

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 I^A and I^B 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.