

CONCEPTS OF GENETICS, 2/e

ANSWERS TO PROBLEM SETS Chapters 1-26

CHAPTER 1

Note: the answers to the Comprehension questions are at the end of the chapter.

Concept check questions (in figure legends)

FIGURE 1.1 Understanding our genes may help to diagnose inherited diseases. It may also lead to the development of drugs to combat diseases. Other answers are possible.

FIGURE 1.2 Many ethical issues are associated with human cloning. Is it the wrong thing to do? Does it conflict an individual's religious views? And so on.

FIGURE 1.3 By sorting the mosquitos, sterile males can be released into the environment to limit mosquito reproduction, because females mate only once.

FIGURE 1.4 DNA is a macromolecule.

FIGURE 1.5 DNA and proteins are found in chromosomes. RNA may also be associated with chromosomes.

FIGURE 1.6 The information to make a polypeptide is stored in DNA.

FIGURE 1.7 The dark-colored butterfly has a more active pigment-producing enzyme.

FIGURE 1.8 Genetic variation is the reason these frogs look different.

FIGURE 1.9 These are examples of variation in chromosome number.

FIGURE 1.10 If this girl had been given a standard diet, she would have developed the harmful symptoms of PKU, which include mental impairment and foul-smelling urine.

FIGURE 1.11 A corn gamete would contain 10 chromosomes. (The leaf cells are diploid.)

FIGURE 1.12 The horse populations have become adapted to their environment, which has changed over the course of many years.

FIGURE 1.13 There are several possible examples of other model organisms, including rats and frogs.

End-of-chapter Questions:

Conceptual Questions

- C1. A chromosome is a very long polymer of DNA. A gene is a specific sequence of DNA within that polymer; the sequence of bases creates a gene and distinguishes it from other genes. Genes are located in chromosomes, which are found within living cells.
- C2. At the molecular level, a gene (a sequence of DNA) is first transcribed into RNA. The genetic code within the RNA is used to synthesize a protein with a particular amino acid sequence. This second process is called translation.
- C3. A. Molecular level. This is a description of how an allele affects protein function.
B. Cellular level. This is a description of how protein function affects cell structure.
C. Population level. This is a description of how the two alleles affect members of a population.
D. Organism level. This is a description of how the alleles affect the traits of an individual.
- C4. Genetic variation involves the occurrence of genetic differences within members of the same species or different species. Within any population, variation may occur in the genetic material.

Variation may occur in particular genes so that some individuals carry one allele and other individuals carry a different allele. Examples include differences in coat color among mammals or flower color in plants. At the molecular level, this type of genetic variation is caused by changes in the DNA sequences of genes. There also may be variation in chromosome structure and number.

- C5. An extra chromosome (specifically an extra copy of chromosome 21) causes Down syndrome.
- C6. You could pick almost any trait. For example, flower color in petunias would be an interesting choice. Some petunias are red and others are purple. There must be different alleles in a flower color gene that affect this trait in petunias. In addition, the amount of sunlight, fertilizer, and water also affects the intensity of flower color.
- C7. The term *diploid* means that a cell has two copies of each type of chromosome. In humans, nearly all of the cells are diploid except for gametes (i.e., sperm and egg cells). Gametes usually have only one set of chromosomes.
- C8. A DNA sequence is a sequence of nucleotides. Each nucleotide may have one of four different bases (i.e., A, T, G, or C). When we speak of a DNA sequence, we focus on the sequence of bases.
- C9. The genetic code is the way in which the sequence of bases in RNA is read to produce a sequence of amino acids within a protein.
- C10. A. A gene is a segment of DNA. For most genes, the expression of the gene results in the production of a functional protein. The functioning of proteins within living cells affects the traits of an organism.
B. A gene is a segment of DNA that usually encodes the information for the production of a specific polypeptide. Genes are found within chromosomes. Many genes are found within a single chromosome.
C. An allele is an alternative version of a particular gene. For example, suppose a plant has a flower color gene. One allele could produce a white flower, while a different allele could produce an orange flower. The white allele and orange allele are alleles of the flower color gene.
D. A DNA sequence is a sequence of nucleotides. The information within a DNA sequence (which is transcribed into an RNA sequence) specifies the amino acid sequence within a polypeptide.
- C11. The statement in part A is not correct. Individuals do not evolve. Populations evolve because certain individuals are more likely to survive and reproduce and pass their genes to succeeding generations.
- C12. A. How genes and traits are transmitted from parents to offspring.
B. How the genetic material functions at the molecular and cellular levels.
C. Why genetic variation exists in populations, and how it changes over the course of many generations.

Application and Experimental Questions

- E1. There are many possible answers. Some common areas to discuss might involve the impact of genetics in the production of new medicines, the diagnosis of diseases, the production of new kinds of food, and the use of DNA fingerprinting to solve crimes.
- E2. A genetic cross involves breeding two different individuals.
- E3. This would be used to a great extent by molecular geneticists. The sequence of DNA is a molecular characteristic of DNA. In addition, as we will learn throughout this textbook, the sequence of DNA is interesting to transmission and population geneticists as well.
- E4. You would see 47 chromosomes instead of 46. There would be three copies of chromosome 21 instead of two copies.