Chapter Five: Heredity
Teacher Notes

Lesson One: Mendel and His Peas

-Who Was Gregor Mendel?
- -Heredity-the passing of genetic traits from parent to offspring.
- -born in 1822 in Heinzendorf, Austria
- -at 21 he entered his monastery; there he conducted and taught science

-Unraveling the Mystery
- -Self-Pollinating Peas
  - -Pea plants were good for several reasons-they grow quickly, there are many kinds, they also self-pollinate.
  - -Self-pollinating plants have both male and female parts
    - -eggs-ovules
    - -sperm-in pollen
    - -self-pollinating plants produced true-breeding plants-a plant that has the same offspring as its parents.
    - -cross-pollinating-pollen from one plant fertilizes the ovule of a flower on a different plant.
      - -pollen many be carried by insects
      - -pollen can be carried by wind
- -Characteristics-a feature that has different forms in a population
  - -studied only one characteristic at a time
  - -traits-different forms (examples brown or red hair)
  - -Mendel studied seed shape, plant height, and flower color
- -Mix and Match
  - -Mendel was careful to use true breeding plants for traits that he studied
  - -Mendel would remove the anther from one plant so it couldn't self-pollinate; he would then select which plants to cross.

-Mendel's First Experiments
- -At first he croseed pea plants to study 7 different characteristics.
  - -He would cross purple flowers with white flowers and the result would be purple.
  - -first generation plants-the result of the cross between the purple and white flower cross.
  - -Dominant Trait-the trait observed in the first generation when parents that have different traits are bred.
  - -Recessive Trait-a trait that reappears in the second generation after disappearing in the first generation when parents with different traits are bred.

-Mendel's Second Experiments
- -Mendel allowed the first generation to self-pollinate-the result was 3 purple flowers and 1 white flower.
- -Ratios in Mendel's Experiments-Mendel found the ratio of dominant to recessive to always be in the same ratio; 3 to 1.
- -Gregor Mendel-Gone but Not Forgotten

-Mendel's work was forgotten until about 30 years after his death.
-This opened the door to the study of genetics

Lesson Two: Traits and Inheritance

-A Great Idea
-Genes-One set of instructions for an inherited trait
-each parent gives one set of genes to each offspring
-Alleles-One of the alternative forms of a gene that governs a characteristic such as hair color. Dominant are should with capital letters, recessive are shown with lowercase letters.
-Phenotypes-a organism's appearance or other detectable characteristic.
-examples-flower color
-In humans this is more complicated; example is albinism or an inherited condition that causes hair, skin, and eyes to not have normal coloring.
-Genotypes-the entire genetic makeup of an organism; also the combination of genes for one or more specific traits.
-homozygous-a plant with two dominant or two recessive alleles
-heterozygous-a plant with one dominant and one recessive allele.
-Punnett Squares-used to organize all the possible combinations of offspring from particular parents.
-What are the Chances?-the chance when the two alleles are different is 50% to 50%
-Probability-the likelihood that a possible future event will occur in any given instance of the event.
-More About Traits
-Incomplete Dominance-when neither trait has a complete dominance.
-example-crossing a white flower and red flower and the result being a pink flower.
-One Gene, Many Traits
-one gene may control more than one trait
-example-fur color gene may also be the gene that determines eye color.
-Many Genes, One Trait
-some traits are determined by several genes working together
-examples-skin color, hair, and eyes
-The Importance of Environment
-fur could be cut, having a poor diet could affect your height

Lesson Three: Meiosis

-Asexual Reproduction-only one parent cell is needed
-structures inside the cell are copied and then the parent cell divides making two exact copies. This is known as mitosis,
-most cells in the human body reproduce this way; single-celled organisms reproduce this way.
-Sexual Reproduction-two parent cells join together to form offspring that are different than both parents. The parent cells are called sex cells. Human sex cells only contain 23 chromosomes (compared to 46 chromosomes in other body cells)

-Homologous Chromosome-chromosomes that have the same sequence of genes and the same structure.

-Meiosis-a process in cell division during which the number of chromosomes decreases to half the original number by two divisions of the nucleus, which results in the production of sex cells.

-Genes and Chromosomes-Walter Sutton took Mendel's research to try to find out where genes were located. He determined that genes were located in chromosomes.

-The Stages of Meiosis

1) Before meiosis begins, chromosomes are in threadlike form. Chromosome makes exact copy of itself forming two halves called chromatids. Chromosomes then thicken and shorten.

2) Similar chromosomes pair with one another, and the paired homologous chromosomes line up at the equator of the cell.

3) Chromosomes separate from their homologous partners and then move to opposite ends of the cell.

4) Nuclear membrane re-forms, and the cell divides (paired chromatids are still joined)

5) Each cell contains one member of each homologous chromosome pair. The chromosomes are not copied again between the two cell divisions.

6) Chromosomes then line up at the equator of each cell.

7) Chromatids pull apart and move to opposite ends of the cell. Nuclear membrane forms around the separated chromosomes, and the cell divides

8) 4 new cells have formed from the original single cell. Each new cell has half the number of chromosomes present in the original cell.

-Meiosis and Mendel

-Sex Chromosomes-pair of chromosomes that determines the sex of an individual.

-females –XX; males – XY; males determine sex since mother always gives an X.

-Sex linked Disorders

-Y chromosome doesn't carry all the genes of an X chromosome

-Most sex-linked disorders are on the X chromosome.

-Males are more often affected because females have an X backup (they have two X's)

-examples-colorblindness, hemophilia

-Genetic Counseling-people who worry they may pass a disease to their children may consult a genetic counselor. These counselors often make a pedigree.

-Pedigree-a diagram that shows the occurrence of a genetic trait in several generations.

-Selective Breeding-organisms with desirable traits are mated.

-examples-chickens that produce large eggs, dogs with small size, plants with large petals.