

Chapter 12

GENETICS: Mendelian Principles

OVERVIEW: Genetics is a sub-discipline of biology concerned with the inheritance of genetic traits. By careful gathering of data concerning the visible traits of pea plants, Gregor Mendel was able to discover several key principles of heredity. These principles are consistent with the manner in which meiosis (gene segregation) and fertilization (gene recombination) occur even though Mendel knew nothing about these cellular processes.

BLUEPRINT: Read Chapter 12, pages 247-255, which considers how the principles of heredity were discovered by Mendel using garden pea plants even before anyone knew about chromosomes and meiosis.

VOCABULARY:

genetics	allele	genotype ratio
phenotype	dominant allele	Punnett square
genotype	recessive allele	<u>Processes</u> (within meiosis):
monohybrid cross	homozygous	independent assortment
trait	heterozygous	segregation
		recombination (in fertilization)

- LEARNING GOALS:
1. Given one of Mendel’s pea plant traits, you should be able to discuss his experiment, results, and conclusions using the VOCABULARY above.
 2. Study the four *skill levels*, Skills A. through D. in "Genetics Problems" at the end of the chapter. Begin with Skill A and apply your genetics problem solving skills at each skill level. Write out your answers.

INTERNET: Visit “Genetics Problem Sets/ Tutorials” at the “BIO 100 Web Links” Page for Assignment # 22.

STUDY OUTLINE: GENETICS: Mendelian Principles and Problems

- I. GENETICS = sub-discipline of biology concerned with inheritance of genetic traits (heredity)
- II. PRINCIPLES OF HEREDITY
 - A. Gregor Mendel (1850) – Austrian monk; careful recording of mathematical ratios of pea plant traits
 - B. Four Principles of Heredity:
 1. Observation #1 – “Many traits have two expressions” (Evidence: Table 12-1)

Principle #1: Each hereditary trait is controlled by two discrete hereditary factors (units)

- a. TRAIT = _____
- b. PHENOTYE = _____

- c. GENE = _____
- d. "TWO UNITS" = _____
- e. ALLELES = _____

2. Observation #2 – Offspring of crosses between two phenotypes often express only one phenotype

Evidence: See Table 12-1

Principle #2: When the two factors contrast with each other, one is expressed (dominant) and one is masked (recessive).

- a. GENOTYPE = _____

Principle #3: There is a segregation (separation) of hereditary factors during gamete formation.

- b. IMPLICATION: Foreshadowed the discovery of meiosis in which chromosome (hence gene) pairs separate prior to uniting in fertilization.

Principle #4: When gametes fuse (fertilization), the two hereditary factors combine at random.

- c. EVIDENCE: Ratios of phenotypes in offspring are as expected from parental genotypes.

3. Mendel as Model (for Science and for Scientifically Literate Students):

Can you see evidence for the following from your reading?

- a. He displayed curiosity –
- b. He kept careful records –
- c. He proposed "models" (to visualize hypotheses) to account for his observations (inductive reasoning)