



# SCIENCE

STUDENT BOOK

▶ **6th Grade | Unit 3**

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# SCIENCE 603

## Plant and Animal Behavior

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# Plant and Animal Behavior

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## Introduction

God has created plants, animals, and other living things in a wonderful way. In the previous LIFEPAcs of this science series, you have learned about several *systems* that God has provided for plants and animals. In this LIFEPAc® you will learn about some systems in plants, animals, and other living organisms that allow them to respond to their environments. We often refer to these response actions of animals and plants as their *behavior*. You will examine some of the parts of animals and plants that allow these response actions and behavior. In particular, you will learn more about the *nervous system* of human beings because it plays such an important role in the behavior and responses of humans. Other animals and living organisms have nervous systems, too, but ours is the most highly developed of all living things created by God.

In addition, you will examine more about the interaction between plants and animals. You will also explore how the physical environment affects the behavior and interactions of plants and animals. Finally, you will learn more about some of the cycles in nature and the balance of nature.

## Objectives

**Read these objectives.** The objectives tell what you should be able to do when you have completed this LIFEPAc. When you have finished this LIFEPAc, you should be able to:

1. Identify the structure and functions of parts of the nervous system.
2. Define and identify reflex, instinct, and learned responses.
3. Define and identify the three types of learned responses.
4. Describe examples of human intelligence.
5. Identify the three major tropisms of plants.
6. Describe how tropisms work in plants.
7. Describe the characteristics of the two major types of biomes.
8. Identify and describe the parts of a food chain.
9. Examine some of the natural cycles in nature.
10. Define and describe the balance of nature.

# 1. ANIMAL AND HUMAN BEHAVIOR

Animals are a special part of God's creation. They are living things that can move in their environments and interact with them. Although they have some similarities with animals, human beings are the most wonderful creatures of all the living things that God has created! Both humans and animals are able to interact with their environments. They respond to a variety of conditions and stimuli. These responses of man and animals to their environment are called behaviors. Most animals have a nervous system that allows them not only to

respond to the environment, but also to move and interact with the environment. Human beings have the most highly developed nervous system of all the animals that God has created.

In this section of the LIFEPAAC, you will learn more about the nervous system of animals and of humans. By studying the nervous system of humans in more detail, you will be able to appreciate the wonderful design that God has provided to His creation. In addition, you will learn about several types of responses that man and animals make to their environment.

## Section Objectives

**Review these objectives.** When you have completed this section, you should be able to:

1. Identify the structure and functions of parts of the nervous system.
2. Define and identify reflex, instinct, and learned responses.
3. Define and identify the three types of learned responses.
4. Describe examples of human intelligence

## Vocabulary

**Study these words to enhance your learning success in this section.**

**axon** (ak son). Sending end of neuron cells; neuron end with little knobs on each branch.

**cerebellum** (ser ə bel əm). Lower back of brain; coordinates muscle movements.

**cerebrum** (ser ə brəm, sə rē brəm). Front part of brain; seat of all intelligence and thought.

**cortex** (kôr teks). Thin gray layer over brain; responsible for high level thought.

**dedrite** (den drīt). Receiving end of neuron; many pointed branches.

**ganglia** (gang lē ə). Clusters of individual neurons.

**hormones** (hôr mōnz). Substances produced by glands of the body which are carried to other organs or tissues where they influence growth, development, etc.

**medulla** (mi dul ə). The lowest part of the brain; the top of the spinal cord.

**neurons** (nūr on, nyū ranz). Nerve cells.

**parasympathetic** (par ə sim pə thet ik). Part of the autonomic nervous system that tends to slow down heartbeat and decrease body activities.

**plexus** (plek səs). One of four major bundles of ganglia gathered near the spinal column.

**stimuli** (stim yə lī). Plural of *stimulus*. Something that rouses or causes activity.

**sympathetic** (sim pə thet ik). Part of the autonomic nervous system that helps the body during times of emergency and increased activity.

**synapse** (sin aps, si naps). Region between neurons that chemically passes on messages.

**Note:** All vocabulary words in this LIFEPAC appear in **boldface** print the first time they are used. If you are not sure of the meaning when you are reading, study the definitions given.

**Pronunciation Key:** hat, āge, cāre, fār; let, ēqual, tērm; it, īce; hot, ōpen, ōrder; oil; out; cup, pūt, rŭle; child; long; thin; /ʃh/ for then; /zh/ for measure; /u/ or /ə/ represents /a/ in about, /e/ in taken, /i/ in pencil, /o/ in lemon, and /u/ in circus.

## NERVOUS SYSTEM

Almost all animals, except the very simplest kinds, have a *nervous system*. The nervous system is something like an “electronic communications network” within the animal that allows it to respond and adjust to changes in its environment.

Invertebrates (animals without a backbone) have a nervous system that ranges from a simple set of nerves to a highly organized system of nerve cords and a simple brain. Vertebrates (animals with a backbone) have a nervous system that consists of three main parts. They are:

1. The *central nervous system* consists of the brain, spinal cord, and nerves.

2. The *autonomic system* is made up of nerves that control the involuntary actions of the heart, lungs, digestive system, and other parts of the body which must operate automatically and continually without interruption. The autonomic system normally operates without the animal or the human being aware of its action.
3. The *sense organs* (like the eyes, ears, nose, tongue, and skin) involve the total action of the nervous system, from initial input (stimulus) to final action (response).



The human nervous system sets people apart from all of the other creatures that share planet earth. God gave humans a very highly developed brain. The human brain functions something like—but much greater than—a highly developed “computer.” The human brain allows us to speak, to solve difficult problems, and to be creative with ideas and activities. Our brain also allows us to know and love God and to make choices for or against the way of life that God wants us to live. Truly, the human nervous system is the most complex and marvelous part of the human body!

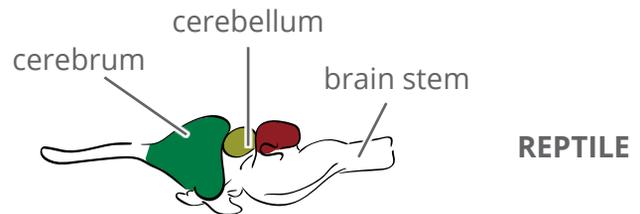
Let’s take a look at the three main parts of the nervous system of vertebrates. We will focus in this LIFEPAK primarily on the human nervous system, since it is the most highly developed of all the nervous systems in nature.

**Central nervous system.** The central nervous system of humans, and most animals, consists of the brain, the spinal cord, and the nerves. It functions like an electronic communications and control network that directs and coordinates the activities of the entire nervous system and the body. We will examine each part of the central nervous system, especially focusing on the brain as the key to the operation of the entire nervous system.

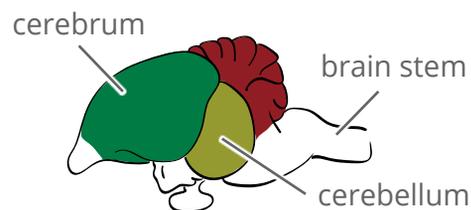
**The brain.** The *brain* is the “central control system” of the entire nervous system and body. The brain is an extremely complex organ. It directs the activity of over ten billion ( 10,000,000,000 + ) nerve cells! It constantly receives current information from the senses about conditions both inside and outside the body. It rapidly processes all this information and transmits messages that control the body’s activities and functions. The brain also stores bits of information from past learning experiences in the form of memory. This makes learning and remembering possible. The brain is also the source of thoughts, moods, and emotions. Using the resources of the brain, human beings can imagine, dream, think, reason, and

respond. We can create, invent, examine, and logically solve problems by using our brains.

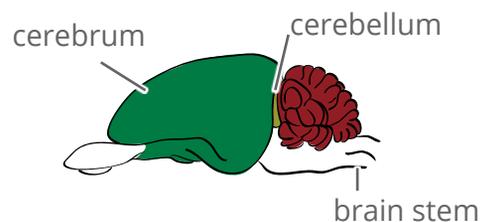
The brain in simple animals such as worms and insects (invertebrates) consists of small groups of nerve cells. Vertebrates (animals with a backbone) have a more complicated brain made up of three parts: the **cerebrum**, the **cerebellum**, and the *brain stem*. Animals with a more highly developed brain include apes, dolphins, and whales. Human beings have the most highly developed brain of all. The human brain consists of billions of interconnected cells. You will learn more about the three main parts of the human brain in the next part of this section of the LIFEPAK.



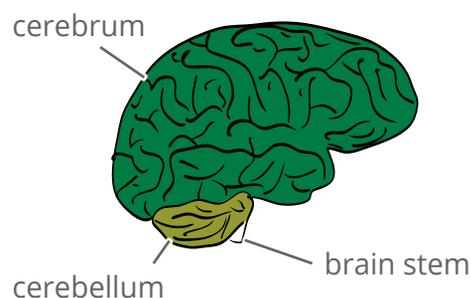
REPTILE



BIRD



CAT



HUMAN

| Brains of vertebrates



**Write the correct letter and answer in each blank.**

- 1.1** We often refer to the response actions of plants and animals as their \_\_\_\_\_ .  
 a. characteristics      b. behavior      c. ideals      d. cycles
- 1.2** Animals are living things that can move around in their \_\_\_\_\_ .  
 a. homes      b. bodies      c. ponds      d. environments
- 1.3** The \_\_\_\_\_ allows humans and animals to respond to their environments and to move and act in their environments.  
 a. nervous system      b. respiratory system      c. green chlorophyll      d. backbone
- 1.4** \_\_\_\_\_ have a nervous system that consists of three main parts.  
 a. Protists      b. Invertebrates      c. Vertebrates      d. Monerans
- 1.5** The most highly developed brain is in \_\_\_\_\_ .  
 a. fish      b. human beings      c. monkeys      d. elephants

**Answer true or false.**

- 1.6** \_\_\_\_\_ The central nervous system consists of the brain, spinal cord, and nerves.
- 1.7** \_\_\_\_\_ The autonomic system is part of the nervous system that controls involuntary actions in the body.
- 1.8** \_\_\_\_\_ A fish has a more highly developed brain than an ape.
- 1.9** \_\_\_\_\_ The spinal cord is part of the respiratory system.
- 1.10** \_\_\_\_\_ The three main parts of the brain in vertebrates are the cerebrum, the cerebellum, and the brain stem.

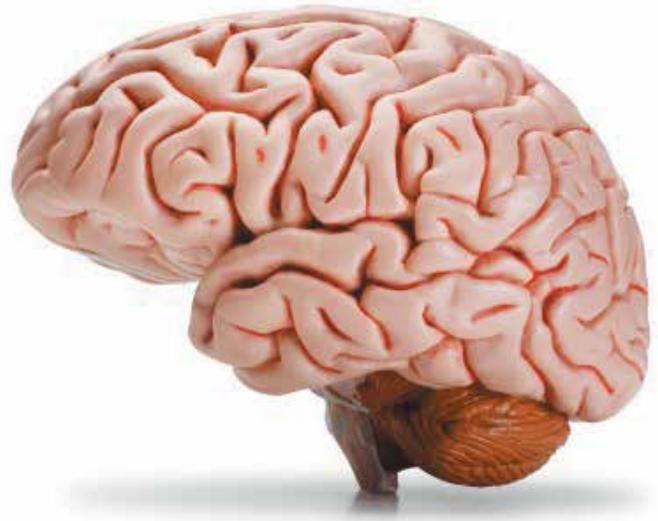
The human brain, like all vertebrate brains, has three main sections. They are the cerebrum, the cerebellum, and the brain stem. Each part consists mainly of nerve cells, called **neurons**, and supporting cells, called glia (which comes from a Greek word meaning “glue”). The human brain is grayish-pink in color. It looks something like a “mushroom,” in that it is like a cap on top of a stem. The brain is also a jelly-like ball that has many ridges and grooves on its surface. Let’s explore each of the three main parts of the human brain in more detail.

**Cerebrum.** The cerebrum makes up about 85 percent of the weight of the human brain. It is the seat of our intelligence and thought. It gives us the ability to learn, reason, remember, create, and think. The cerebrum handles thousands of messages from all parts of our body at the same time! It is greater than the most sophisticated computer built by man.

The cerebrum is divided into two halves called *hemispheres*. A large groove called the *longitudinal fissure* divides these two halves of the cerebrum. One of these halves is called the *left cerebral hemisphere*, and the other half is called the *right cerebral hemisphere*. The two hemispheres are connected by bundles of nerve fibers. The largest of these nerve fibers connecting the two hemispheres of the cerebrum is called the *corpus callosum*. Each hemisphere of the cerebrum is divided into four *lobes* (regions). The four lobes, and their locations, are as follows:

1. the *frontal lobe*, at the front of the cerebrum;
2. the *temporal lobe*, at the lower side;
3. the *parietal lobe*, in the middle; and
4. the *occipital lobe*, at the rear.

The surface of the two hemispheres of the cerebrum is covered with a layer of grey matter called the **cortex** (or the *cerebral cortex*). It is a thin layer of nerve cell bodies about 3.2 mm (1/8 inch) thick. The cortex has many folds and creases called *convolutions*. The cortex is responsible for all higher thought and



reasoning. The greater the amount of convolutions of the cortex, the higher the intelligence.

The cerebrum is connected to the sensory organs throughout the nervous system. The cerebrum interprets the messages sent to it from each one of these organs. The cerebrum is the part of the brain that allows us to *see, smell, hear, taste, and feel* our surroundings. The location centers for these sensory parts are located in different parts and lobes of the cerebrum; however, a blow to the head to one of these areas can cause our sensing and the messages from our sense organs to get mixed up. That is why we can “see stars” when we receive a blow to the back of the head where our vision is controlled in the occipital lobe. If the blow to the head is severe enough, we can even lose our sight, hearing, or any one of our senses. The skull or *cranium* is designed to protect the entire brain from most damage.

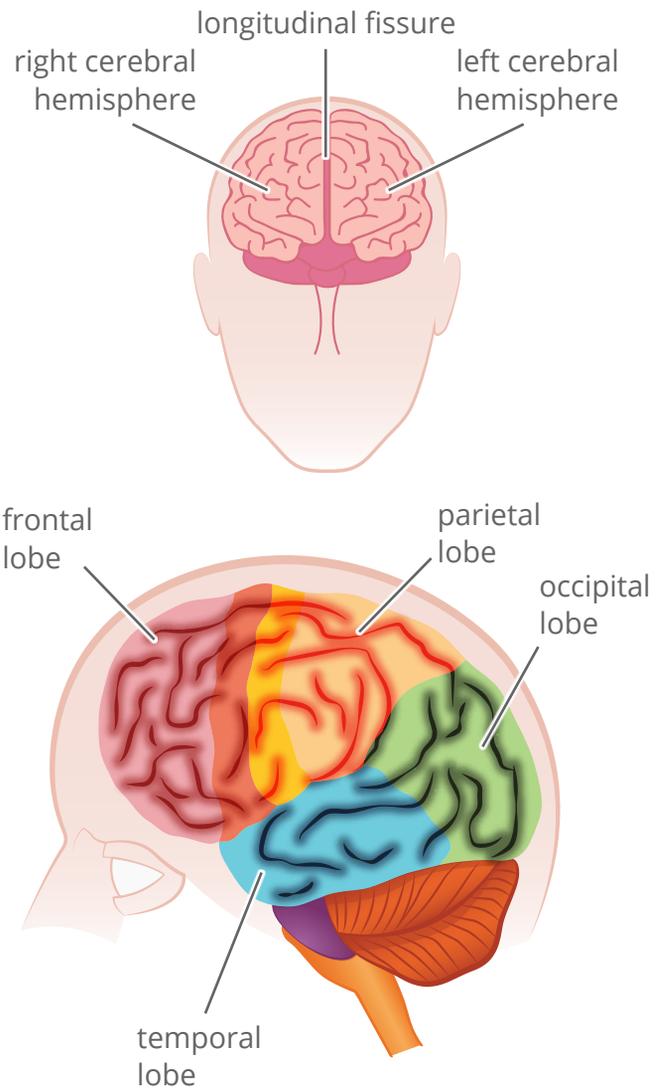
The cerebrum also controls the muscles of the body. The nerves carrying the messages cross over from the left side of our body to the right side of our brain and from the right to the left. A stroke in one part of the brain can cause paralysis in various parts of the body when a portion of this motor area of the brain gets damaged.

**Cerebellum.** The second main part of the brain is called the *cerebellum*. It is located in the lower back part of the brain. Its primary function is to coordinate all the muscles so that they work together. If the cerebellum is undeveloped, like it is in a newborn baby, muscular movements are jerky and uncoordinated. As the child grows, the cerebellum develops and causes all the muscles to act together in coordinated movements. This part of the brain also controls our sense of balance so we can walk or run straight.

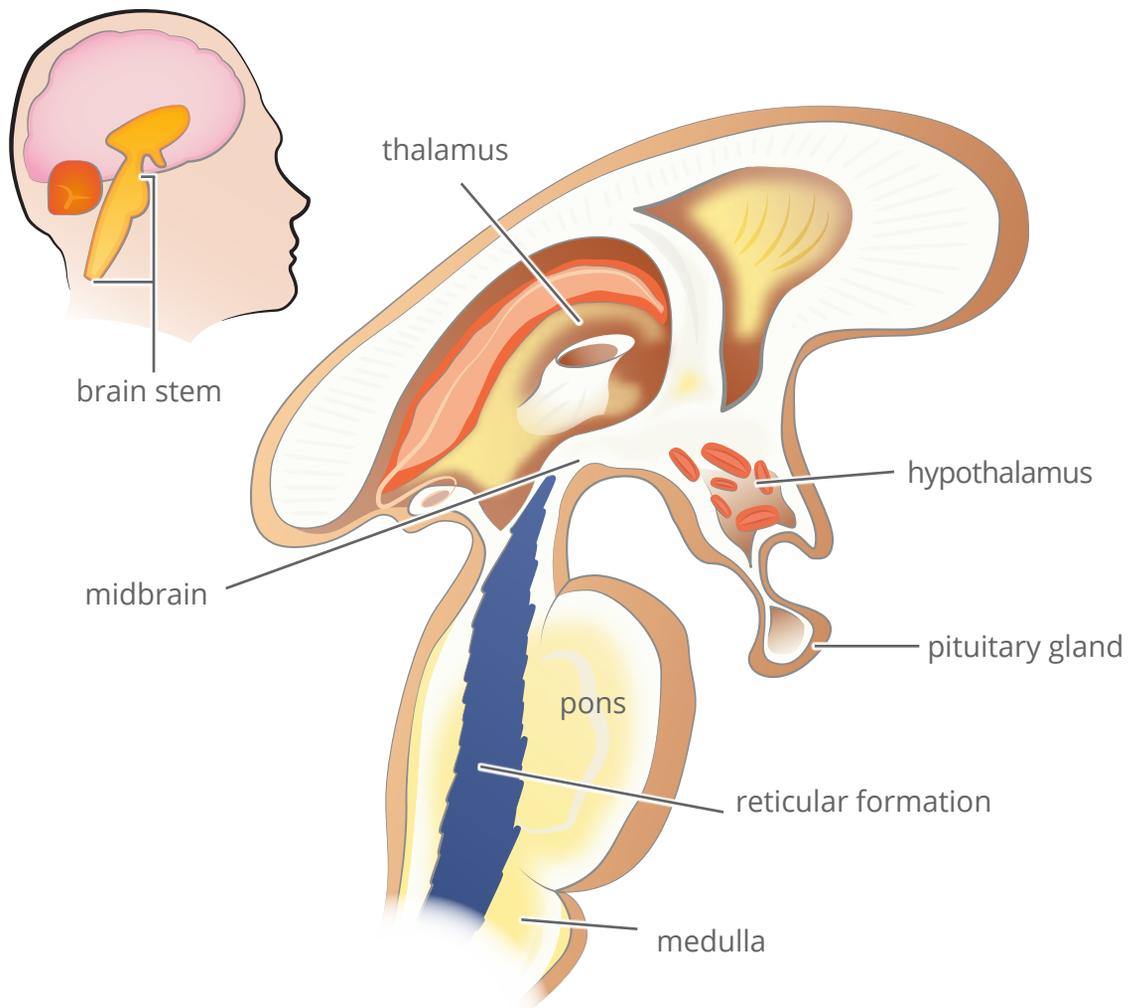
**Brain stem.** The third main part of the brain is called the *brain stem*. It is located on the back underside of the brain. It is a stalk-like structure that connects the cerebrum with the spinal cord. The brain stem consists of several different parts. The bottom part of the brain stem is called the **medulla**. The medulla has nerve centers that control breathing, heartbeat, and many other vital body functions.

Above the medulla, in the brain stem, is the *pons*. It contains nerve fibers that connect the cerebrum and the cerebellum. Above the pons is the *midbrain*. It contains nerve centers to help control movements of the eyes and the size of the pupils.

The upper part of the brain stem contains the *hypothalamus* and the *thalamus*. There are actually two thalami, one on the left and one on the right. The thalamus receives nerve impulses from various parts of the body and connects them to the appropriate areas of the cortex. The thalamus also relays impulses from one part of the brain to another. The hypothalamus



| The hemispheres and lobes of the cerebrum regulates body temperature, hunger, and other internal conditions of the body. The hypothalamus also controls the activity of the nearby *pituitary gland*.



### | The brain stem

Deep within the brain stem is a network of nerve fibers called the *reticular formation*. The reticular formation helps regulate and maintain the brain's awareness level. Sensory messages that pass through the brain stem stimulate the reticular formation. In turn, this stimulates the alertness and activity throughout the cortex covering the cerebrum.

Now, you understand more about the complexity of the brain and its three main parts:

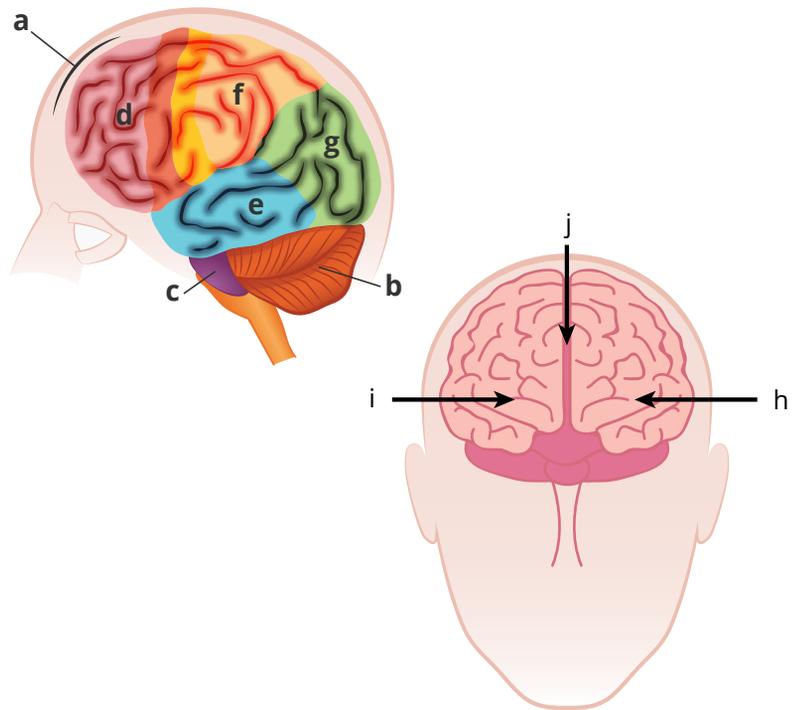
the cerebrum, the cerebellum, and the brain stem. From the brain stem, the brain sends out twelve pairs of nerve bundles that move from the brain to the body. These nerves connect to the sense organs, muscles, facial glands, and vital organs. These nerve bundles are like many tiny strands of wire wrapped together and wrapped with a cover. These twelve pairs of nerve bundles then branch out from the spinal cord to thirty-one pairs of special nerve bundles that connect every part of the brain.



**Complete the following activities.**

- 1.11** The three main parts of the brain are the a. \_\_\_\_\_, the b. \_\_\_\_\_, and the c. \_\_\_\_\_.
- 1.12** All the parts of the brain consist of nerve cells, called a. \_\_\_\_\_, and supporting cells, called b. \_\_\_\_\_.
- 1.13** Label the parts of the brain shown in the illustrations shown.

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
- d. \_\_\_\_\_
- e. \_\_\_\_\_
- f. \_\_\_\_\_
- g. \_\_\_\_\_
- h. \_\_\_\_\_
- i. \_\_\_\_\_
- j. \_\_\_\_\_



- 1.14** The \_\_\_\_\_ is a stalk-like structure that connects the cerebrum with the spinal cord.
- 1.15** From the brain stem, the brain sends out twelve pairs of \_\_\_\_\_ that move down from the brain to the body.

**Match these activities and functions with the parts of the brain.** Note that the name of one part of the brain may be used for more than one activity or function.

- |      |       |  |                        |
|------|-------|--|------------------------|
| 1.16 | _____ | controls muscles of the body   | a. cerebrum            |
| 1.17 | _____ | coordinates muscles so they work together                              | b. cortex              |
| 1.18 | _____ | controls breathing, heartbeat, and other vital body functions          | c. cerebellum          |
| 1.19 | _____ | controls movement of the eyes and size of pupils                       | d. brain stem          |
| 1.20 | _____ | contains nerve fibers that connect the cerebrum and cerebellum         | e. medulla             |
| 1.21 | _____ | interprets messages sent to it from sense organs                       | f. pons                |
| 1.22 | _____ | responsible for all higher thought                                     | g. midbrain            |
| 1.23 | _____ | responsible for ability to remember                                    | h. thalamus            |
| 1.24 | _____ | responsible for ability to learn                                       | i. hypothalamus        |
| 1.25 | _____ | connects cerebrum with spinal cord                                     | j. reticular formation |
| 1.26 | _____ | regulates and maintains brain's awareness level                        |                        |
| 1.27 | _____ | controls the activity of the pituitary gland                           |                        |
| 1.28 | _____ | relays impulses from one part of the brain to another                  |                        |
| 1.29 | _____ | regulates body temperature, hunger, and other internal body conditions |                        |
| 1.30 | _____ | connects nerve impulses from body to cortex                            |                        |

# SELF TEST 1

Answer true or false (each answer, 2 points).

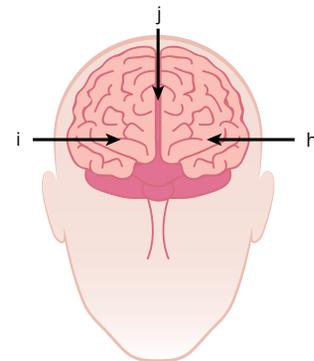
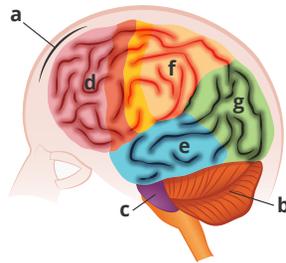
- 1.01 \_\_\_\_\_ Both humans and animals are able to interact with their environments.
- 1.02 \_\_\_\_\_ The central nervous system consists of the brain, spinal cord, and nerves.
- 1.03 \_\_\_\_\_ The brain stores information from past experience.
- 1.04 \_\_\_\_\_ The layer of gray matter covering the cerebrum is called the cortex.
- 1.05 \_\_\_\_\_ The top part of the brain stem is called the medulla.
- 1.06 \_\_\_\_\_ The reticular formation helps regulate and maintain the brain's awareness level.
- 1.07 \_\_\_\_\_ The autonomic nervous system regulates certain body functions without conscious control of the brain.
- 1.08 \_\_\_\_\_ "Knee jerk" is a conditional response.
- 1.09 \_\_\_\_\_ Behavior is the response action of living things to their environment.
- 1.010 \_\_\_\_\_ An example of "trial-and-error" learning is Pavlov's dogs.

Match the following items (each answer, 2 points).

- |       |                                |    |  |
|-------|--------------------------------|----|--|
| 1.011 | _____ habit                    | a. | has greatest intelligence of earth's creatures             |
| 1.012 | _____ simple motor act         | b. | instinct   |
| 1.013 | _____ habits of adjustment     | c. | carry and transmit messages                                |
| 1.014 | _____ man                      | d. | learn by doing over and over                               |
| 1.015 | _____ migration of birds       | e. | a very simple habit involving muscle movement              |
| 1.016 | _____ upper part of brain stem | f. | hypothalamus and thalamus                                  |
| 1.017 | _____ axon                     | g. | good and bad habits  |
| 1.018 | _____ dendrites                | h. | "glue" that holds nerve cells together                     |
| 1.019 | _____ synapse                  | i. | small space between axon and dendrite of different neurons |
| 1.020 | _____ trial-and-error learning | j. | lower part of backbone                                     |

1.021 Label the correct parts of the brain in the illustrations (each answer, 3 points).

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
- d. \_\_\_\_\_
- e. \_\_\_\_\_
- f. \_\_\_\_\_
- g. \_\_\_\_\_
- h. \_\_\_\_\_
- i. \_\_\_\_\_
- j. \_\_\_\_\_



Answer the following questions (each answer, 5 points).

1.029 What is an example of a conditional response and how is it learned? \_\_\_\_\_

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1.030 In what ways are human beings and animals similar and different? \_\_\_\_\_

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	<b>SCORE</b> _____	<b>TEACHER</b> _____	initials _____	date _____
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