CHAPTER 14
MENDEL AND THE GENE IDEA

Learning objectives

Gregor Mendel's Discoveries
1. Explain how Mendel’s particulate mechanism differed from the blending theory of inheritance.
2. Define the following terms: true breeding, hybridization, monohybrid cross, P generation, F₁ generation, F₂ generation.
3. Use a Punnett square to predict the results of a monohybrid cross, stating the phenotypic and genotypic ratios of the F₂ generation.
4. Describe Mendel’s Law of Segregation and the phase of meiosis in which it is applied.
5. Distinguish between the following pairs of terms: dominant and recessive; heterozygous and homozygous; genotype and phenotype.
6. Explain how a testcross can be used to determine if an individual with the dominant phenotype is homozygous or heterozygous.
7. Use a Punnett square or probabilities to predict the results of a dihybrid cross and state the phenotypic and genotypic ratios of the F₂ generation.
8. State Mendel's law of independent assortment and describe how this law can be explained by the behavior of chromosomes during meiosis.

From activity:
9. Use the rule of multiplication to calculate the probability that a particular F₂ individual will be homozygous recessive or dominant.
10. Given a Mendelian cross, use the rule of addition to calculate the probability that a particular F₂ individual will be heterozygous.
11. Use the laws of probability to predict, from a trihybrid cross between two individuals that are heterozygous for all three traits, the expected proportion of the offspring that would be:
   a. homozygous dominant for the three traits
   b. heterozygous for all three traits
   c. homozygous recessive for two specific traits and heterozygous for the third

Extending Mendelian Genetics
12. Give examples of incomplete dominance and co-dominance.
13. Explain how phenotypic expression in the heterozygote differs with complete dominance, incomplete dominance, and co-dominance.
14. Explain why dominant alleles are not necessarily more common in a population. Illustrate your explanation with an example.
15. Describe the inheritance of the ABO blood system and explain why the I¹ and I² alleles are said to be co-dominant.
16. Define and give examples of pleiotropy and epistasis.
17. Describe a simple model for polygenic inheritance and explain why most polygenic characters are described in quantitative terms.
18. Describe how environmental conditions can influence the phenotypic expression of a character. Give an example.
19. Given a simple family pedigree, deduce the genotypes for specific family members.