Focus on the New York State Learning Standards

Lesson 4.6 Genes

2.1a Hereditary information is contained in genes. Genes are composed of DNA that makes up the chromosomes of cells.
2.1b Each gene carries a single unit of information. A single inherited trait of an individual can be determined by one pair or by many pairs of genes. A human cell contains thousands of different genes.
2.1c Each human cell contains a copy of all the genes needed to produce a human being.
2.2a In all organisms, genetic traits are passed on from generation to generation.
2.3.3 Explain the impact of the use and abuse of electronically generated information on individuals and families.

You can understand how inherited traits are passed from parents to offspring.

Genes are tiny segments of DNA molecules that carry the instructions for inherited traits.

Long molecules of **DNA** store the genetic information of an organism.

A **chromosome** is a tightly bundled molecule of DNA.

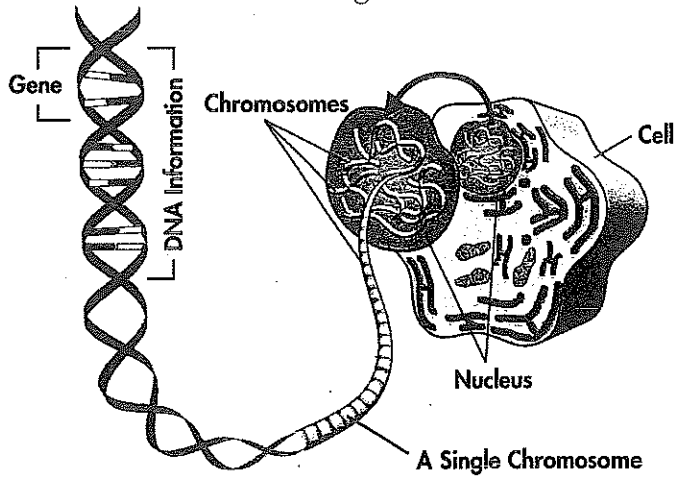
Different forms of the same gene are called **alleles**.

Guided Instruction

DIRECTIONS Read the following information.

Inside the nucleus of every cell in your body is a complete set of coded instructions. These instructions are for building another human being identical to you. Unless you have an identical twin, no one else has instructions exactly like yours. These instructions determine whether you will have straight hair or curly hair, or brown eyes or blue eyes. The instructions for these traits come from your mother and father.

The instructions for individual traits are supplied by **genes**. Each gene carries a single instruction. Genes are tiny segments of very long **DNA** molecules. These molecules are tightly coiled and bundled up into structures called **chromosomes**. Most human cells have 23 pairs of chromosomes (46 chromosomes in all) inside their nuclei. Lined up along each chromosome are thousands of genes. It is estimated that a human body cell contains 35,000 different genes.



Guided Questions

What are **genes?**

What are located on **DNA** molecules?

How are **chromosomes** related to genes?

INFORMATION SYSTEMS
Computer records of a person's genetic makeup may help doctors fight a possible future inherited disease. However, theft or misuse of such records may result in discrimination.

Like chromosomes, most genes come in pairs. An individual has two copies of each gene, one inherited from the mother and one from the father. These copies are not always identical. Different forms of a gene are called **alleles**. A particular trait can be determined by a single pair of genes or by many pairs of genes. A simple trait, such as whether or not a person has dimples, can be controlled by a single pair of genes. Traits that can occur over a wide range, such as height and skin color, are more complicated. There are many different heights and skin colors seen in humans. These traits are usually determined by the instructions from many pairs of genes.

Guided Questions

What is an **allele**?

Directions For each question, write your answer in the spaces provided.

1. What is the relationship between a gene and a trait?

2. Is DNA like a single blueprint for the building of a house or like a book of blueprints? Explain.

3. What are some traits that are determined by more than one pair of genes?

4. A teacher shows students a string of beads as a model of a chromosome and genes. What do the beads represent? Explain.

5. Explain how computer records of a person's genetic makeup can have a positive and a negative impact.

6. Explain why the majority of genes in an organism occur in pairs.

Apply the New York State Learning Standards to the State Test

Directions(7–10): For each question, write your answer in the spaces provided. Base your answers to questions 7 through 10 on the table below.

ORGANISM	NUMBER OF CHROMOSOMES PER CELL
Human	46
Lettuce	18
Fruit Fly	8
Cat	38
Potato	48
Crayfish	400
Dog	78
Bacteria	1
Sunflower	34
Goldfish	94

7 Which organism has the smallest number of chromosomes? Which organism has the largest?

8 How many *pairs* of chromosomes does a dog have in each body cell? How many chromosomes does a dog have in every sex cell? Explain your answer.

9 Can you conclude that there is a relationship between the number of chromosomes in plants and the number of chromosomes in animals? Explain.

10 Can you conclude that larger organisms have a greater number of chromosomes than smaller organisms? Explain.

Directions (11–17): Each question is followed by four choices. Decide which choice is the *best* answer. Circle the number of the answer you have chosen.

11 Which of the following contains only a single instruction for determining a trait in an organism?

(1) DNA molecule
(2) chromosome
(3) gene
(4) cell

12 Which number is closest to the number of different genes in a human body cell?

(1) 40,000
(2) 4,000
(3) 400
(4) 40

13 Which trait is most likely determined by genes?

(1) how old a person is
(2) what a person likes to eat
(3) whether or not a person has dimples
(4) when a person wakes up

14 Where do an organism's genes come from?

(1) the mother only
(2) the father only
(3) both the mother and father
(4) neither the mother nor father

15 How many pairs of chromosomes are there in most human cells?

(1) 58
(2) 46
(3) 23
(4) 12

16 What are alleles?

(1) different chromosomes
(2) molecules of DNA
(3) different forms of the same gene
(4) coiled bundles of DNA

17 Which of the following is in the correct order from the smallest to the largest?

(1) chromosome, DNA, cell, nucleus
(2) DNA, chromosome, cell, nucleus
(3) gene, DNA, nucleus, cell
(4) chromosome, gene, nucleus, cell

The Respiratory System

(pages 564–572)

Respiratory System Functions

(pages 565–566)

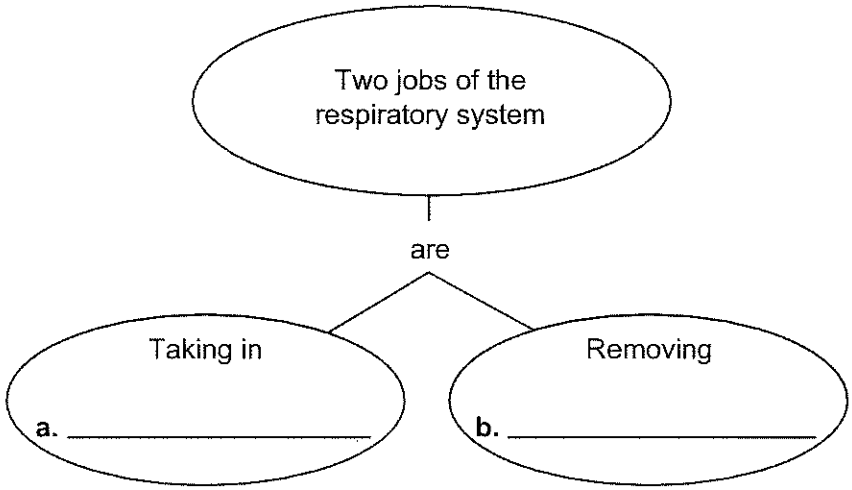
Key Concept: **The respiratory system moves oxygen from the outside environment into the body. It also removes carbon dioxide and water from the body.**

- **Respiration** is a process that takes place in your cells. It gives you energy. For respiration to take place, cells need oxygen.
- Cells produce carbon dioxide and water as waste products of respiration. Cells need to get rid of these wastes.
- The respiratory system provides oxygen for respiration. The respiratory system also gets rid of the waste products of respiration.
- The respiratory system is just one body system that makes respiration possible.
- Respiration could not take place without the digestive system and the circulatory system. The digestive system breaks down food to give the cells energy for respiration. The circulatory system carries both oxygen and food to the cells so respiration can take place. It also carries away the waste products of respiration.

Answer the following questions. Use your textbook and the ideas above.

1. Is the following sentence true or false? The respiratory system is at work when you breathe. _____

2. Fill in the blank in the concept map about the respiratory system.



The Path of Air (pages 566–568)

Key Concept: **As air travels from the outside environment to the lungs, it passes through the following structures: nose, pharynx, trachea, and bronchi.**

- Air enters the respiratory system through the nose. From the nose, air moves to the **pharynx** (FAR ingks), or throat. Then, air goes into the **trachea** (TRAY kee uh), or windpipe. From the trachea, air passes into the bronchi. **Bronchi** (BRAHNG ky) are passages that go to the lungs.
- Most of these structures are lined with tiny hairs and a sticky material called mucus. The hairs and mucus clean and moisten the air before it reaches the lungs.
- The two **lungs** are the main organs of the respiratory system. The lungs are in the chest.
- The lungs are made up of tiny structures called **alveoli** (al VEE uh ly) (singular alveolus). Alveoli are hollow sacks. Air goes into the alveoli. In the alveoli, oxygen is removed from air and wastes are added to air.

Answer the following questions. Use your textbook and the ideas on page 257.

3. Read the words in the box. In each sentence below, fill in one of the words.

trachea	bronchi	alveoli

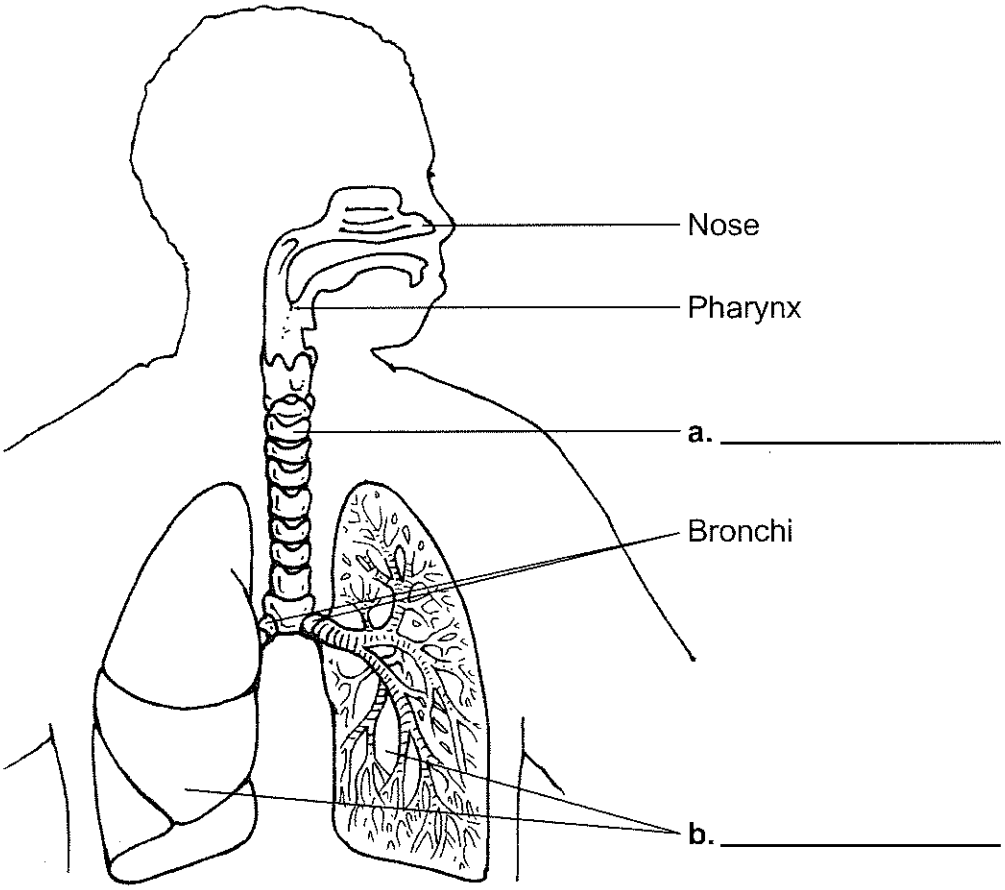
a. Tiny structures in the lungs where oxygen is removed from air are called

_____.

b. Passages from the trachea to the lungs are called

_____.

4. Fill in the blanks in the diagram of the respiratory system.



Gas Exchange (pages 569–570)

Key Concept: **After air enters the alveoli, oxygen passes through the walls of the alveoli and then through the capillary walls into the blood. Carbon dioxide and water pass from the blood into the alveoli. This whole process is known as gas exchange.**

- Gas exchange takes place in the alveoli. (Remember, alveoli are tiny hollow sacks in the lungs.) Alveoli are surrounded by capillaries.
- When you breathe in, air fills the tiny sacks of the alveoli. Oxygen in the air moves out of the sacks and into the capillaries. At the same time, carbon dioxide and water in the blood move out of the capillaries and into the sacks. When you breathe out, the air leaves the sacks, taking carbon dioxide and water with it.
- If you could spread out all the alveoli in your lungs, they would cover a very big area. Alveoli give the lungs a much bigger surface for gases to move across. With alveoli, a lot of gas can be exchanged quickly.

Answer the following questions. Use your textbook and the ideas above.

5. How do alveoli help the lungs exchange gases? Circle the letter of the correct answer.

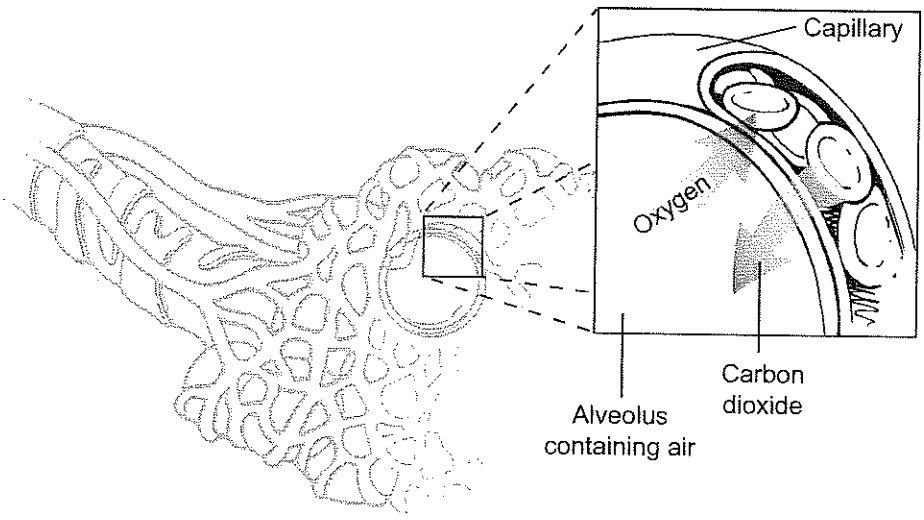
a. Alveoli give the lungs more energy to carry out gas exchange.

b. Alveoli give the lungs a bigger surface for gases to move across.

c. Alveoli help move air from the nose to the lungs.

6. What process does the picture show?

_____



How You Breathe (pages 570–572)

Key Concept: **When you breathe, the actions of your rib muscles and diaphragm expand or contract your chest. As a result, air flows in or out.**

- Breathing is controlled by the diaphragm. The **diaphragm** (DY uh fram) is a large muscle just below the lungs.
- When you breathe in, the diaphragm contracts, or gets shorter. This makes the space inside the chest get bigger. Air rushes into the lungs to fill the extra space.
- When you breathe out, the diaphragm relaxes again. This makes the space inside the chest get smaller. Air is squeezed out of the lungs.
- **Vocal cords** are tissues at the top of the trachea. When you speak, outgoing breath passes over the vocal cords. The vocal cords vibrate, or move quickly back and forth. When the vocal cords vibrate, they make sounds.

Answer the following questions. Use your textbook and the ideas on page 260.

7. Fill in the blanks in the table about breathing.

How You Breathe		
What the Diaphragm Does	**How the Chest Changes**	**Which Way Air Moves**
Contracts	gets bigger	**a.** _____ _____
Relaxes	**b.** _____ _____	out of lungs

8. When air passes over the _____, they vibrate and make sounds.