated first, in S phase

- 2 divisions, resulting in 4 haploid cells
- **Homologous chromosomes** align on metaphase plate, are pulled to opposite ends- Meiosis I
- **Sister chromatids** are pulled to opposite ends of the cell in Meiosis II

Anaphase/Telophase

- Organism has three sets of homologous chromosomes
- N = 3 (haploid); 2N = 6 (diploid)
- Haploid cells do not contain just maternally inherited (red) or paternally inherited (blue) chromosomes
- Individiual chromsomes are mixed, and gamete cells have both maternally derived and paternally derived chromosomes

Mechanisms that mix chromosomes in gamete formation:

–Crossing over

–Independent assortment of chromosomes

Crossing Over

- Prophase I: homologous chromosomes pair up gene by gene
- DNA is swapped between **homologous chromosomes**
- DNA from two parents combines into a single chromosome

Independent Assortment of Chromosomes

- Homologous pairs of chromosomes orient randomly - metaphase I
- Homologous chromosomes sort into daughter cells independently
- 2^n possible combinations (n= haploid #)

Mendelian Genetics:
Vocabulary & Figures

- Character, trait (allele vs. gene)
- Genotype, phenotype
- Dominant alleles, recessive alleles
- Law of segregation
- Homozygous vs. heterozygous
- Punnett Square, test cross
- P, F1, F2 generations
- Chapter 14, Figures 14.2, 3, 5

CONCEPTS:

1. Four tenets of Mendel's Model (and how these apply to what we have already learned about meiosis and inheritance)

2. The use of Punnett squares to calculate probability of genotypes and phenotypes in mating

Mendel revealed the <u>observable</u> implications of meiosis- long before anything was known about DNA or chromosomes

Four tenets of Mendel's Model:

1) Alleles, which are alternative versions of genes, account for variations in characters, called "traits"
i.e., there is a relationship between genotype (genetic make-up) and phenotype (appearance).

Sickle cell disease: Relationship between genotype (hemoglobin mutation) and phenotype (sickle cell disease)

Genotype : Genes : Alleles AS Phenotype : Characters : Traits

2) For each character, organisms inherit 2 alleles- one from each parent.

Alleles are found on homologous chromosomes, one of each pair comes from each parent

3) If the alleles on homologous chromosomes differ (**heterozygous**), the **dominant** allele determines the appearance

i.e., in heterozygotes, the **recessive** allele has no impact on appearance

A letter represents the allele; **dominant** alleles are CAPITAILIZED, **recessive** allele are lowercase

For example, genotype:

R, r = hemoglobin alleles

R = normal
r = mutated

R is dominant
r is recessive

Phenotype:
RR, **Rr**: normal, **rr**: sickle cell

4) The law of segregation: Alleles segregate during gamete formation: Meiosis I

Possible gamete combinations can be shown using a Punnett square

COMMON MISCONCEPTIONS!!
Look out for these common misunderstandings

a. Chromosomes with a single unreplicated chromatid are found in haploid cells; replicated chromosomes with two chromatids are found in diploid cells. NOT SO!!!!
b. Chromosomes consisting of two chromatids are formed when a maternal chromatid and a paternal chromatid come together during fertilization and join at the centromere. NOT SO!!
c. Dominant alleles are more likely to be **inherited** than recessive alleles. NOT SO!!
d. All dominant alleles are found at greater frequency than recessive alleles in populations. NOT SO!!
e. All mutations are recessive. NOT SO!!
f. All recessive alleles are deleterious NOT SO!!