

**Assess Your Understanding**

# Human Inheritance

## What Are Some Patterns of Human Inheritance?

1a. **EXPLAIN** Why do some traits exhibit a large number of phenotypes? \_\_\_\_\_

b. **DRAW CONCLUSIONS** Aaron has blood type O. Can either of his parents have blood type AB? Explain. \_\_\_\_\_

**got it?** .....

I get it! Now I know that some human traits are controlled by \_\_\_\_\_

I need extra help with \_\_\_\_\_

## What Are the Functions of the Sex Chromosomes?

2a. **REVIEW** What is the sex of a person who is a carrier for colorblindness? \_\_\_\_\_

b. **CHALLENGE** Mary and her mother are both colorblind. Is Mary's father colorblind too? How do you know? \_\_\_\_\_

**got it?** .....

I get it! Now I know that the functions of the sex chromosomes are \_\_\_\_\_

I need extra help with \_\_\_\_\_

Place the outside corner, the corner away from the dotted line, in the corner of your copy machine to copy onto letter-size paper.

**Key Concept Summaries**

# Human Inheritance

## What Are Some Patterns of Human Inheritance?

<b>Some human traits are controlled by single genes with two alleles, and others by single genes that have multiple alleles. Still other traits are controlled by many genes that act together.</b>	as dimpled chin, produce two distinctly different physical appearances, or phenotypes. Other traits such as blood type are controlled by a single gene that has more than two alleles. Human traits such as height are controlled by many genes and show a wide variety of phenotypes.
Human traits that are controlled by a single gene with either a dominant or a recessive allele, such	

## What Are the Functions of the Sex Chromosomes?

The body cells of humans contain 23 chromosome pairs. The <b>sex chromosomes</b> are one of the 23 pairs. <b>The sex chromosomes carry genes that determine a person's sex as being either male or female. They also carry genes that determine other traits.</b> The sex chromosomes are the only chromosome pair that do not always match. Girls have two X chromosomes, but boys have an X and a Y. So, while all eggs carry one X chromosome, a male's sperm cells carry either an X or a Y chromosome. When an egg is fertilized by a sperm cell, the sex chromosome carried by the sperm cell determines whether a child will be a girl (X) or boy (Y).	passed from parent to child on a sex chromosome. Traits controlled by sex-linked genes, such as colorblindness, are called sex-linked traits. Sex-linked genes, like other genes, can have dominant and recessive alleles. In females, a dominant allele on an X chromosome will mask a recessive allele on the other X chromosome. But in males, because the Y chromosome is much smaller than the X chromosome, there is usually no matching allele on the Y chromosome to mask the allele on the X chromosome. So any allele on the X chromosome, even a recessive allele, will produce the trait in the male who inherits it. A <b>carrier</b> is a person who has one recessive allele for a trait and one dominant allele. A carrier of a trait controlled by a recessive allele does not express the trait, but can pass the recessive allele on to his or her offspring.
Genes found on the X and Y chromosomes are often called <b>sex-linked genes</b> because their alleles are	

**On a separate sheet of paper, explain how sex chromosomes are different from other chromosome pairs. Then explain why a recessive trait controlled by a gene located on a sex chromosome is more likely to be expressed in a male than a female.**

Place the outside corner, the corner away from the dotted line, in the corner of your copy machine to copy onto letter-size paper.

**Lesson Quiz**

# Human Inheritance

If the statement is true, write *true*. If the statement is false, change the underlined word or words to make the statement true.

- \_\_\_\_\_ The body cells of humans contain 46 pairs of chromosomes.
- \_\_\_\_\_ A widow's peak is a trait controlled by many genes.
- \_\_\_\_\_ In the case of sex-linked traits, only females can be carriers.
- \_\_\_\_\_ In females, a recessive allele on the X chromosome often has no matching allele on the Y chromosome.
- \_\_\_\_\_ The only thing determined by the genes carried on a sex chromosome is a person's sex.
- \_\_\_\_\_ Colorblindness is a trait controlled by a dominant allele on the X chromosome.

Fill in the blank to complete each statement.

- The sex chromosome carried by a human egg will always be a(n) \_\_\_\_\_ chromosome.
- A person who has one recessive and one dominant allele for a trait is called a(n) \_\_\_\_\_.
- The only pair of human chromosomes that do not always match are the \_\_\_\_\_.
- Genes found on the X and Y chromosomes are often called \_\_\_\_\_ genes.

**Assess Your Understanding**

# Human Genetic Disorders

## How Are Genetic Disorders Inherited in Humans?

1a. **EXPLAIN** Which of the two major causes of genetic disorders is responsible for Down syndrome?

\_\_\_\_\_

b. **INFER** Why is hemophilia more common in males? \_\_\_\_\_

\_\_\_\_\_

**got it?** .....

I get it! Now I know that the two major causes of genetic disorders are \_\_\_\_\_

\_\_\_\_\_

I need extra help with \_\_\_\_\_

\_\_\_\_\_

## How Are Genetic Disorders Traced, Diagnosed, and Treated?

**got it?** .....

I get it! Now I know that genetic disorders are traced, diagnosed, and treated by \_\_\_\_\_

\_\_\_\_\_

I need extra help with \_\_\_\_\_

\_\_\_\_\_

**Key Concept Summaries**

# Human Genetic Disorders

## How Are Genetic Disorders Inherited in Humans?

A **genetic disorder** is an abnormal condition that a person inherits through genes or chromosomes.

**Some genetic disorders are caused by mutations in the DNA of genes. Other disorders are caused by changes in the overall structure or number of chromosomes.**

Cystic fibrosis is a genetic disorder in which the body produces abnormally thick mucus. In the lungs, this can cause difficulty breathing. A person with cystic fibrosis inherits one mutated allele from each parent. In Down syndrome, instead of a pair of chromosomes, a person inherits three copies of chromosome 21. People with Down syndrome experience some degree of intellectual disability and often have heart defects.

Sickle-cell disease and hemophilia are both blood disorders. In sickle cell disease, a mutation produces abnormal hemoglobin, a protein in red blood cells. The cells carry less oxygen than normal cells and have a crescent or sickle shape that causes them to clog blood vessels. While a person with just one sickle-cell allele will produce both normal and abnormal cells, a person with two sickle-cell alleles will show symptoms of the disease.

Hemophilia slows or prevents blood clotting so that even small bumps can cause bleeding. Because hemophilia is caused by a recessive allele on the X chromosome, it is more common in males than females.

## How Are Genetic Disorders Traced, Diagnosed, and Treated?

**Today, doctors use tools such as pedigrees, karyotypes, and genetic testing to trace and diagnose genetic disorders. People with genetic disorders are helped through medical care, education, and job training. A pedigree** is a chart or "family tree" that tracks which members of a family have a particular trait. A **karyotype**, a picture of all the chromosomes in a cell, can be used to determine whether a person has the correct

number of chromosomes. Couples that have a family history of a genetic disorder may turn to a genetic counselor for advice. They can find out their chances of having a child with the disorder and learn how to prepare to raise him or her. People with genetic disorders face serious challenges. Yet medical treatments, physical therapy, education, and job training programs can help those affected to live active, productive lives.

On a separate sheet of paper, describe what cystic fibrosis is and what causes it. Then explain what a couple planning a family can do if they have a family history of cystic fibrosis.

Place the outside corner, the corner away from the dotted line, in the corner of your copy machine to copy onto letter-size paper.

**Lesson Quiz**

# Human Genetic Disorders

Write the letter of the correct answer on the line at the left.

1. \_\_\_ Which of the following is a genetic disorder that results when two mutated alleles are inherited?  
A Down syndrome  
B colorblindness  
C cystic fibrosis  
D hemophilia
2. \_\_\_ Which of the following is the protein that is **NOT** normal in people with sickle-cell disease?  
A mucus  
B clotting protein  
C karyotype  
D hemoglobin
3. \_\_\_ Which of the following is a genetic disorder that results from having an extra chromosome?  
A Down syndrome  
B colorblindness  
C cystic fibrosis  
D hemophilia
4. \_\_\_ Which is not a cause of human genetic disorders?  
A changes in the number of chromosomes  
B abnormal hemoglobin  
C changes in the structure of chromosomes  
D mutations in the DNA of genes

Fill in the blank to complete each statement.

5. To trace the occurrence of a trait through several generations of a family, you could create a(n) \_\_\_\_\_.
6. A couple that have a family history of a genetic disorder might wish to receive advice from a(n) \_\_\_\_\_.
7. The allele for the sickle-cell trait is \_\_\_\_\_ with the normal allele.
8. \_\_\_\_\_ is a genetic disorder caused by a recessive allele on the X chromosome.
9. A doctor may use a(n) \_\_\_\_\_ to examine the chromosomes in a cell.
10. A condition in which a person's skin, hair, and eyes lack normal coloring is called \_\_\_\_\_.

**Assess Your Understanding**

# Advances in Genetics

## How Can Organisms Be Produced With Desired Traits?

- 1a. **IDENTIFY** The technique of crossing two individuals with similar characteristics is (inbreeding/hybridization).
- b. **EXPLAIN** Why are identical twins not clones according to the text definition? \_\_\_\_\_  
\_\_\_\_\_
- c. **APPLY CONCEPTS** Lupita has a houseplant. Which method would be the best way of producing a similar plant for a friend? Explain your answer.  
\_\_\_\_\_  
\_\_\_\_\_

**got it?** .....

- I get it! Now I know that the three ways of producing organisms with desired traits are \_\_\_\_\_  
\_\_\_\_\_
- I need extra help with \_\_\_\_\_  
\_\_\_\_\_

Place the outside corner, the corner away from the dotted line, in the corner of your copy machine to copy onto letter-size paper.

**Key Concept Summary**

# Advances in Genetics

## How Can Organisms Be Produced With Desired Traits?

Due to advances in genetics, DNA evidence can show such things as family relationships or the ability to produce organisms with desirable traits. <b>Selective breeding, cloning, and genetic engineering are three different methods for developing organisms with desirable traits.</b>	plant that results is genetically identical to its one parent.
The process of selecting organisms with desired traits to be parents of the next generation is called <b>selective breeding</b> . Two techniques for selective breeding are inbreeding and hybridization. <b>Inbreeding</b> involves crossing two individuals that have similar desirable characteristics. Inbreeding produces organisms that are genetically very similar. When inbred organisms are mated, the chances of inheriting two recessive alleles are increased. This can lead to genetic disorders. In <b>hybridization</b> , breeders cross two genetically different individuals. A hybrid organism has two different alleles for a trait. The hybrid organism that results is bred to have the best traits of both parents.	In the process of <b>genetic engineering</b> , genes from one organism are transferred into the DNA of another organism. Genetic engineering can produce medicines and improve food crops. Many people with diabetes need injections of the human protein insulin. One type of genetically engineered bacterium produces human insulin. DNA for human insulin is inserted into bacterial DNA, which is then inserted into a bacterial cell. The cell and its offspring then produce large amounts of human insulin quickly.
A <b>clone</b> is an organism that has exactly the same genes as the organism from which it was produced. Some plants can be cloned from a stem cutting. The	In the future, genetic engineering may correct some human genetic disorders. The process, called <b>gene therapy</b> , will involve inserting copies of a gene directly into a person's cells. For example, hemophilia might be treated by replacing the defective allele on the X chromosome. Some people are concerned about long-term effects of genetic engineering. For example, some people fear that genetically engineered crops may harm the environment or cause health problems in humans.

On a separate sheet of paper, compare and contrast selective breeding and genetic engineering.

Place the outside corner, the corner away from the dotted line, in the corner of your copy machine to copy onto letter-size paper.



**Lesson Quiz**

# Advances in Genetics

If the statement is true, write *true*. If the statement is false, change the underlined word or words to make the statement true.

1. \_\_\_\_\_ In the process of cloning, breeders cross two genetically different individuals.
2. \_\_\_\_\_ Crossing two individuals that have similar desirable characteristics is called genetic engineering.
3. \_\_\_\_\_ In selective breeding, organisms with desired traits are chosen to be parents of the next generation.
4. \_\_\_\_\_ The process by which genes from one organism are transferred into the DNA of another organism is called inbreeding.
5. \_\_\_\_\_ Through gene therapy, a genetic disorder may be corrected by inserting copies of a gene directly into a person's cells.
6. \_\_\_\_\_ Hybridization results in an organism that has exactly the same genes as the organism from which it was produced.

Fill in the blank to complete each statement.

7. Small rings of DNA called \_\_\_\_\_ are found in some bacterial cells.
8. Some people are concerned that \_\_\_\_\_ of crops may cause harm to the environment or health problems in humans.
9. By using a stem cutting from an African violet, it is easy to produce a new plant, which is a(n) \_\_\_\_\_.
10. A hybrid organism has two different \_\_\_\_\_ for a trait.

**Assess Your Understanding**

# Using Genetic Information

**What Are Some Uses of Genetic Information?**


1a. **DEFINE** What is a genome? \_\_\_\_\_

\_\_\_\_\_

b. **CHALLENGE** Do you think it is ethical for doctors to share a patient's medical records? Explain. \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

c. **ANSWER**  How can genetic information be used? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**got it?** .....

I get it! Now I know that there are positive and negative ways of using genetic information such as \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

I need extra help with \_\_\_\_\_

\_\_\_\_\_

... this document contains the content of your copy machine to copy onto letter-size paper.

**Key Concept Summary**

# Using Genetic Information

## What Are Some Uses of Genetic Information?

Each person's genes contain unique information about that particular person's growth and development. **Genetic information can be used positively to identify individuals and to learn about health and disease, or negatively to discriminate against people.**

As it becomes easier to obtain genetic information, there are concerns about who can access that information and how it might be used. **Ethics** is the study of principles about what is right and wrong, fair and unfair. Using genetic information in an ethical way means using it in a way that is fair and just. The Genetic Information and Nondiscrimination

An organism's full set of DNA is called its **genome**. In 2003, scientists working on the Human Genome Project cracked a code that is six billion letters long. They identified the DNA sequence of the entire human genome. Scientists continue to research the function of tens of thousands of genes.

Act (GINA) of 2008 makes it illegal for health insurance companies and employers to discriminate against individuals based on genetic information. It also makes it illegal for insurance companies and employers to ask or tell an individual that they must have a genetic test done.

The DNA technology used in the Human Genome Project can also identify people and show whether people are related. Small pieces, or fragments, of a person's DNA are used to produce a pattern called a DNA fingerprint. Except for identical twins, no two people have the exact same DNA fingerprint. Genetic "fingerprints" can be used to show someone was at a crime scene, to prevent the wrong person from going to jail, and to identify skeletal remains. Saved DNA fingerprints can be used to identify the bodies of unknown soldiers or civilians.

Doctors are expected to protect patients' privacy by not revealing their medical information, including their medical history and genetic information. But if a patient has a genetic condition, the patient's relatives are likely at risk, too. Should other family members have the right to know? Or should a patient's medical records be kept private?

**On a separate sheet of paper, explain how the increased use and availability of genetic information carries both rewards and risks.**

Place the outside corner, the corner away from the dotted line, in the corner of your copy machine to copy onto letter-size paper.

**Lesson Quiz**

# Using Genetic Information

If the statement is true, write *true*. If the statement is false, change the underlined word or words to make the statement true.

- \_\_\_\_\_ The Genetic Information Nondiscrimination Act made it legal for health insurance companies and employers to tell an individual to have a genetic test done.
- \_\_\_\_\_ DNA technology used in the Human Genome Project can show whether people are related.
- \_\_\_\_\_ Identical twins have identical DNA.
- \_\_\_\_\_ A person's medical records may contain information about a person's genetics, such as whether he or she drinks alcohol or smokes.
- \_\_\_\_\_ The goal of the Human Genome Project was to identify the DNA sequence of part of the human genome.
- \_\_\_\_\_ Genetic fingerprints can be used to preserve skeletal remains.

Fill in the blank to complete each statement.

- \_\_\_\_\_ is the study of principles about what is right and wrong, fair and unfair.
- An organism's full set of DNA is called its \_\_\_\_\_.
- Some people fear health insurance companies or employers could use a person's genetic information to \_\_\_\_\_ against him or her.
- Selected fragments of DNA from a person's cells can be used to produce a unique pattern called a DNA \_\_\_\_\_.