

This lesson focuses on the central nervous system, peripheral nervous system and autonomic nervous system.

Photo Credit: Margaret Swanson



How many thoughts do you think you have in any given day?

# - ->> INSPIRE

Your knowledge of the nervous system and how it responds to massage movements will help you, as a salon professional, relax and soothe your clients' tight and fatigued muscles.

SCIENCE 102°.8 THE NERVOUS SYSTEM

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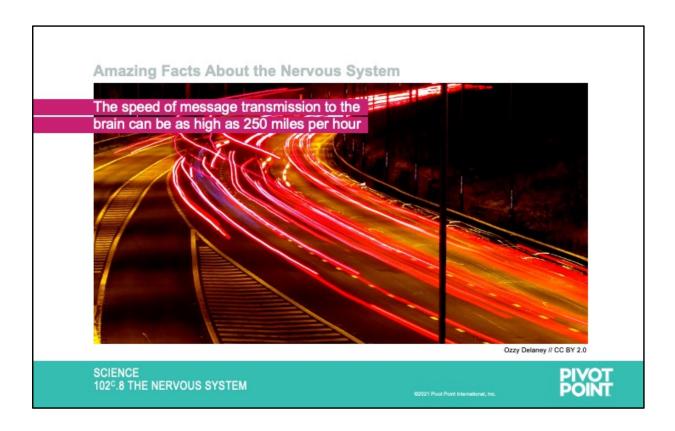


- · Following this lesson, you'll be able to:
- · Describe the structure and function of the central nervous system
- · Explain the structure and function of the peripheral nervous system
- · Offer examples of names of nerves found in the peripheral nervous system
- · Describe the structure and function of the autonomic nervous system

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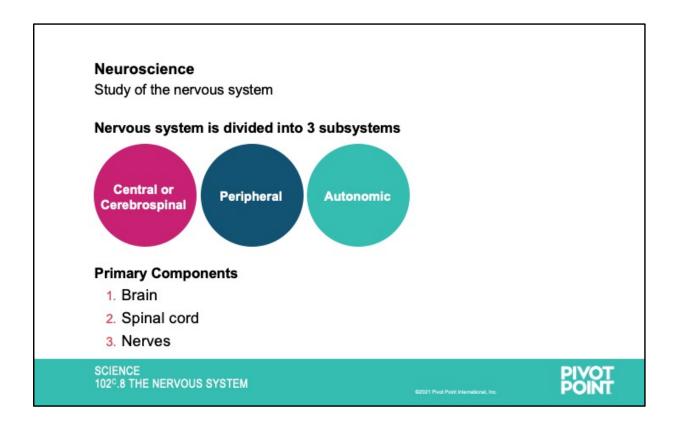




Sphenopalatine ganglioneuralgia is the scientific name for brain freeze.

It is thought that a yawn works to send more oxygen to the brain, therefore working to cool it down and wake it up.

Most people dream about 1-2 hours a night and have an average of 4-7 dreams each night.

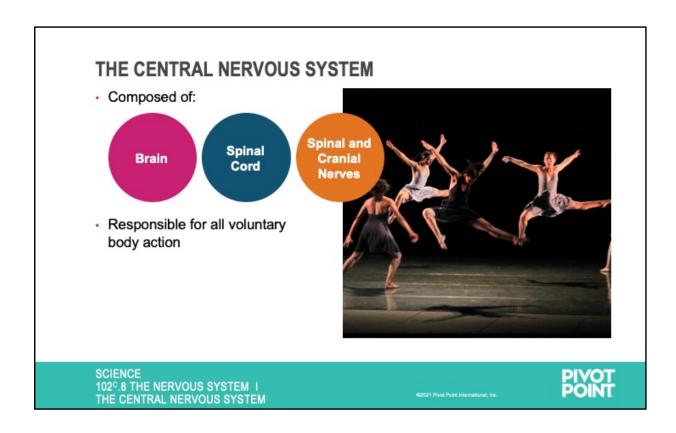


The study of the nervous system is called neuroscience. The nervous system coordinates and controls the operation of the human body.

The nervous system is divided into three subsystems:

- 1. The central or cerebrospinal nervous system
- 2. The peripheral nervous system
- 3. The autonomic nervous system

Primary components of the nervous system include the brain, spinal cord and nerves. The components of the nervous system, operating in harmony, receive and interpret stimuli and send messages from the nerve cell to the appropriate tissues, muscles and organs.



The central or cerebrospinal nervous system is composed of the brain, spinal cord and spinal and cranial nerves. The central nervous system is responsible for all voluntary body action.

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#### THE BRAIN AND SPINAL CORD

#### Brain

- Controls the nervous system
- · Is the command center
- · Weighs 45-49 ounces

#### **Spinal Cord**

- Composed of long nerve fibers
- · Originates in the base of the brain and extends to the base of spine
- Holds 31 pairs of spinal nerves

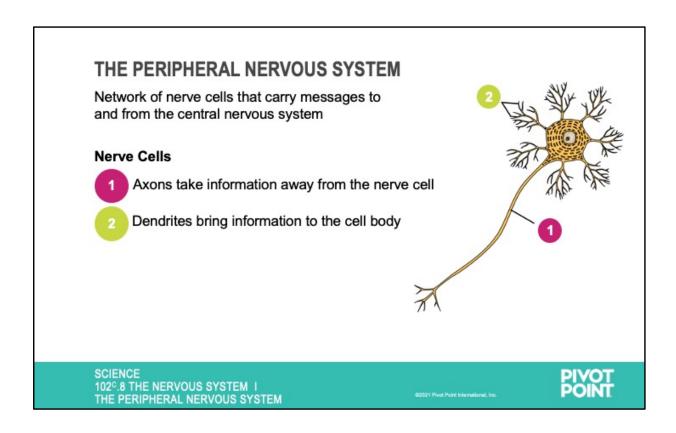
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The brain controls the nervous system. For that reason, the brain is referred to as the command center. The average adult human brain weighs between 45 and 49 ounces.

The spinal cord, composed of long nerve fibers, originates in the base of the brain and extends to the base of the spine. The spinal cord holds 31 pairs of spinal nerves that branch out to muscles, internal organs and skin.



The peripheral (pe-RIF-ur-al) nervous system is composed of sensory and motor nerves that extend from the brain and spinal cord to other parts of the body. This network of nerve cells carries messages to and from the central nervous system.

#### Nerve cells:

Like other cells, the nerve cell or neuron (NU-ron) has a nucleus, cytoplasm (SI-to-plazm) and membrane.

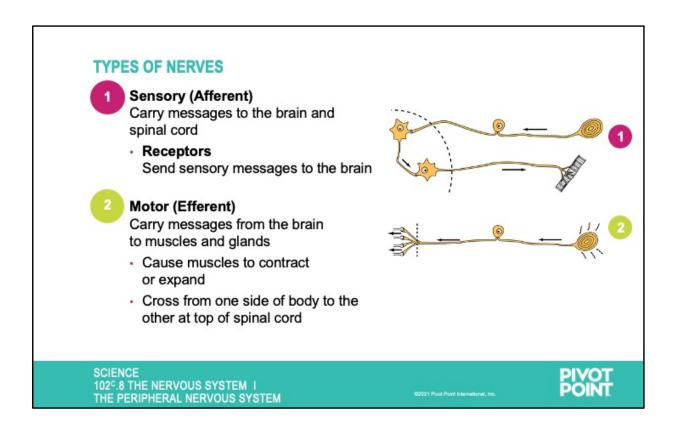
Nerve cells differ in appearance from other cells due to the long and short threadlike fibers called axons and dendrites, that extend from the cell.

Axons (AK-sonz) (1) take information away from the cell body in the form of nerve impulses.

Dendrites (DEN-dritz) (2) bring information to the cell body.

#### **DISCOVER MORE**

The dendrite system is similar to over a million interstate highways traveling back and forth from nerve cell to nerve cell. Certain activities, such as harmful narcotic drugs or a prolonged lack of oxygen, can close the highways down, never to open again.



Nerves or nerve tissues perform two basic functions.

- 1. Sensory or afferent nerves carry messages to the brain and spinal cord.
- Receptors (sensory nerve endings) send messages like touch, temperature, sight, sound, taste, smell, pain, and pressure to the brain for processing.
- 2. Motor or efferent nerves carry messages from the brain to the muscles and glands.
- When the brain sends a message, motor nerves receive the message and cause a muscle to contract or expand.
- · Motor nerves cross over from one side of the body to the other at the top of the spinal cord.
- Signals from the right side of the brain go to the left side of the body and vice versa.

Sensory and motor nerves can work together or independently. For example, if you want to pick up a pen, the brain simply sends a message to the motor nerves of your hand. This is a conscious decision. You are in control of your hand movement. However, remember the last time you accidentally touched a hot curling iron? Your sensory nerves sent a rapid message to your brain, transmitting the sensation you experienced. Your brain immediately responded by sensing pain and sending impulses back to motor nerves to move your hand away. This interaction of sensory and motor nerves is called a reflex action.

#### **FACE, HEAD AND NECK NERVES**

Trifacial Nerve (Trigeminal or 5th Cranial)

- Chief sensory nerve
- · Transmits facial sensations to the brain
- · Controls motor nerve function of chewing
- · Divides into 3 main branches



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Two of the 12 pairs of cranial nerves exert primary control in the areas of the face, head and neck: the trifacial (trigeminal or 5th cranial) nerve and the facial (7th cranial) nerve.

The largest of the cranial nerves, the trifacial (trigeminal or 5th cranial) nerve, is the chief sensory nerve primarily responsible for transmitting facial sensations to the brain and for controlling the motor nerve function of chewing (mastication). The trifacial nerve divides into three main branches.

#### **Trifacial Nerve**

- Ophthalmic Top <sup>1</sup>/<sub>3</sub> of face
  - Supraorbital
  - SupratrochlearInfratrochlear
  - Nasal
- Maxillary Middle <sup>1</sup>/<sub>3</sub> of face
  - Zygomatic
  - Infraorbital
- Mandibular Bottom <sup>1</sup>/<sub>3</sub> of face
  - Auriculotemporal
  - Mental



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The ophthalmic branch is the main nerve branch to the top 1/3 of the face, which further divides into:

- 1. Supraorbital (soo-pra-OR-bi-tal) Extends to skin of the upper eyelid, eyebrow, forehead and scalp
- 2. Supratrochlear (soo-pra-TRO-klee-ur) Extends to the skin of the upper side of the nose and between the eyes

2a. Infratrochlear (in-fra-TRO-klee-ur) – Emerges on the skin of the upper eyelid and side of the nose

3. Nasal (NA-zal) – Extends to the tip and lower side of the nose

The maxillary branch is the main nerve branch to the middle  $\frac{1}{3}$  of the face, which further divides into:

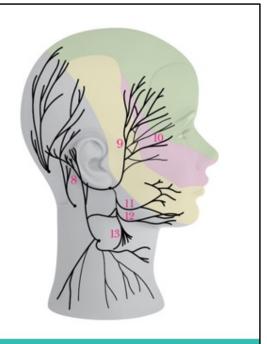
- 4. Zygomatic (zi-go-MAT-ik) Extends to the side of the forehead, temple and upper part of the cheek
- 5. Infraorbital (IN-fra-or-bi-tal) Extends to the lower eyelid, side of the nose, upper lip and mouth

The mandibular branch is the main nerve branch to the lower 1/3 of the face and further divides into:

- 6. Auriculotemporal (aw-RIK-u-lo- TEM-po-ral) Extends to the ear and to the area from the top of the head to the temple
- 7. Mental (MEN-tal) Extends to the lower lip and chin

# Facial Nerve (7th Cranial) Primary motor nerve of the face

- · Emerges from brain at the lower part of ear
- Has 6 branches of particular importance
  - Posterior Auricular
  - Temporal
  - 10. Zygomatic (upper and lower)
  - 11. Buccal
  - 12. Marginal Mandibular
  - Cervical



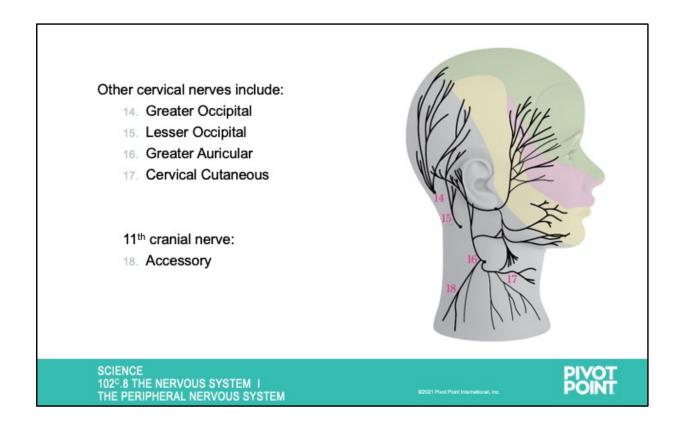
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The facial (7th cranial) nerve emerges from the brain at the lower part of the ear and is the primary motor nerve of the face. The facial nerve controls muscles of facial expression and sensation from the skin and tongue. Of its many branches, six are of particular importance.

- 8. Posterior Auricular (pos-TER-e-er aw-RIK-u-lur) Extends to muscles behind and below ear
- 9. Temporal (TEM-po-ral) Extends to muscles of temple, side of forehead, eyebrow, eyelid and upper cheek
- 10. Zygomatic (zi-go-MAT-ik) Extends to upper muscles of cheek
- 11. Bucal (BUK-al) Extends to the muscles of the mouth
- 12. Marginal Mandibular (mahr-JUH-nal man-DIB-u-lur) Extends to the muscles of the chin and lower lip
- 13. Cervical (SUR-vi-kal) Extends to the muscles on the side of the neck and platysma muscle



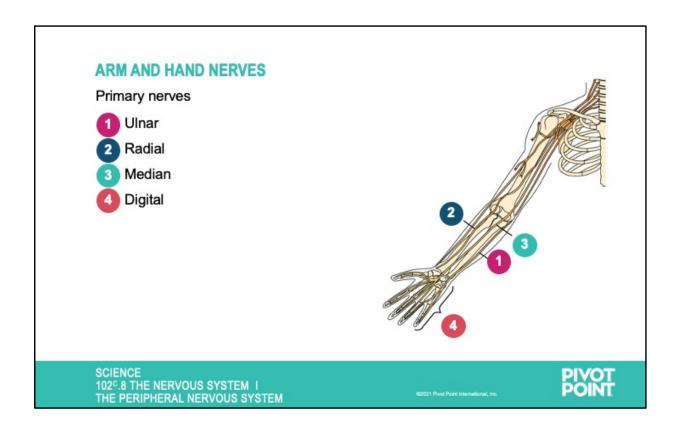
Other cervical nerves originate in the spinal cord with branches into the scalp and neck.

- 14. Greater Occipital (ak-SIP-et-el) Extends up the back of scalp to top of head
- 15. Lesser Occipital (ak-SIP-et-el) Extends into the muscles at back of skull 16. Greater Auricular (aw-RIK-u-lur) Extends into the side of neck and external ear
- 17. Cervical Cutaneous (SUR-vi-kal Ku-TA-ne-us) Extends into the side and front of neck to breastbone

The 11th cranial nerve is affected when using massage movements during a facial:

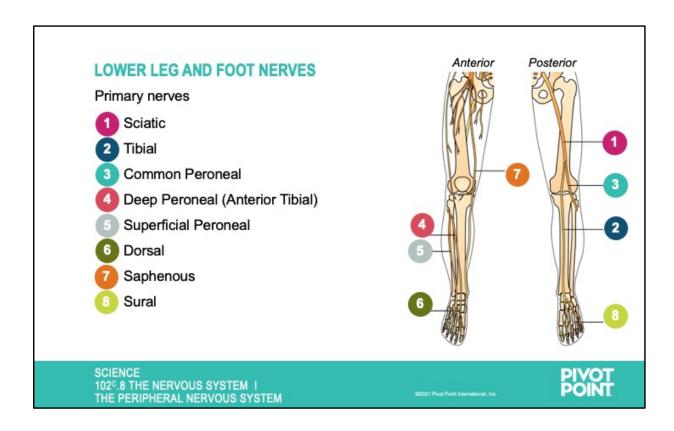
18. Accessory (ac-CES-sory) - Extends into sternocleidomastoideus and trapezius muscle

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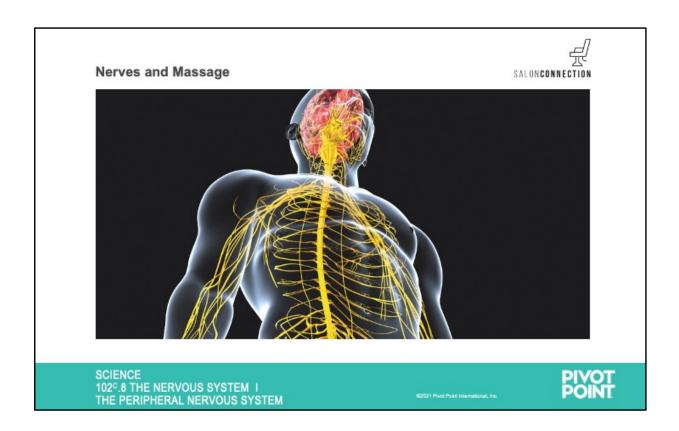
The primary nerves found in the arm and/or hand transmit sensations to the brain and carry impulses from the brain to the muscles.

- 1. Ulnar (UL-nur) Extends down little-finger side of arm into palm of the hand 2. Radial (RAY-de-ul) Extends down thumb side of arm into back of the hand
- 3. Median (ME-de-un) Extends down mid-forearm into the hand
- 4. Digital (DIJ-i-tul) Extends into fingers of the hand



The nerves of the leg and foot help move the body through the actions of the legs, feet and toes while maintaining balance when the body is moving or at rest.

- 1. Sciatic (sy-AT-ik) Begins in the lower back and runs through the buttock and down the lower limb
- 2. Tibial (TIB-ee-al) Passes behind the knee and the common peroneal nerve
- 3. Common Peroneal (per-oh-NEE-al) Runs alongside the sciatic nerve from the femur to the buttocks, then ventures further down on its own along the knee and behind the fibula. The nerve then splits inside the neck of the fibula into the deep peroneal and superficial peroneal.
- 4. Deep Peroneal, a.k.a. Anterior Tibial (an-TER-e-er TIB-e-al) A branch of the common peroneal
- 5. Superficial Peroneal (su-pur-FI-shul per-oh-NEE-al) A branch of the common peroneal
- 6. Dorsal (DOR-sul) The superficial nerve simply sits closer to the skin than the deep nerve and becomes the dorsal nerve
- 7. Saphenous (sa-FEEN-us) Begins in the thigh
- 8. Sural (SUR-ul) Runs down the back of the leg to the outside of the foot and little toe



The nerves of the face, head, neck, hands and feet may be stimulated during facials and/or massage. During massage services, movements can stimulate sensitive nerve tissues resulting in nerve impulses that expand and contract corresponding muscles. Through this process, tight muscles can be relaxed; fatigued muscles can be soothed.

## THE AUTONOMIC NERVOUS SYSTEM

- Responsible for all involuntary body functions
- Operates the digestive, excretory, respiratory, circulatory, endocrine and reproductive systems



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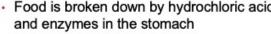


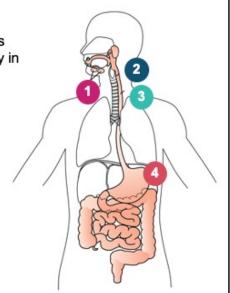
The autonomic (aw-to-NOM-ik) nervous system is responsible for all involuntary body functions. The autonomic system operates the digestive, excretory, respiratory, circulatory, endocrine and reproductive systems. The circulatory system can be found in a separate lesson, while the other involuntary systems are briefly explained in this lesson.

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# THE DIGESTIVE SYSTEM Breaks food down into simpler chemical compounds easily absorbed by cells or eliminated from the body in waste products Enzymes from salivary glands (1) start breaking down food · Food travels down pharynx (2) and through esophagus (3) Food is propelled into stomach (4)

esophagus (peristalsis) Food is broken down by hydrochloric acids





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by twisting and turning of

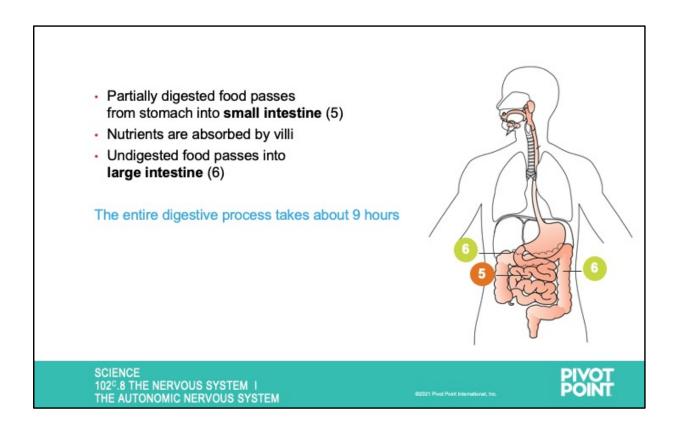


The digestive process begins as soon as food is ingested, when enzymes (EN-zimz) secreted by the salivary (SAL-i-ver-e) glands (1) start breaking down the food.

Food travels down the pharynx (FAR-ingks) (2) and through the esophagus (e-SOF-ah-gus) (3) into the stomach (4), propelled by a twisting and turning motion of the esophagus called peristalsis (per-i-STALsis).

In the stomach, hydrochloric (hi-dro-KLO-rik) acids and several other enzymes further break down food.

One of these other enzymes, pepsin, is responsible for the breakdown of protein into polypeptide (pol-e-PEP-tide) molecules and free amino acids, which are particularly important to the production of hair, skin and nails

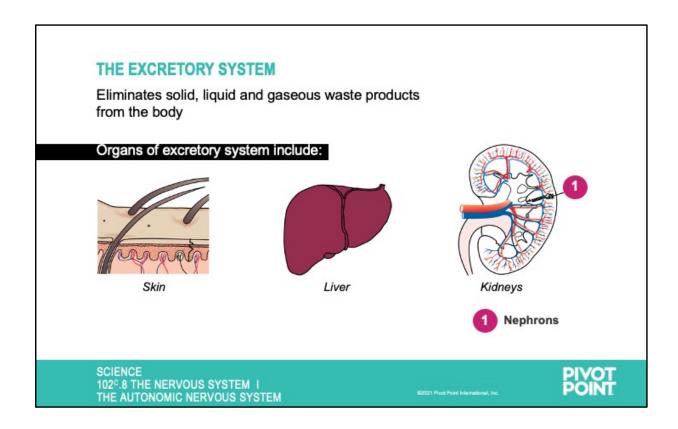


As partially digested food passes from the stomach into the small intestine (5), the assimilation of nutrients begins.

• Nutrients are absorbed by the villi (VIL-i), which are fingerlike projections of the intestine walls, and transported through the circulatory system to the tissues and cells of the body.

Undigested food passes into the large intestine (6), or colon, which stores the waste for eventual elimination through the anal canal.

 This process of digestion takes about 9 hours to complete. Happiness and relaxation promote good digestion. Good digestion helps keep all other bodily functions on track.



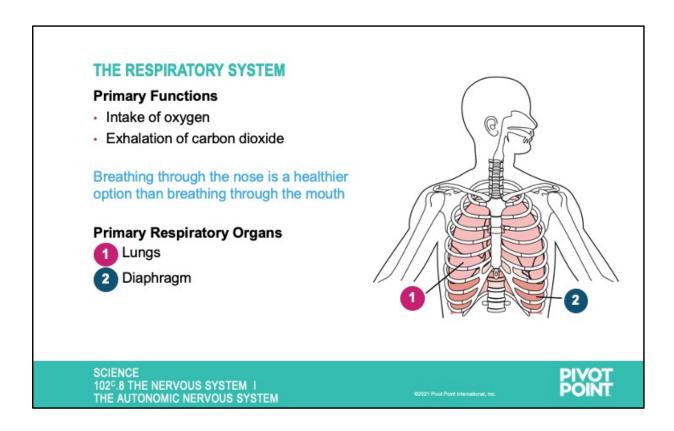
The excretory system eliminates solid, liquid and gaseous waste products from the body.

Organs of the excretory system include:

The skin covers nearly 20 square feet of body surface and is the body's largest organ. The skin releases water, carbon dioxide and other waste through the sweat glands.

The liver converts and neutralizes ammonia from the circulatory system to urea (u-RE-ah). Urea is then carried, through the bloodstream, to the kidneys for excretion.

The kidneys receive urea from the liver and then pass the urea through small tube-like structures known as nephrons (NEF-ronz) (1). Nephrons filter waste products and water allowing usable nutrients to be reabsorbed into the blood. Excreted waste products travel through the ureter and bladder and are eliminated from the body in urine.



The respiratory system is made up of organs and tissues that help you breathe. The primary functions of the respiratory system are:

- The intake of oxygen to be absorbed into the blood
- The exhalation of oxygen's toxic byproduct, carbon dioxide

Both of these functions take place every time you take a breath. While it is possible to breathe through both the mouth and the nose, breathing through the nose is the healthier option. The nose contains mucus membranes, to filter out dust and dirt, and warms the inhaled air as it travels through the nasal passages.

Primary respiratory system organs:

- 1. The lungs are spongy organs composed of cells into which air enters when you inhale. These cells process oxygen for absorption into the blood and release carbon dioxide as you exhale.
- 2. The diaphragm is a muscular organ that separates the chest cavity from the abdomen. The diaphragm expands and contracts automatically to force air in and out of the lungs

#### THE ENDOCRINE SYSTEM

- Specialized ductless glands regulate and control growth, reproduction and health of the body
- · Manufactures and secretes hormones into bloodstream
- Affects hair growth, skin conditions, energy levels
  - Signs of fatigue or changes in hair growth may signal need for medical attention

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The endocrine system is composed of a group of specialized ductless glands that regulate and control the growth, reproduction and health of the body. These glands manufacture chemical substances called hormones and secrete them directly into the bloodstream. For example, the thyroid gland is a ductless gland that is responsible for making and storing hormones that help regulate the heart rate, blood pressure, body temperature and the rate at which food is converted into energy.

The endocrine system directly affects hair growth, skin conditions and energy levels. Signs of fatigue or changes in hair growth may signal the need for medical attention.

#### THE REPRODUCTIVE SYSTEM

- Responsible for process by which a living organism procreates
- · Produces estrogen and testosterone
  - Hormones that have the ability to influence skin conditions such as acne, hair growth and hair color

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The reproductive system is responsible for the process by which a living organism procreates. Estrogen and testosterone are two hormones produced by the reproductive system that have the ability to influence skin conditions such as acne, hair growth and hair color.

#### **CHECK WHAT YOU KNOW**

- TRUE FALSE The nervous system coordinates and controls the operation of the human body.
- TRUE FALSE The central nervous system is responsible for all involuntary body action.
- Primary components of the nervous system include the nerves, spinal cord and
- 4. The network of nerve cells that carries messages to and from the central nervous system is known as the \_\_\_\_\_\_\_.
- 5. The type of nerves that carry messages to the brain and spinal cord are called afferent or \_\_\_\_\_\_.

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6.	The type of nerves that carry messages from the brain to the muscles and glands are called efferent or
7.	The nerve responsible for controlling the motor nerve function of chewing is known as the 5th cranial or
8.	The primary nerves of the arm and/or hand are the ulnar, radial, median and
9.	A subsystem of the nervous system responsible for all involuntary body functions is the
10.	During the digestive process, food travels through the esophagus to the
	ENCE  ©.8 THE NERVOUS SYSTEM   CHECK WHAT YOU KNOW

#### **CHECK WHAT YOU KNOW**

- 1. TRUE FALSE The nervous system coordinates and controls the operation of the human body. Page 95
- 2. TRUE FALSE The central nervous system is responsible for all involuntary body action. Page 95
- Primary components of the nervous system include the nerves, spinal cord and <u>brain</u>. Page 95
- 4. The network of nerve cells that carries messages to and from the central nervous system is known as the <a href="mailto:peripheral">peripheral</a> <a href="mailto:nervous">nervous</a> <a href="mailto:system">system</a>. Page 96
- 5. The type of nerves that carry messages to the brain and spinal cord are called afferent or sensory nerves. Page 96

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#### CHECK WHAT YOU KNOW

- 6. The type of nerves that carry messages from the brain to the muscles and glands are called efferent or <u>motor</u> <u>nerves</u>. Page 96
- 7. The nerve responsible for controlling the motor nerve function of chewing is known as the 5th cranial or <u>trifacial</u> <u>nerve</u>. Page 97
- 8. The primary nerves of the arm and/or hand are the ulnar, radial, median and <u>digital</u>. Page 99
- 9. A subsystem of the nervous system responsible for all involuntary body functions is the autonomic nervous system. Page 101
- During the digestive process, food travels through the esophagus to the <u>stomach</u>. Page 101

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### THE CENTRAL NERVOUS SYSTEM

- Neuroscience is the study of the nervous system
- The central nervous system is composed of the brain, spinal cord and nerves – Controls all voluntary body action
  - The brain controls the nervous system
  - The spinal cord originates in the base of the brain and extends to the base of the spine; holds 31 pairs of spinal nerves

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#### THE PERIPHERAL NERVOUS SYSTEM

- Network of nerve cells that carries messages to and from the central nervous system
  - Axons take information away from the cell
  - Dendrites bring information to the cell body
- Two types of nerves
  - Sensory Messages to the brain and spinal cord
  - Motor Messages from the brain to the muscles and glands

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#### THE PERIPHERAL NERVOUS SYSTEM

- Trifacial (5th cranial) is the chief sensory nerve of the face
- The facial (7th cranial) nerve is the primary motor nerve of the face
- Primary nerves found in the arm and/or hand are the ulnar, radial, median and digital
- Lower leg and foot nerves move the body through the actions of the legs, feet and toes while maintaining balance

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#### THE AUTONOMIC NERVOUS SYSTEM

- Responsible for all involuntary body functions
- Operates the:
  - Digestive system Breaks food down
  - Excretory system Eliminates waste products from the body
  - Respiratory system Responsible intake of oxygen and exhalation of carbon dioxide
  - Endocrine system Regulates and controls the growth, reproduction and health of the body
  - Reproductive system Responsible for the process by which living organisms procreate

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