

**Chapter 14 – Mendel & the Gene Idea****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, and F2 generation
3. List and explain the four components of Mendel's hypothesis that lead him to deduce the law of segregation.
4. Use a Punnett square to predict the results of a monohybrid cross, stating the phenotypic and genotypic ratios of the F2 generation
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 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
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 proportions of the offspring:
  - a. Homozygous dominant for all three traits
  - b. Heterozygous for all three traits
  - c. Homozygous recessive for 2 specific traits and heterozygous for the third
12. Explain why it is important the Mendel used large sample sizes in his studies.

**Extending Mendelian Genetics**

13. Give an example of incomplete dominance and explain why it does not support the blending theory of inheritance.
14. Explain how phenotypic expression of the heterozygote differs with complete dominance, incomplete dominance, and codominance
15. Explain why Tay-Sachs disease is considered recessive at the organismal level but codominant at the molecular level.
16. Explain why genetic dominance does not mean that a dominant allele subdues a recessive allele. Illustrate your explanation with the use of round vs. wrinkled pea seed shape
17. Explain why dominant alleles are not necessarily more common in a population. Illustrate your explanation with an example.
18. Describe the inheritance of the ABO blood system and explain why the  $I^A$  and  $I^B$  alleles are said to be codominant
19. Define and give examples of pleiotropy and epistasis
20. Describe a simple model for polygenic inheritance and explain why most polygenic characters are described in quantitative terms.
21. Describe how environmental conditions can influence the phenotypic expression of a character. Explain what is meant by 'a norm of reaction'
22. Distinguish between the specific and broad interpretations of the terms phenotype and genotype.

**Mendelian Inheritance in Humans**

23. Explain why studies of human inheritance are not as easily conducted as Mendel's work with his peas.
24. Given a simple family pedigree, deduce the genotypes for some of the family members.
25. Explain how a lethal recessive allele can be maintained in a population.
26. Describe the inheritance and expression of cystic fibrosis, Tay-Sachs, and sickle-cell disease.
27. Explain why lethal dominant genes are much rarer than lethal recessive genes
28. Give an example of a late-acting lethal dominant gene in humans and explain how it can escape elimination by natural selection.
29. Define and give examples of multifactorial disorders in humans.
30. Explain how carrier recognition, fetal testing, and newborn screening can be used in genetic screening and counseling.