

# Chapter 6

# Living Systems: Biological Diversity and Heredity

## Introduction

The tremendous diversity of living things is explored in Chapter 6. The Linnaean classification system is used to classify organisms. Organisms acquire their traits through the process of reproduction, which involves mitosis and meiosis. Almost 200 years ago, an Austrian monk named Gregor Mendel first developed a method of predicting which traits an organism might express.

Through a variety of techniques, humans have used some form of genetic engineering to encourage the expression of desirable traits while minimizing undesirable ones. Before the advent of modern **genetic engineering**, which uses microscopes and other precise lab equipment, humans depended on naturally occurring **mutations** to provide new traits in organisms to be bred. Progress in the field of genetic engineering has led to many recent discoveries that allow humans to not only choose desirable traits, but to create or “engineer” them as well.

## Students Should Understand the Following Concepts

- Biologists use characteristics common to different organisms to classify them.
- Reproduction is the process through which genetic information is passed from one generation to the next.
- Mitosis produces two new cells that are identical to the original parent cell. They have the same number of chromosomes as the parent cell.
- Meiosis produces cells that have half as many chromosomes as regular body cells. The cells produced by meiosis are called sex cells or gametes.

- Fertilization combines sex cells to form a new organism.
- The probability that a given trait will be inherited can be predicted through the use of a **Punnett square**.
- A change in an organism’s genetic code is called a **mutation**. Over time, mutations may accumulate to create a new species through a gradual process called evolution.

## Activities to Develop the Topic

Use one or more of the following activities to help your students review this topic.

One good way to immediately get the students involved in the lesson is to arrange the class in a circle. Have each of the students take off one of their shoes and toss it into the middle of the circle. Have the students look at all of the shoes and develop ways to classify the shoes. Some students may suggest separating athletic shoes from dress shoes. Other students may classify the shoes by color or size. Once the students have settled on their classification systems, write some of them on the chalkboard. Then have the class develop subcategories for the groupings shown on the board. Continue this process until the subcategories contain only one or two shoes each. Explain that this is basically what scientists do. They classify organisms on the basis of observable traits.

With Linnaean classification addressed, move on to discussing where organisms get their traits and genetic material. In order to introduce mitosis and meiosis; start by asking students if they ever received a cut. Most students will be able to volunteer a story. Have a student show the class an area that was injured and has healed. Use this example to begin a class discussion on how the human

Name \_\_\_\_\_

Date \_\_\_\_\_

Class \_\_\_\_\_

## Review of Chapter 6

Use the following table to answer questions 1-3.

Group	Wolf	Dog	Horse	Grasshopper	Chimpanzee
Kingdom	Animalia	Animalia	Animalia	Animalia	Animalia
Phylum	Chordate	Chordate	Chordate	Arthropod	Chordate
Class	Mammalia	Mammalia	Mammalia	Insectae	Mammalia
Order	Carnivore	Carnivore	Ungulate	Orthoptera	Primate
Family	Canidae	Canidae	Equidae	Locustidae	Pongidae
Genus	<i>Canis</i>	<i>Canis</i>	<i>Equus</i>	<i>Schistocerca</i>	<i>Pan</i>
Species	<i>lupus</i>	<i>familliaris</i>	<i>caballus</i>	<i>americana</i>	<i>traglodytes</i>

1. Chordates are animals that have backbones. How many of these organisms have a backbone?  
(1) 2  
(2) 3  
(3) 4  
(4) 5
2. What is the most specific level of classification?  
(1) kingdom  
(2) species  
(3) order  
(4) phylum
3. Two animals that belong to the same genus but different species are  
(1) dogs and horses  
(2) chimpanzees and wolves  
(3) horses and chimpanzees  
(4) dogs and wolves
4. Compared with an organism that reproduces asexually, organisms that reproduce sexually  
(1) have fewer parents  
(2) have less variation in offspring  
(3) have more variation in offspring  
(4) always have more chromosomes
5. The process in which a sperm cell fuses with an egg cell is called  
(1) mitosis  
(2) meiosis  
(3) budding  
(4) fertilization

6. Cutting a sea star in half can sometimes result in creating two identical sea stars. This is an example of
- (1) asexual reproduction                      (3) cleavage  
 (2) sexual reproduction                      (4) fertilization
7. If a fruit fly normally has 4 chromosomes in its body cells, how many chromosomes will be found in the gametes of a fruit fly?
- (1) 2              (2) 4              (3) 6              (4) 8
8. How many chromosomes will a human liver cell have when compared with a human nerve cell?
- (1) The nerve cell will have more chromosomes because it is more complicated.  
 (2) The liver cell will have more chromosomes because it is more complicated.  
 (3) They will both have the same number of chromosomes.  
 (4) You cannot predict how many chromosomes a particular cell will have.
9. When a single-celled organism reproduces asexually, the two resulting daughter cells will have
- (1) the same amount of genetic material as the parent cell  
 (2) half as much genetic information as the parent cell  
 (3) twice the genetic information as the parent cell  
 (4) different amounts of genetic information depending upon the size of the cell
10. What characteristic would have made pea plants good study subjects for Mendel?
- (1) They produce many offspring.  
 (2) They produce a wide range of vague traits.  
 (3) They grow slowly.  
 (4) They cannot breed among themselves.

Use the following table to answer questions 11 and 12.

*Probabilities of Offspring of Hybrid Red-Eyed Fruit Flies*

Type of Genes	Appearance	Probability
RR—pure dominant	Red eyes	1/4 (25%)
Rr—hybrid dominant	Red Eyes	2/4 (50%)
rr—pure recessive	White eyes	1/4 (25%)

11. What percentage of the fruit fly offspring will have white eyes?
- (1) 25%                      (3) 75%  
 (2) 50%                      (4) 100%
12. What fraction of the flies will be hybrid for the red-eye trait?
- (1) 1/2              (2) 1/3              (3) 1/4              (4) 2/3

13. Black hair is dominant over white hair for a particular species of cat. What is the probability of two white cats producing an offspring with black hair?
- (1) 100% (3) 0%  
(2) 50% (4) you cannot determine the probability
14. The probability that two hybrid organisms will produce an offspring that is pure recessive is
- (1) 25% (3) 75%  
(2) 50% (4) 100%
15. According to natural selection,
- (1) the physically strongest and largest organisms will always survive  
(2) the organisms best suited for an environment will survive  
(3) humans must pick the best organisms and allow them to breed  
(4) exact copies of organisms ensure that a species can survive changes in the environment
16. Which of the following factors does NOT cause a change in an organism's genetic structure?
- (1) exposure to a radioactive substance  
(2) asexual reproduction  
(3) exposure to certain chemicals  
(4) exposure to UV light
17. A change in an organism's genetic structure is known as
- (1) an adaptation (3) a selection  
(2) a mutation (4) a cleavage
18. The practice of breeding organisms for desirable traits is called
- (1) adaptation (3) cloning  
(2) natural selection (4) selective breeding
19. A couple planning to have children might see a genetic counselor to
- (1) predict the probability of the couple's child inheriting a genetic disease  
(2) cure their children of any genetic disease while still in the womb  
(3) vaccinate the couple against passing on a genetic disease to their child  
(4) discuss the traits they want their child to possess
20. Which of the following is NOT considered a genetic disease?
- (1) albinism (3) sickle-cell anemia  
(2) Tay-Sachs (4) AIDS