

VISIBLE  BODY®

The Brain Part I

A nervous system lab activity using Visible Body Suite

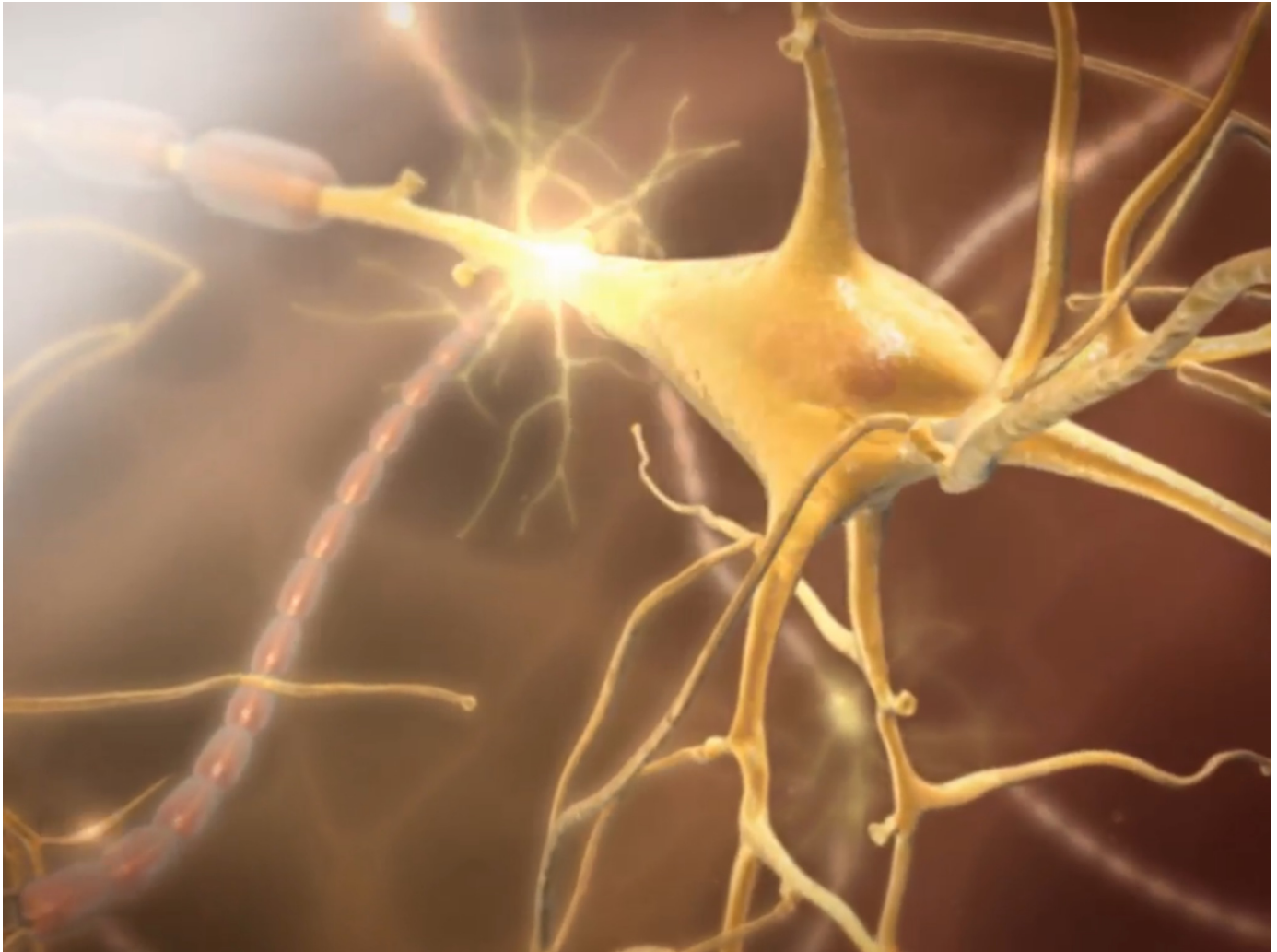
**Blythe Nilson, Associate Professor of Biology,
University of British Columbia Okanagan**

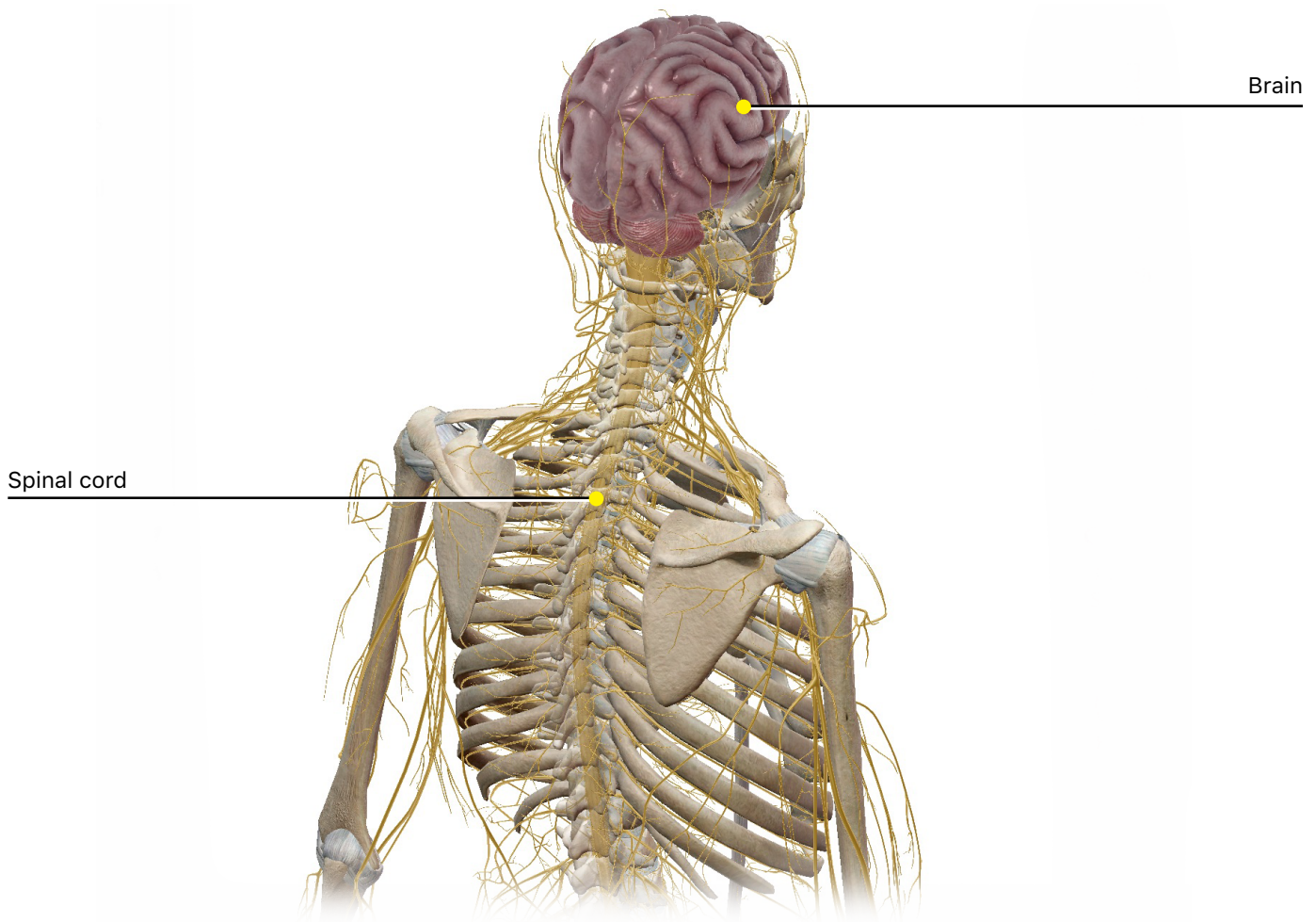
PRE-LAB EXERCISES

Open Visible Body Suite. From the main menu, select Anatomy & Physiology. Click or tap on Unit 5. Nervous System & Special Senses. You can also use the Search function to find any of the modules in this lab.

You are responsible for the identification of all **bold terms**.

A. Watch the video called Module 17.1 Nervous System Functions, then explore the 3D anatomical view named Module 17.2 Nervous System Anatomy, and then answer the following questions.

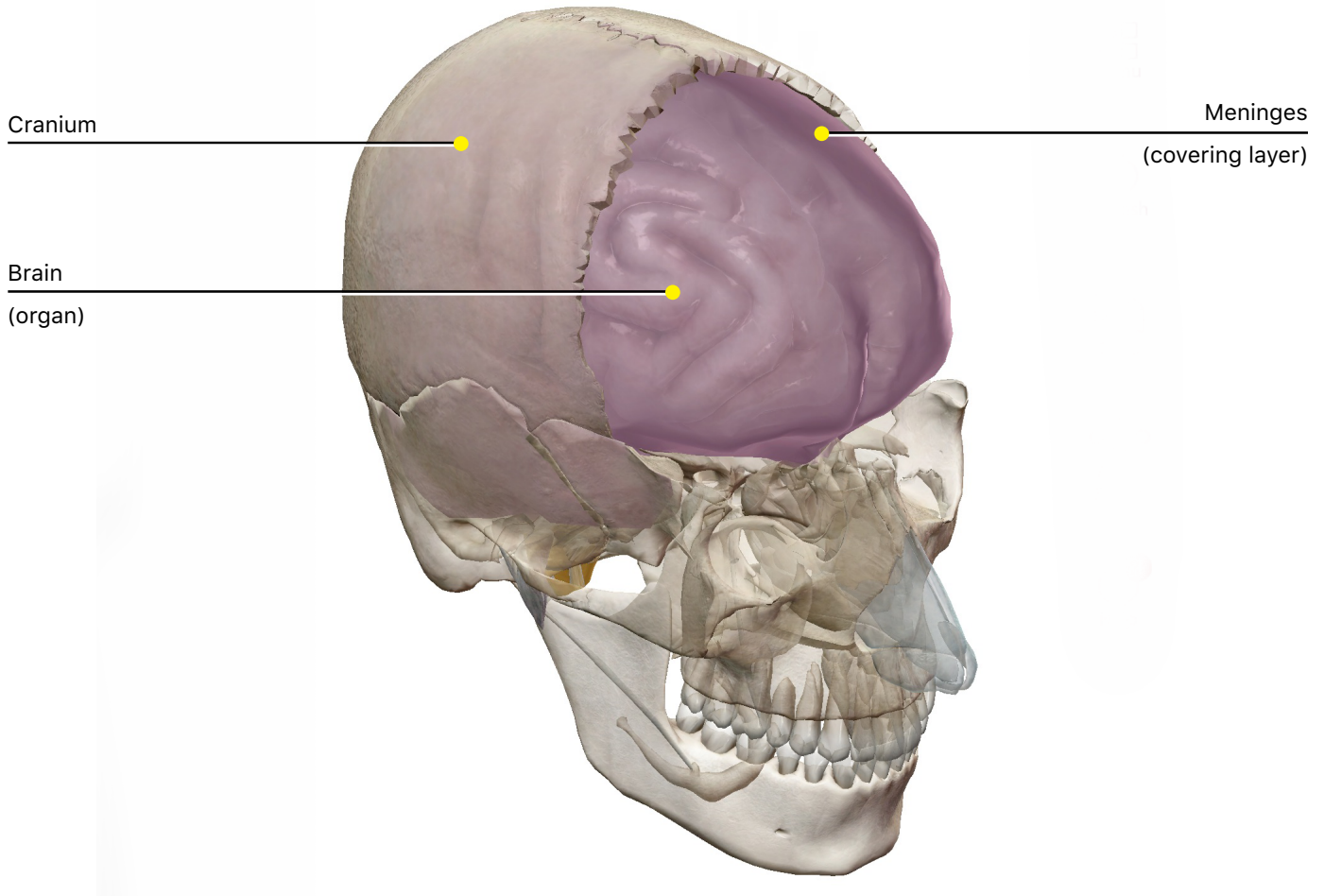




1. How are electrical impulses passed throughout the body?
2. The **brain** receives information from the body via _____.
3. The **nervous system** is broadly divided into the _____ nervous system and the _____ nervous system.
4. The **central nervous system** consists of the _____ and the _____.



B. Explore the 3D anatomical view named Module 20.1 The Brain and answer the following questions.



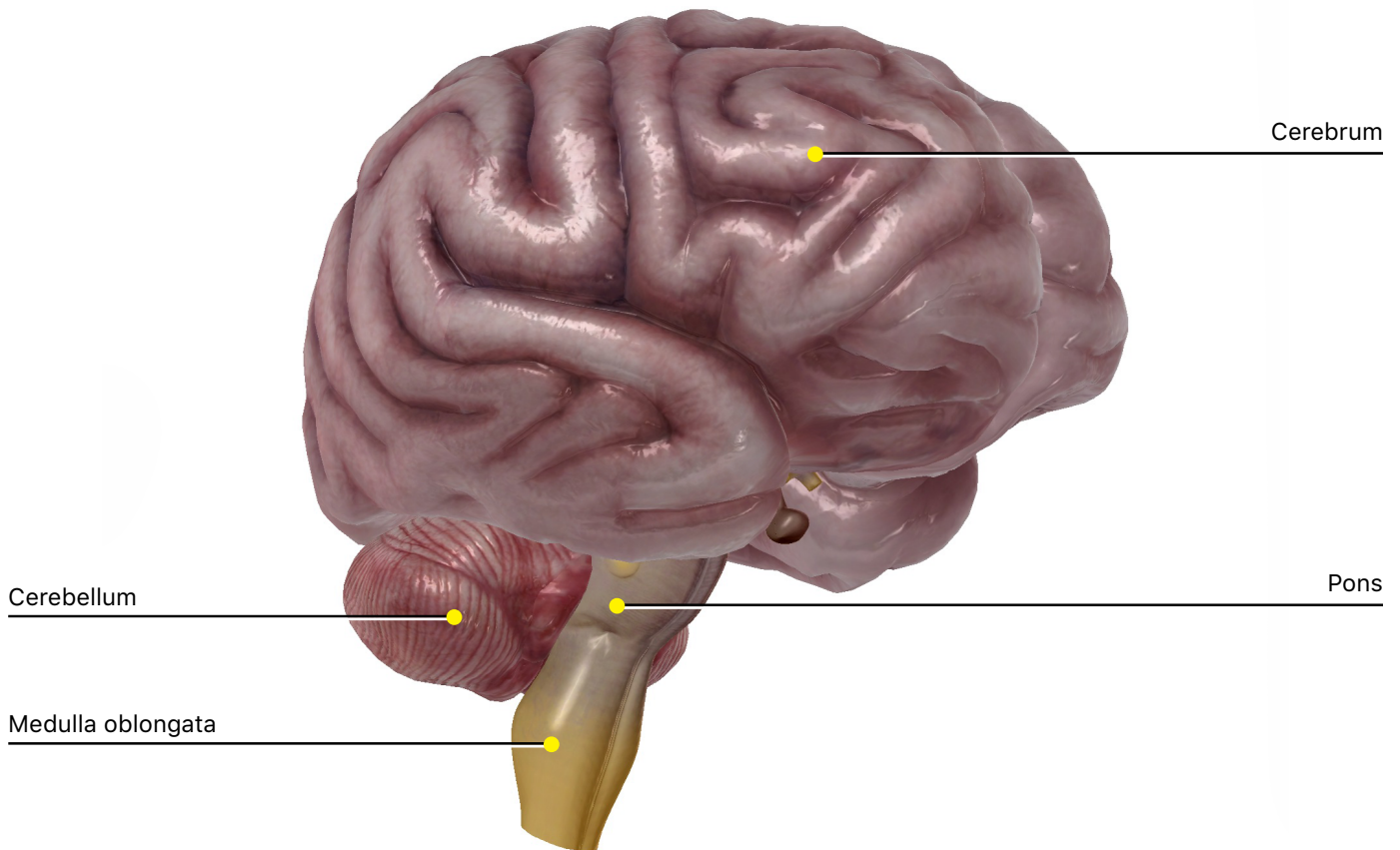
1. The brain is the largest organ of the nervous system. What are its main functions?
2. The brain is part of the _____ nervous system. It is housed within the _____ and covered by the _____.
3. Select the **meninges** from the left-side menu and use the book icon to read the definition.
 - a. What are the three layers of meninges?
 - b. Which is the outermost layer of the meninges?
4. Select the **cranium** from the left-side menu and use the book icon to read the definition. The cranium consists of the bones that _____ and fuse with the _____ to form the **skull**.

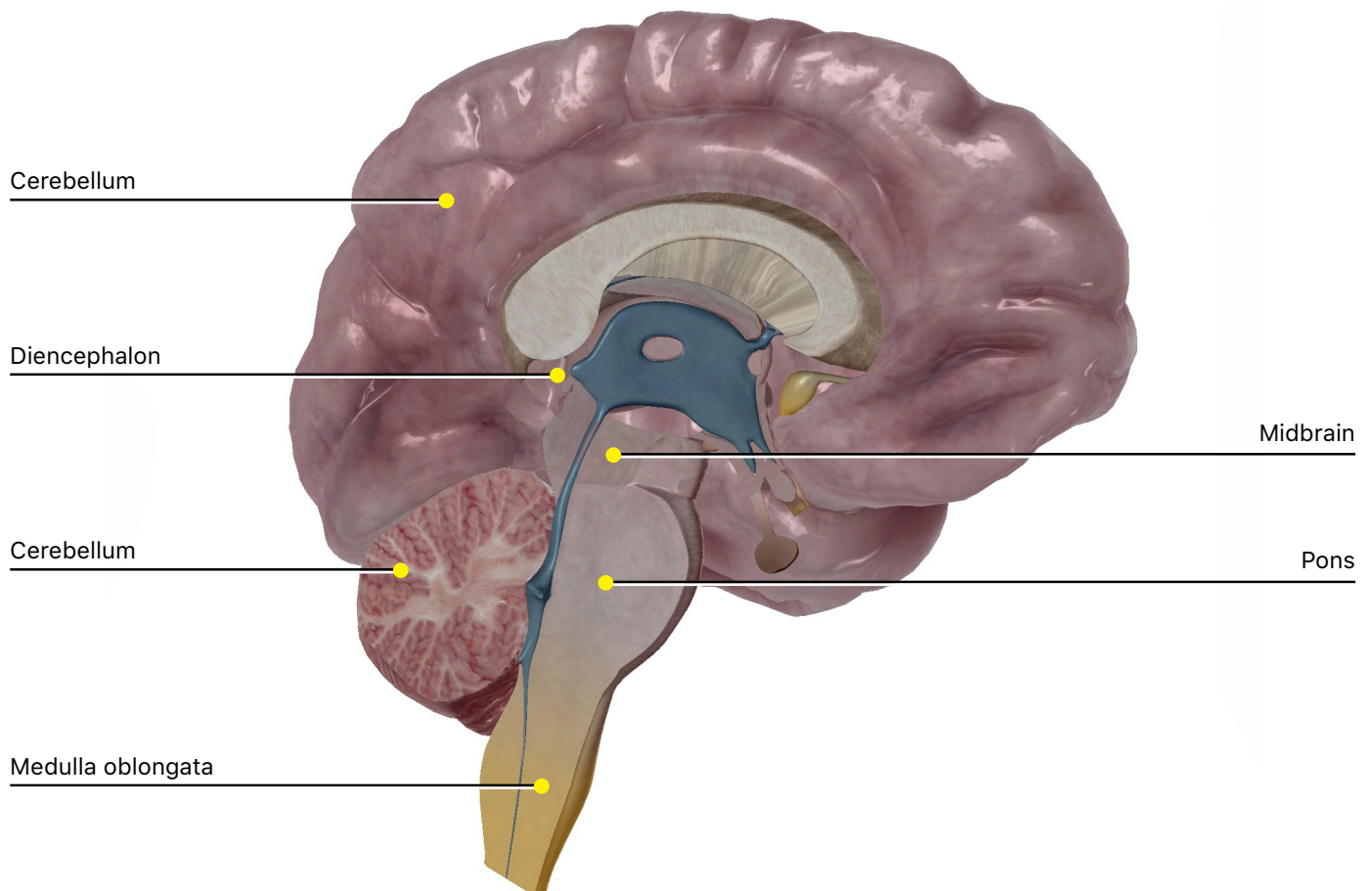
IN-LAB EXERCISES

Use the following modules in Visible Body Suite to guide your exploration of the brain. Be sure to select the book icon in the context box to learn more about the structures you are exploring.

You are responsible for the identification of **all bold terms** and all answers to the questions.

Explore the 3D anatomical views in Modules 20.2 Brain Regions and 20.3 Brain Cross Section; select each brain region from the left-side menu to observe its location and use the book icon to read its definition. Use these modules to answer the following questions.



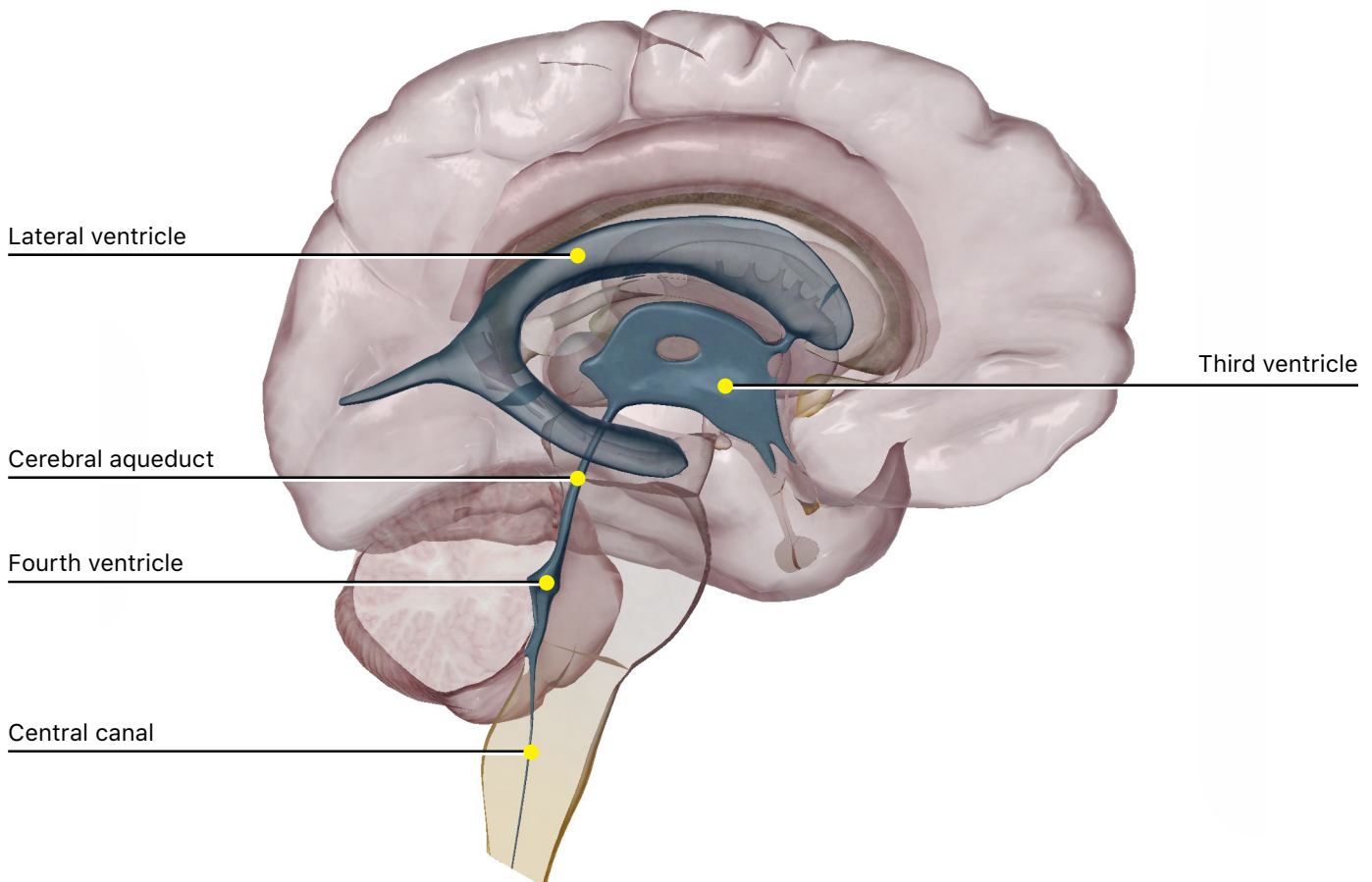


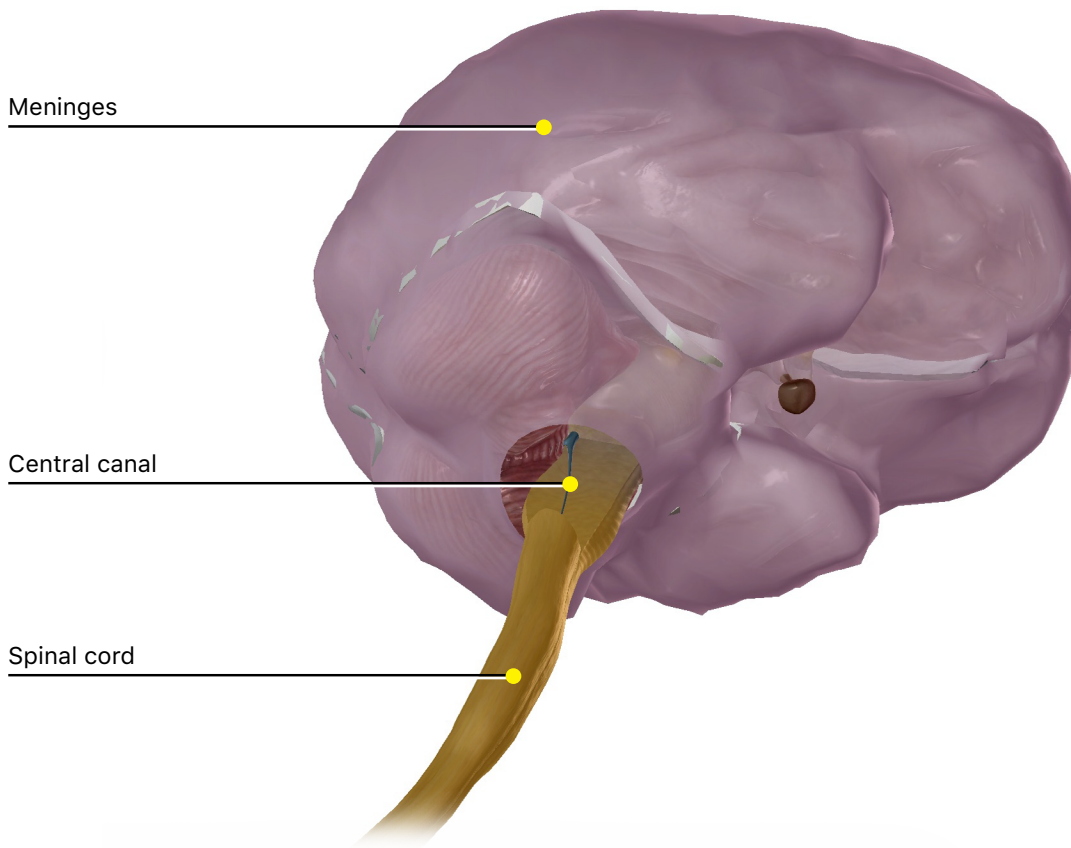
1. List the six major regions of the brain and identify their main functions.

2. The largest region of the brain is the _____. Its outer _____ mostly contains cell bodies, and thus, it is known as _____ matter. The inner _____ mainly consists of myelinated neuronal processes, and thus, it is known as _____ matter.

3. The region of the brain that connects to the **spinal cord** is the _____.
4. The brain can also be organized into regions based on the early stages of brain development. These regions are the **prosencephalon**, **mesencephalon**, **metencephalon**, and **myelencephalon**.
- a. Which major brain regions are part of the **forebrain** (prosencephalon)?
 - b. Which major brain region is also called the **mesencephalon**?
 - c. Which major brain regions make up the **metencephalon**?
 - d. Which major brain region is part of the **myelencephalon**?

B. Explore the 3D anatomical views in Modules 20.4 Ventricles of the Brain and 20.5 Cerebrospinal Fluid, and then answer the following questions.





1. The central nervous system contains cavities filled with **cerebrospinal fluid (CSF)**. In the brain, there are four connected cavities called **ventricles**. In Module 20.4 Ventricles of the Brain, select the **lateral ventricles** from the left-side menu and use the Hide Others tool to remove the other brain structures from the view. Rotate the view as needed to examine the lateral ventricles and use the book icon to read a description of the ventricles.

a. Locate and name the four parts of each lateral ventricle.

b. Which part connects the two lateral ventricles to each other?

c. The two lateral ventricle cavities are separated by the _____.

2. Select the **third ventricle** from the left-side menu and use the book icon to review the description of the ventricles. This flat cavity connects to the lateral ventricles via the _____.

3. Select the **fourth ventricle** from the left-side menu and use the book icon to review the description of the ventricles. Use the Hide tool to remove the cerebellum from the view, so you can examine the fourth ventricle.

a. The fourth ventricle is connected to the third ventricle via the _____.

b. The fourth ventricle is composed of a single _____ and two _____.

c. The lowest part of the fourth ventricle is continuous with the _____ in the spinal cord.

4. Select any ventricle and use the arrow in the content box to choose Ventricles from the selected structure list, highlighting them in the view. Then, use the Hide Others tool to examine the brain's ventricles and canals in isolation. Finally, use the Show Others tool to observe the location of each ventricle.

a. The lateral ventricles are located in the _____.

b. The third ventricle is located in the _____.

c. The fourth ventricle is located between the _____ and the _____ and continues into the _____.

5. Use the right arrow at the bottom of the left-side menu to open Module 20.5 Cerebrospinal Fluid and learn about how CSF supports the central nervous system as it circulates through a system of ventricles and canals. CSF is produced by _____, which are special structures found on the _____.

6. Select the ventricles from the left-side menu and note where the **central canal** enters and travels through the _____.

7. Select the meninges from the left-side menu and use the book icon to read their definition.

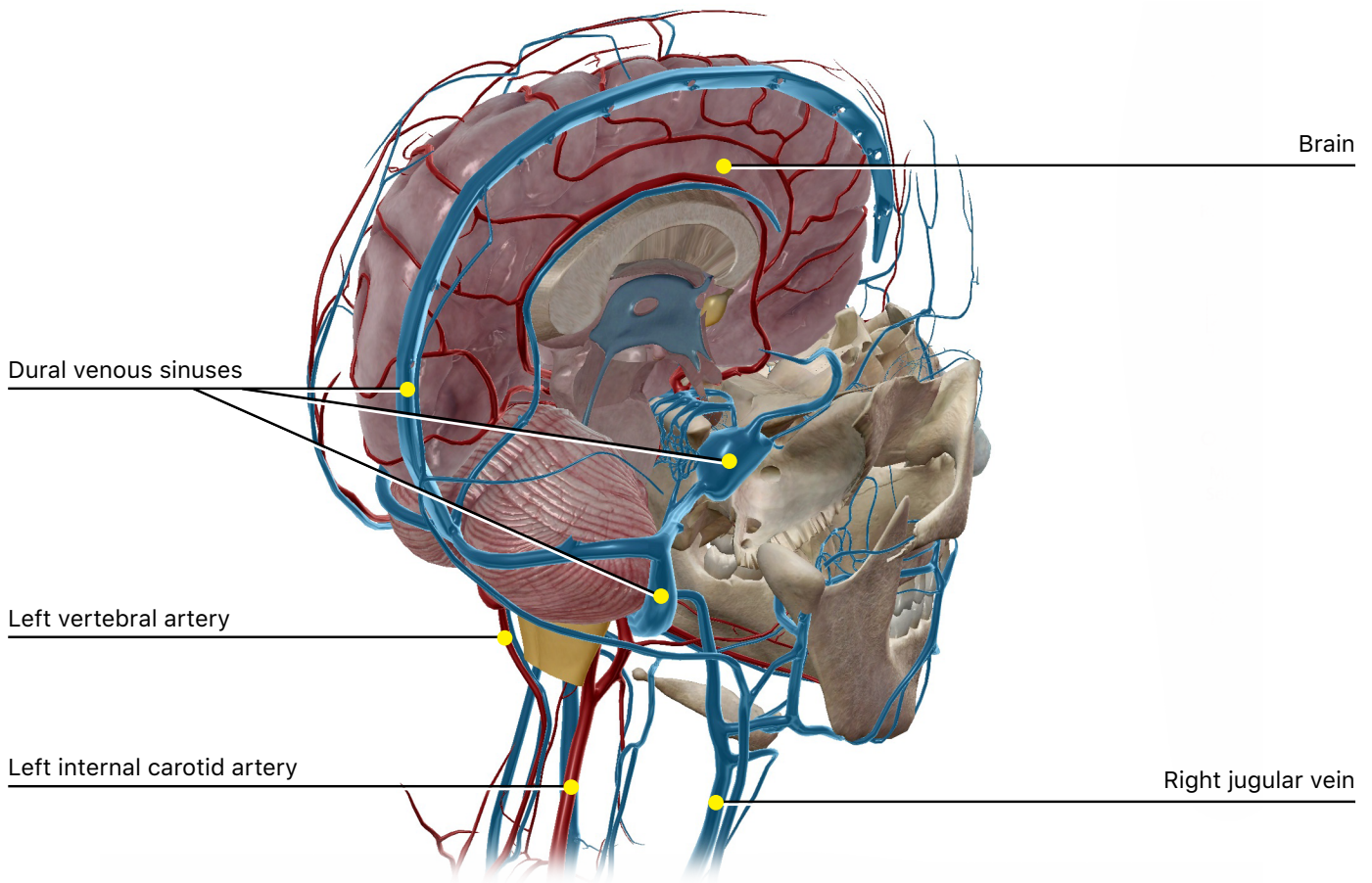
a. The meninges are the three layers of connective tissue that surround the _____ and the _____.

b. CSF circulates between the inner two layers of the meninges. These inner layers are the _____ and _____. (*For a different view of the meninges, go back to Module 20.1 The Brain.*)

8. What are the functions of CSF?



C. Explore the 3D anatomical view in Module 20.6 Blood Supply to the Brain and answer the following questions.

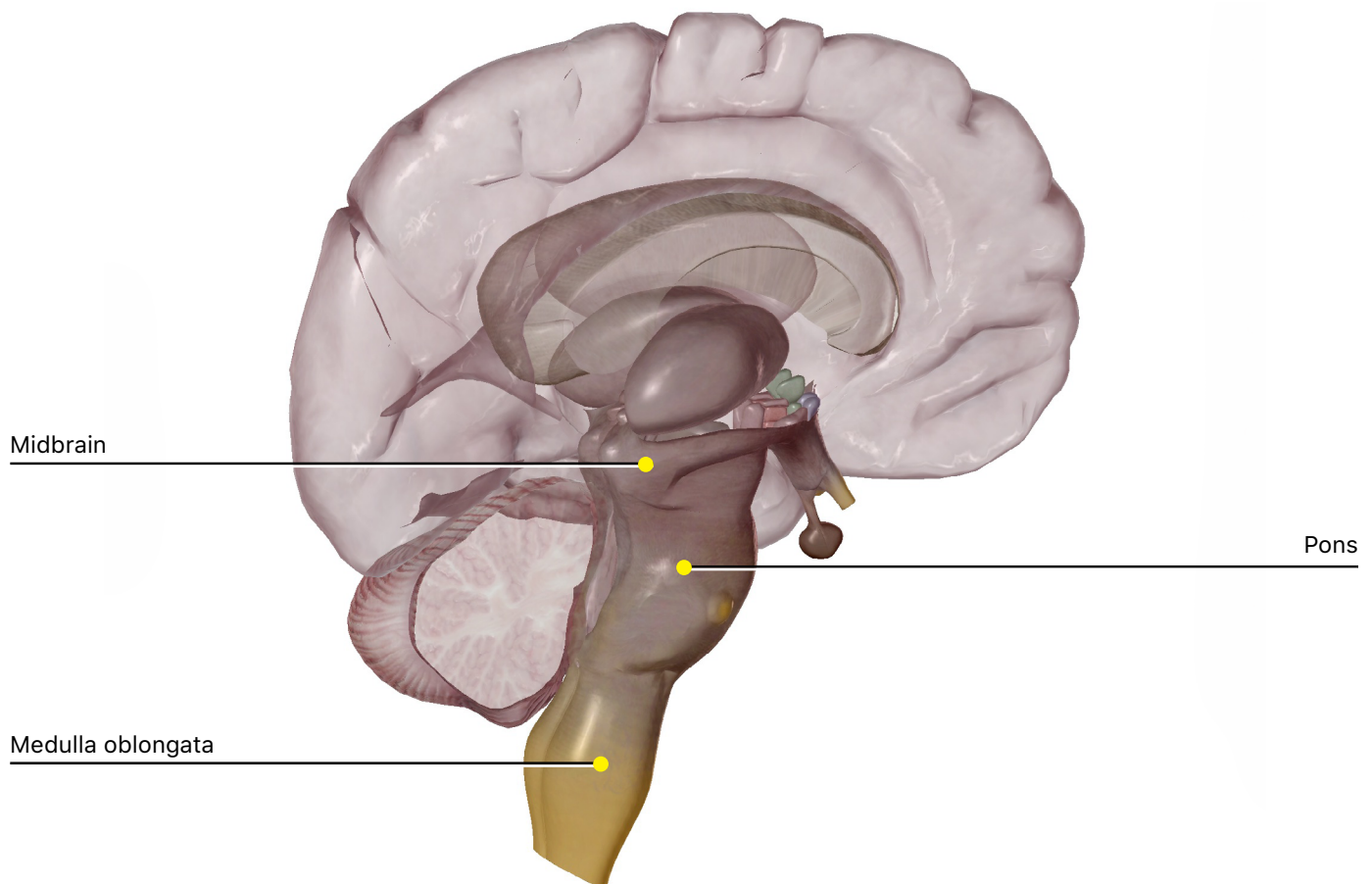


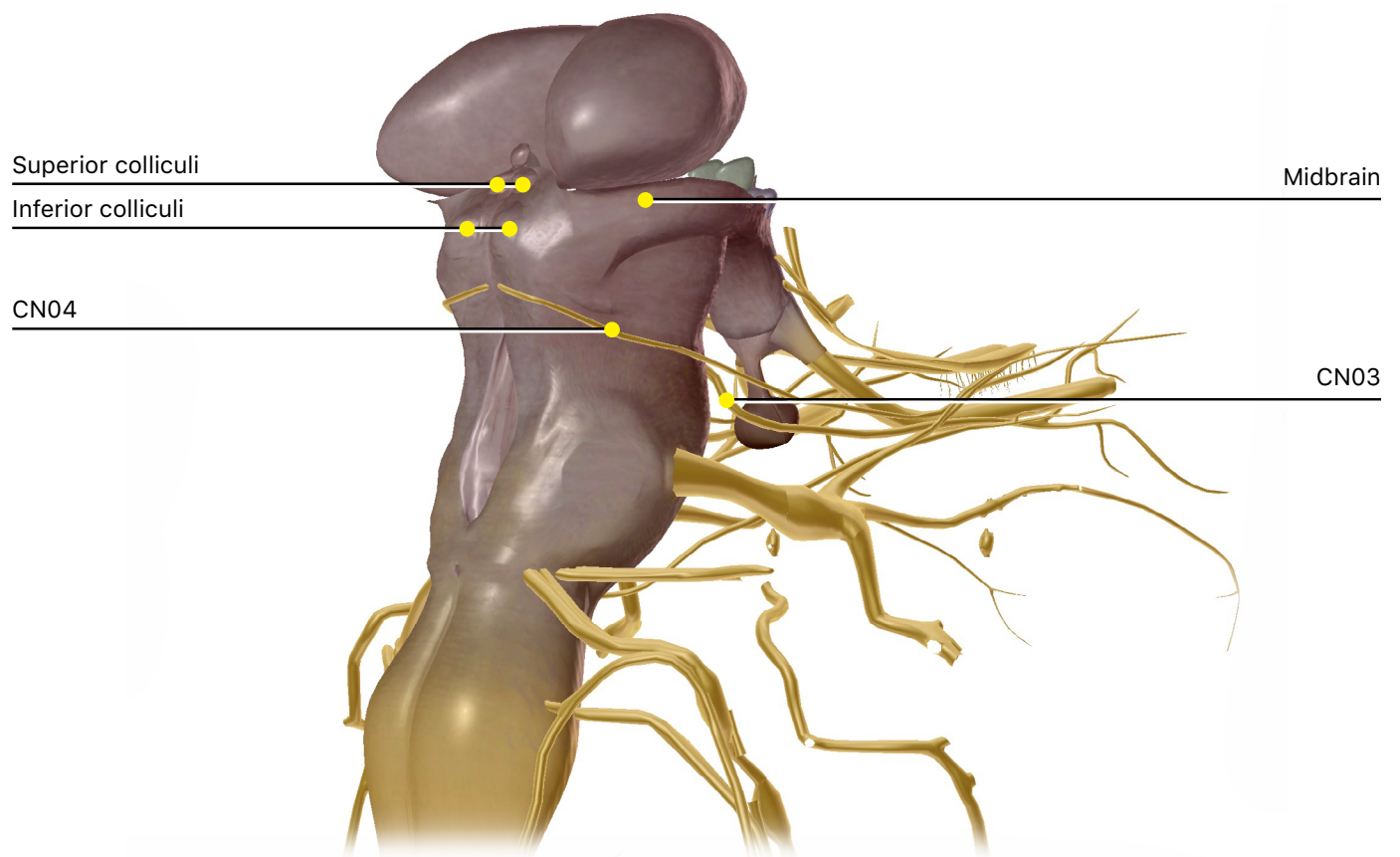
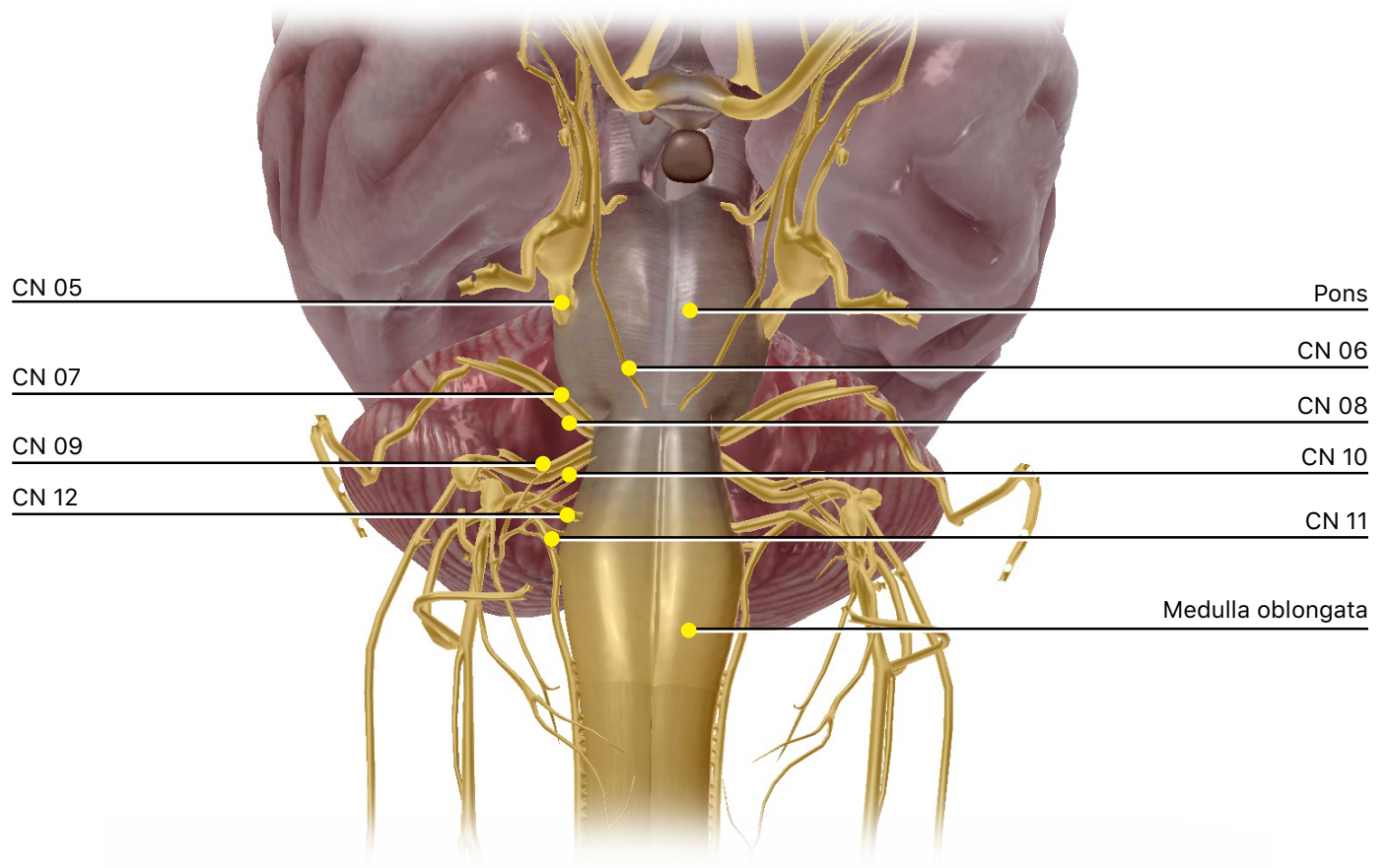
1. The brain requires a lot of oxygen and cannot live very long without it. What are the two pairs of arteries that bring oxygenated blood to the brain?
2. Capillary walls in the brain and the _____ surrounding them form the _____ barrier, which prevents harmful substances from entering brain tissue.
3. Select the **dural venous sinuses** from the left-side menu and use the book icon to read their definition.
 - a. What is the function of the dural venous sinuses?
 - b. Where are they located?

c. The direction of blood flow through the sinuses runs from the superior and inferior _____ sinuses into the right and left _____ sinuses, which drain into the sigmoid sinuses.

4. Blood is drained from the sigmoid sinuses into the paired _____ veins.

D. Explore the 3D anatomical views in Modules 20.7 Brain Stem, 20.8 Medulla and Pons, and 20.9 Midbrain. Use these modules to answer the following questions.





1. Evolutionarily speaking, the **brain stem** is the oldest part of the brain. Use Module 20.7 Brain Stem to answer the following questions.

- a. What are the three major brain regions that make up the brain stem?
- b. Motor and sensory neurons connect the CNS to the _____ via the brain stem.
- c. What are the main functions of the brain stem?

2. Use the right arrow at the bottom of the left-side menu to open Module 20.8 Medulla and Pons and learn about how **nuclei** in the **medulla oblongata** and **pons** control many involuntary functions. What are nuclei?

3. Select the medulla from the left-side menu and use the book icon to read its definition.

- a. The medulla oblongata is about _____ cm long and is continuous with the _____.
- b. What separates the medulla into right and left halves?
- c. The anterior, upper regions on each side are pyramidal in shape and are called the **medullary pyramids**. They contain _____ fibers that pass from the brain to the spinal cord.
- d. The medulla acts as the autonomic reflex center for which two body systems?
- e. It also controls other reflexes that are critical to survival. Which four reflexes are mentioned in the definition?

4. Select the pons from the left-side menu and use the book icon to read its definition.

- a. Pons means “bridge” in Latin. The pons acts as a bridge between the _____ and the _____. This bridge consists of _____.

b. The pons also houses the _____ nuclei, some of which form part of the reticular formation that is responsible for breathing rhythms.

5. Select **cranial nerves** V-XII from the left-side menu to highlight them in the view. Cranial nerves (CN) are nerves that arise from the brain. Cranial nerves V-XII (5-12) arise from the medulla and the pons, with one exception. Select each cranial nerve and use the book icon to read its definition.

a. Which cranial nerves arise from the medulla?

b. Which cranial nerves arise from the pons?

c. The cranial nerve that doesn't arise from the medulla or the pons is CN XI, which is also called the _____ nerve. Select one of these nerves and observe how it runs parallel to the spinal cord with multiple connections to it. *(Note: This nerve was very recently believed to originate in the brain stem, so it retains the name Cranial Nerve XI. Some people are now calling it the "spinal accessory nerve.")*

d. Is CN XI a motor, sensory, or mixed nerve?

6. Use the right arrow at the bottom of the left-side menu to open Module 20.9 Midbrain. Select the **midbrain** from the left-side menu and use the book icon to read its definition.

a. The midbrain connects the _____ to the _____.

b. The midbrain contains special nuclei called _____.

7. Select the **superior colliculi** from the left-side menu and use the book icon to review the midbrain definition. These appear as swellings on the posterior surface of the midbrain. Which reflexes do these nuclei control?

8. Select the **inferior colliculi** from the left-side menu and use the book icon to review the midbrain definition. Which reflexes do these nuclei control?



9. Select cranial nerves III-IV from the left-side menu to highlight them in the view.

a. Select the right or left CN III, arising from the anterior midbrain. Use the book icon to read their definition.

i. What is the name of these nerves?

ii. What do these nerves control?

iii. Are they motor, sensory, or mixed nerves?

b. Select the right or left CN IV, arising from the posterior midbrain. Use the book icon to read their definition.

i. What are these nerves called?

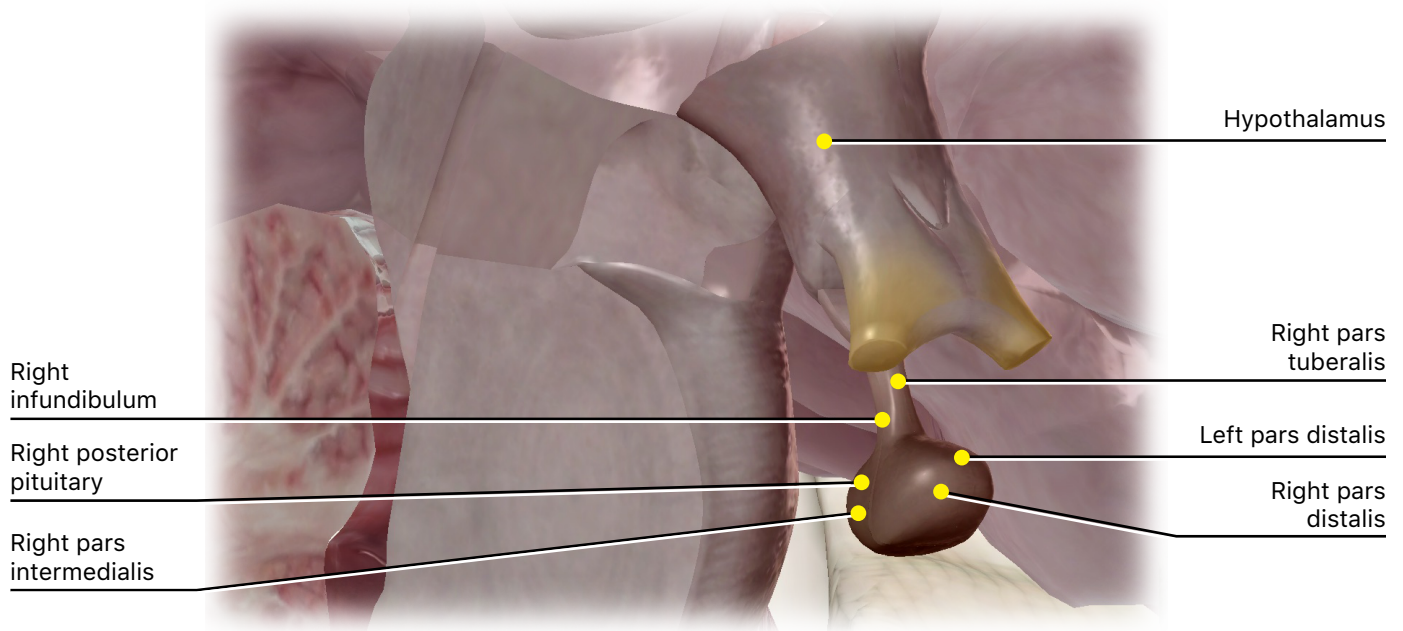
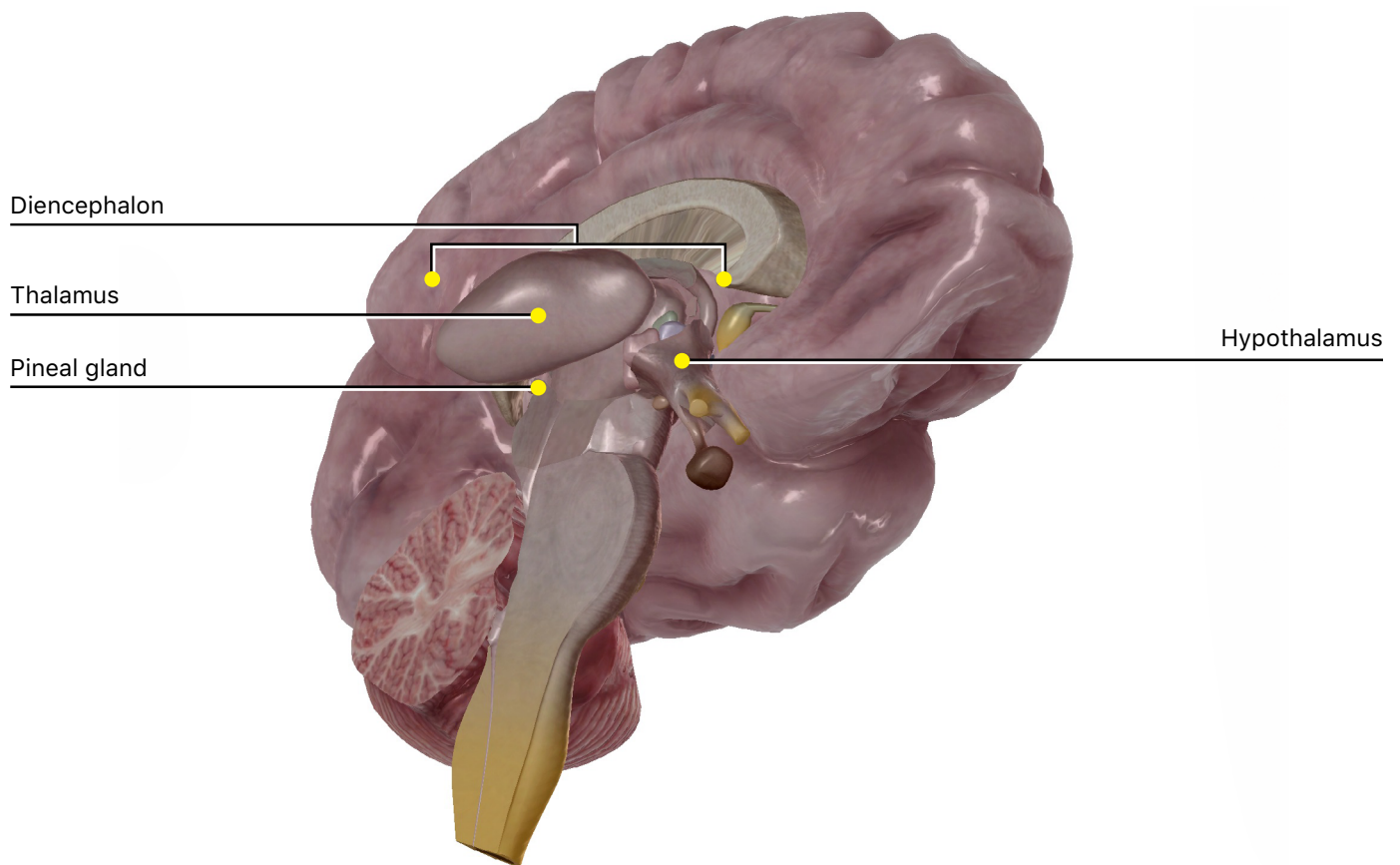
ii. What do these nerves control?

iii. Are they motor, sensory, or mixed nerves?

iv. What is special about CN IV?



F. Explore the 3D anatomical views in Modules 20.12 Diencephalon, 20.13 Thalamus, 20.14 Hypothalamus, and 20.15 Pituitary Gland. Use these modules to answer the following questions.



1. What are the three parts of the diencephalon?

2. In Module 20.12, select the diencephalon from the left-side menu, rotate the view to see its central location in the brain, and use the book icon to read its definition. The diencephalon is connected to two other brain regions: the _____ and the _____.

3. Select the **pineal gland** from the left-side menu and use the book icon to read its definition.
 - a. What is the main role of the pineal gland?

 - b. Why is the pineal gland a useful landmark for X-ray technicians?

4. Use the right arrow at the bottom of the left-side menu to open Module 20.13 Thalamus. Select the **thalamus** from the left-side menu and use the book icon to read its definition. The right and left thalamus make up most of the diencephalon. What are the main roles of the thalamus?

5. Use the right arrow at the bottom of the left-side menu to open Module 20.14 Hypothalamus. Select the **hypothalamus** from the left-side menu and use the book icon to read its definition.
 - a. What are the main roles of the hypothalamus?

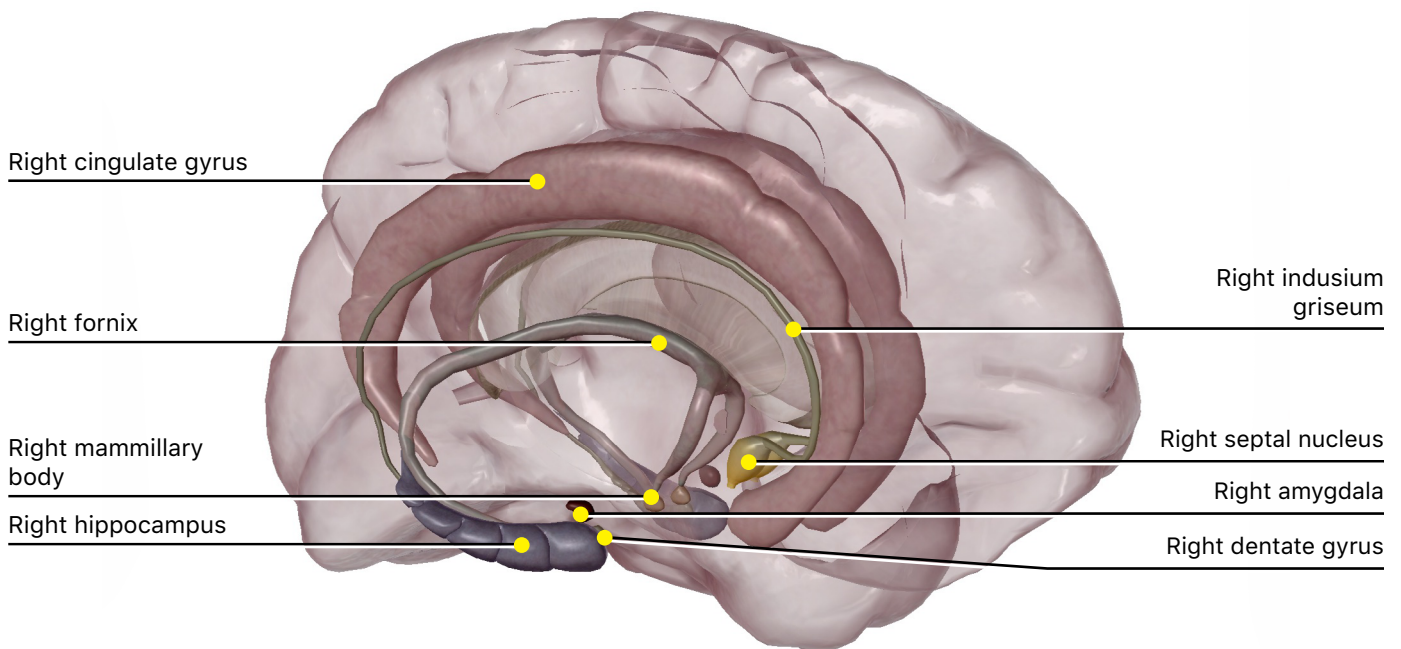
 - b. The hypothalamus also secretes hormones that regulate _____ functions and influence the _____ gland.

6. Use the right arrow at the bottom of the left-side menu to open Module 20.15 Pituitary Gland. Select the **pituitary gland** from the left-side menu to highlight the pituitary, which is often called the “master gland.” Zoom in and rotate the view so that you can see the entire gland from the side, and use the book icon to read its definition.



- a. The pituitary is an **endocrine gland** that is connected to the hypothalamus by a stalk called the _____.
- b. Locate the three parts of the **anterior pituitary**, which are the _____, _____, and _____. The anterior pituitary produces and secretes its own hormones but is controlled by the _____.
- c. Select the **posterior pituitary**, which is also called the _____ and is an outgrowth of the _____. The posterior pituitary stores and secretes hormones it receives from the _____.

G. Explore the 3D anatomical view in Module 20.16 Limbic System and answer the following questions.



1. The **limbic system** is a functional classification, including many structures from different regions of the brain. What are the main brain functions associated with the limbic system?

2. Select the limbic system structures from the left-side menu and rotate the model to view their position in the brain. Then, use the Hide Others tool to remove the other brain structures. In the image, locate the following structures of the limbic system:

Amygdalas

Hippocampi

Cingulate gyri

Septa nuclei

Dentate gyri

Fornix

Mammillary bodies

Medial olfactory striae

Olfactory bulbs



PUTTING IT ALL TOGETHER

1. Consider the overall organization of the brain from the medulla oblongata all the way to the prefrontal cortex. How would you describe the broad functions of the structures as they progress from the brain stem to the cerebral cortex?

2. Which arteries supply the brain with blood?

3. Describe how blood is drained from the brain.

4. The brain is protected from potentially dangerous substances in blood by the _____.

5. The CNS has its own circulation system that carries _____ through a series of canals and _____.

6. Which brain regions make up the brain stem?

7. Cranial nerves are part of the PNS. There are _____ pairs of cranial nerves. One of these is mis-named because it actually arises from the spinal cord. What is the name and number of this "cranial" nerve?

8. What regions of the brain are included in the diencephalon?

9. Explain why the pituitary gland is part of the endocrine system and part of the central nervous system?



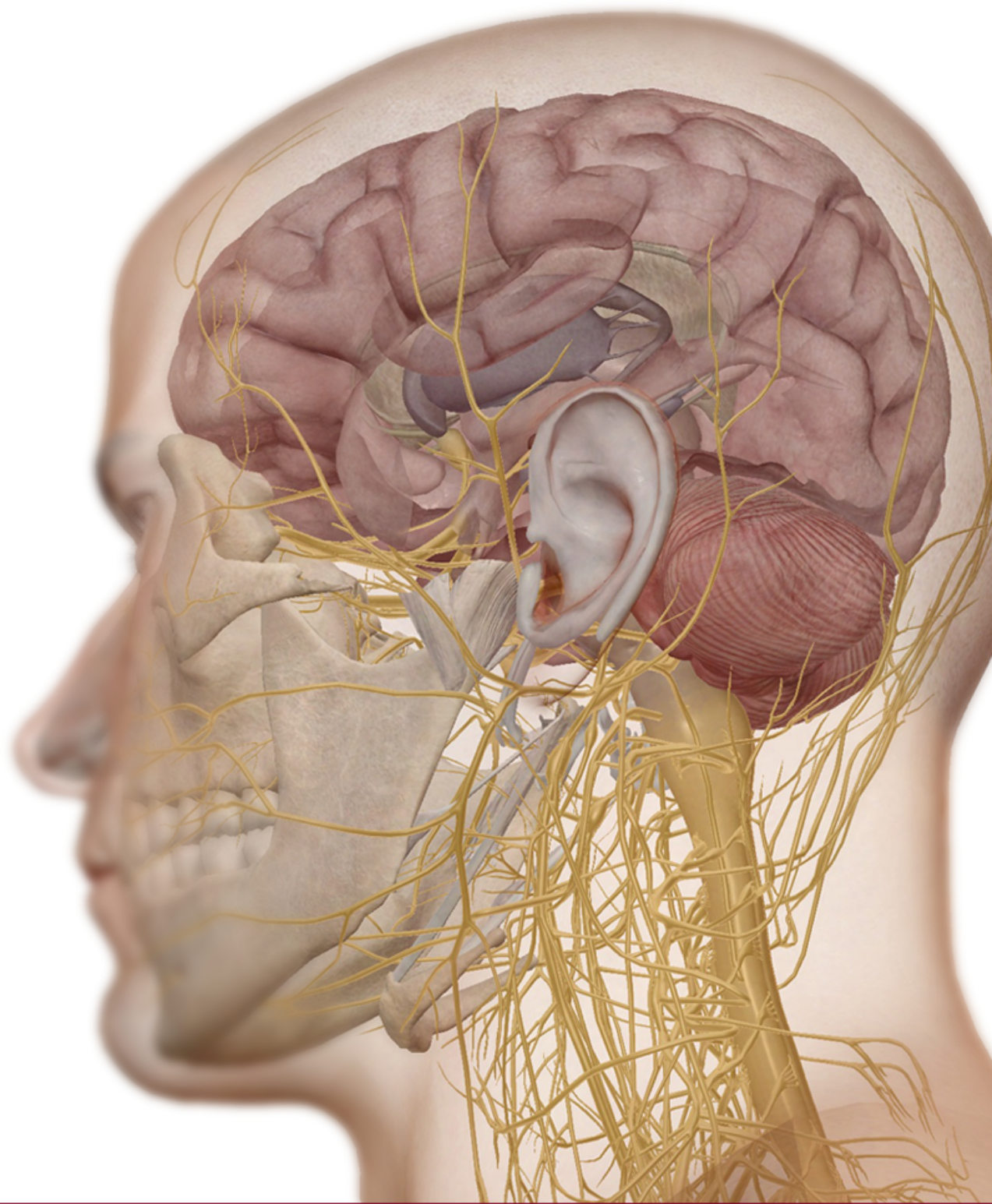
10. Why is the pituitary often referred to as the "master gland"?

11. The limbic system is a functional group of structures from several regions of the brain. What brain functions are associated with this system?

TIME TO PRACTICE!

GO TO THE QUIZZES MENU AND COMPLETE NERVOUS SYSTEM QUIZZES 20.A AND 20.B.



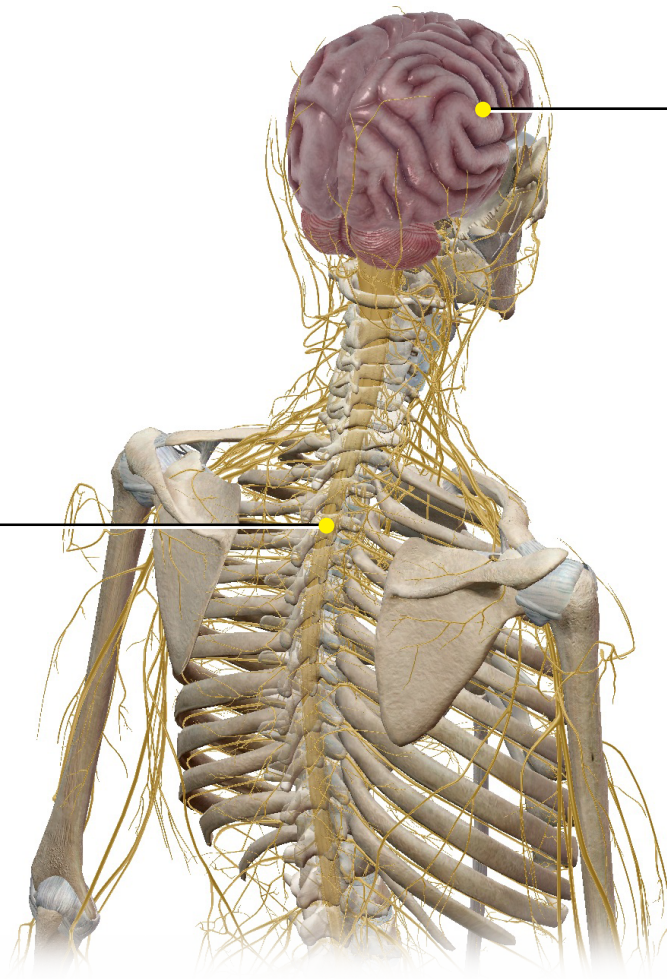


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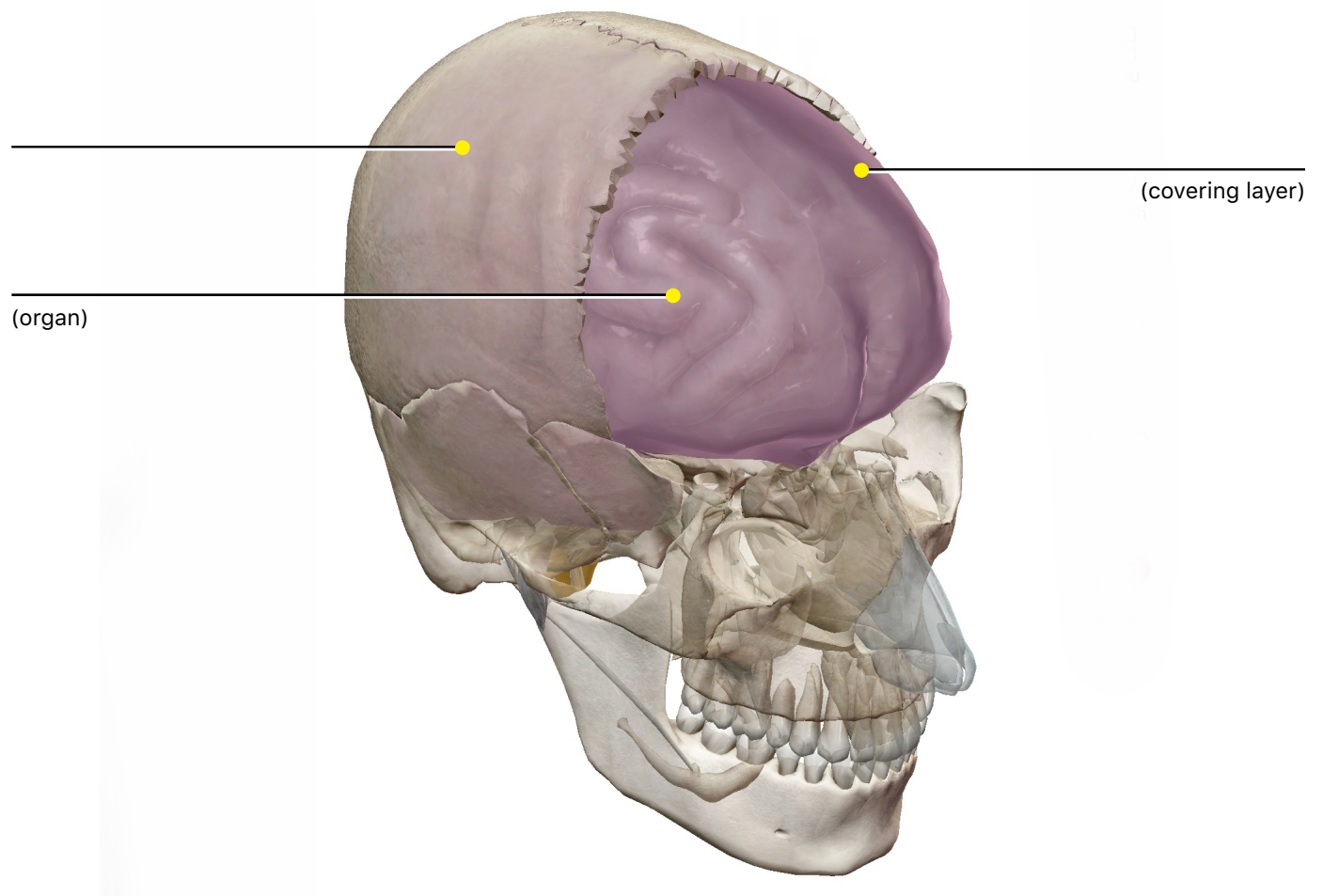
Student Practice

Label the structures in the following figures.

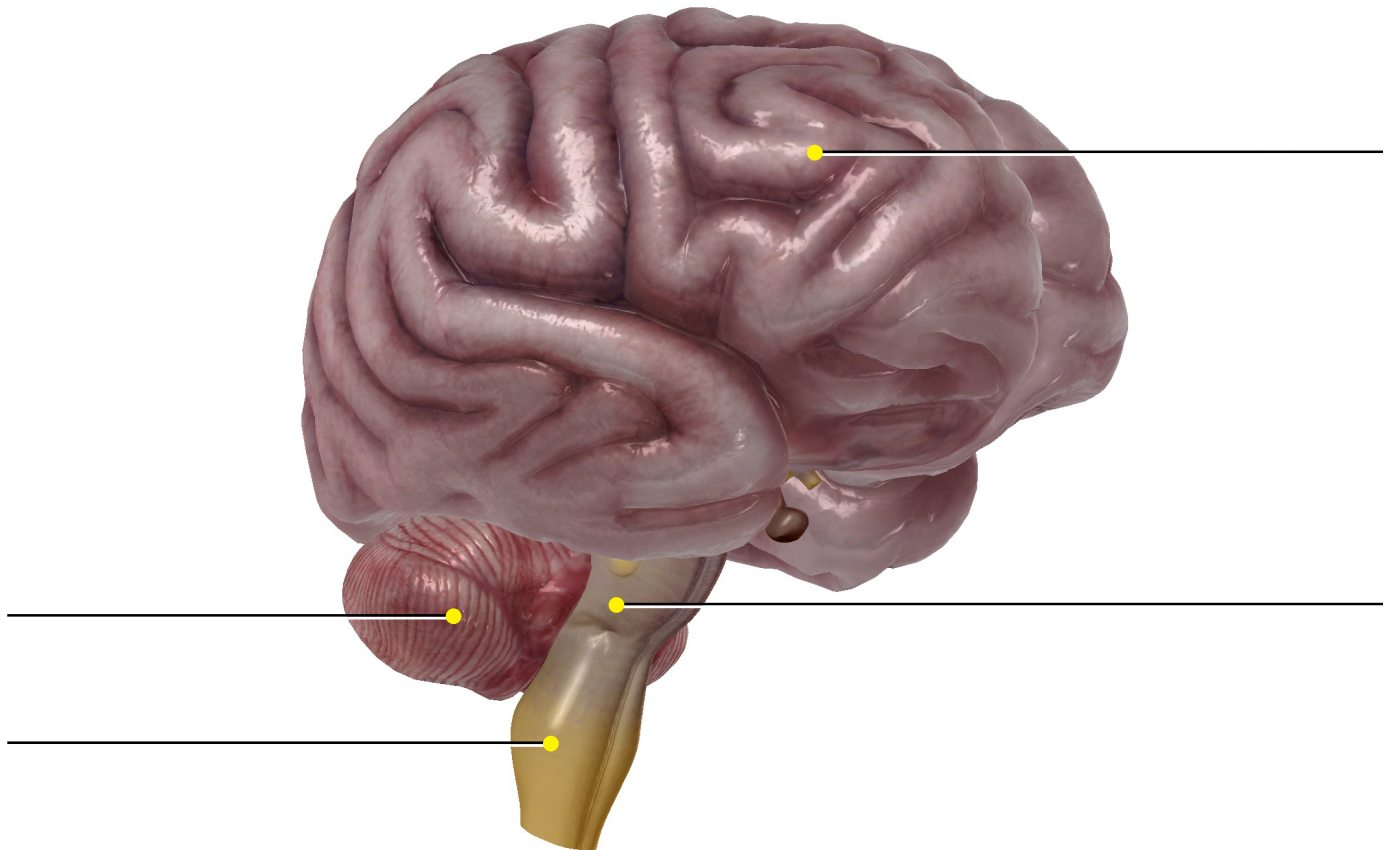
Module 17.2 Nervous System Anatomy



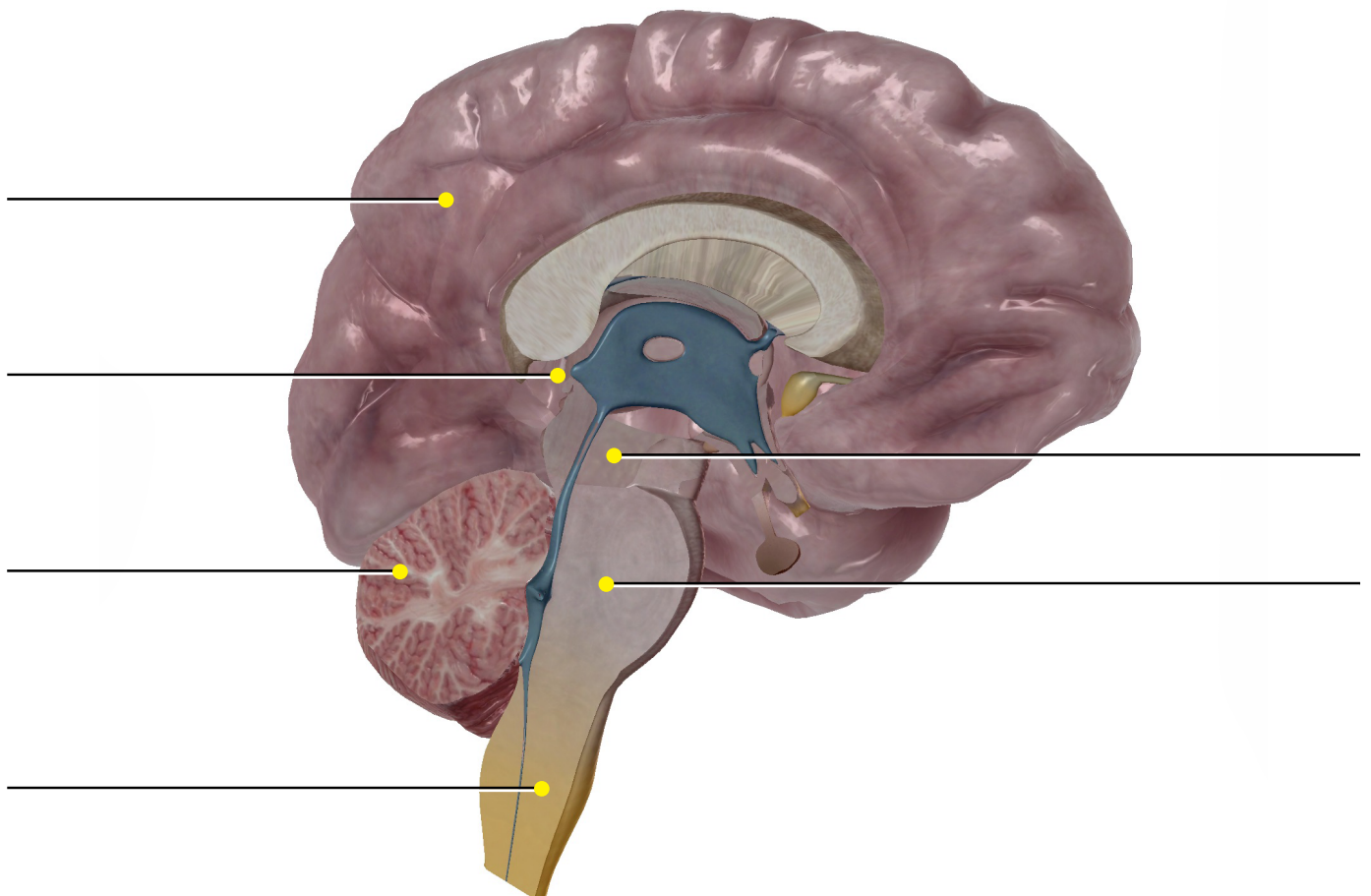
Module 20.1 The Brain



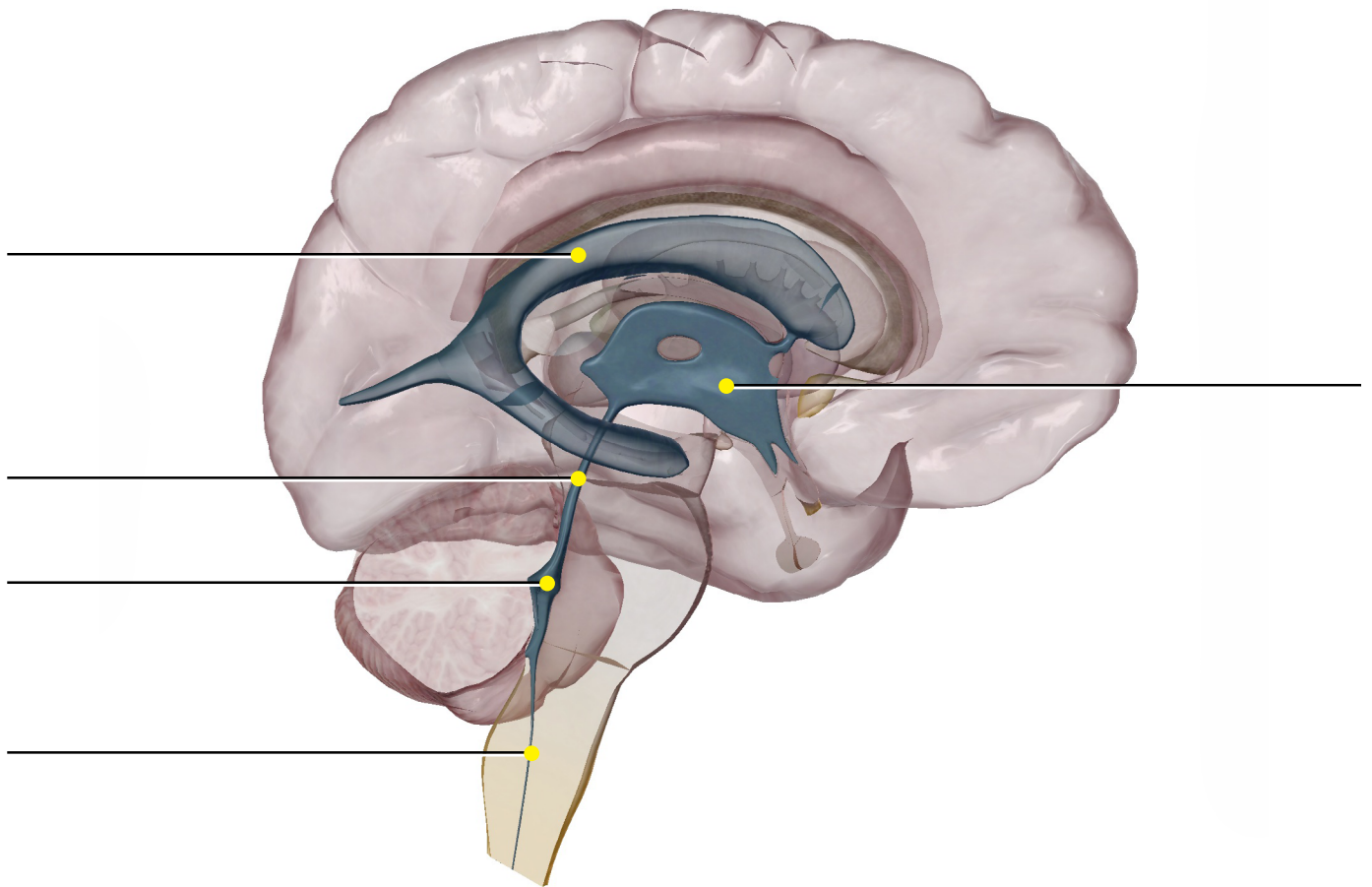
Module 20.2 Brain Regions



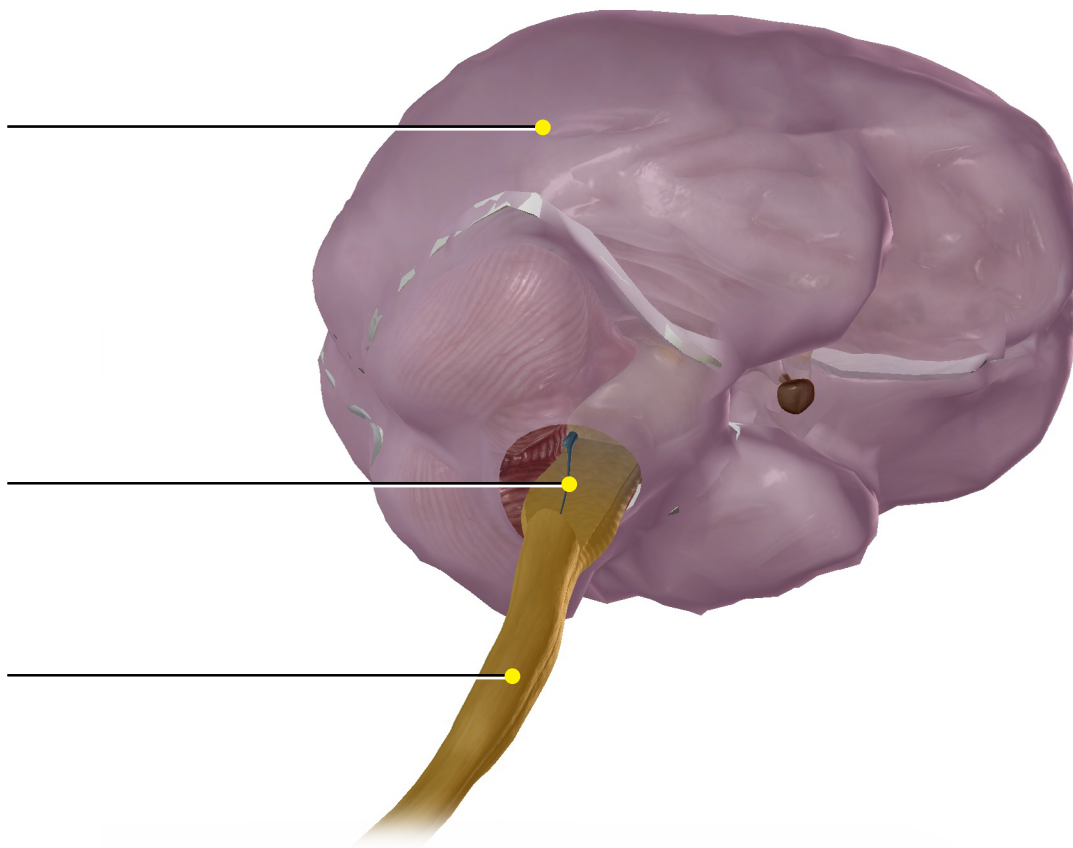
Module 20.3 Brain Cross Section



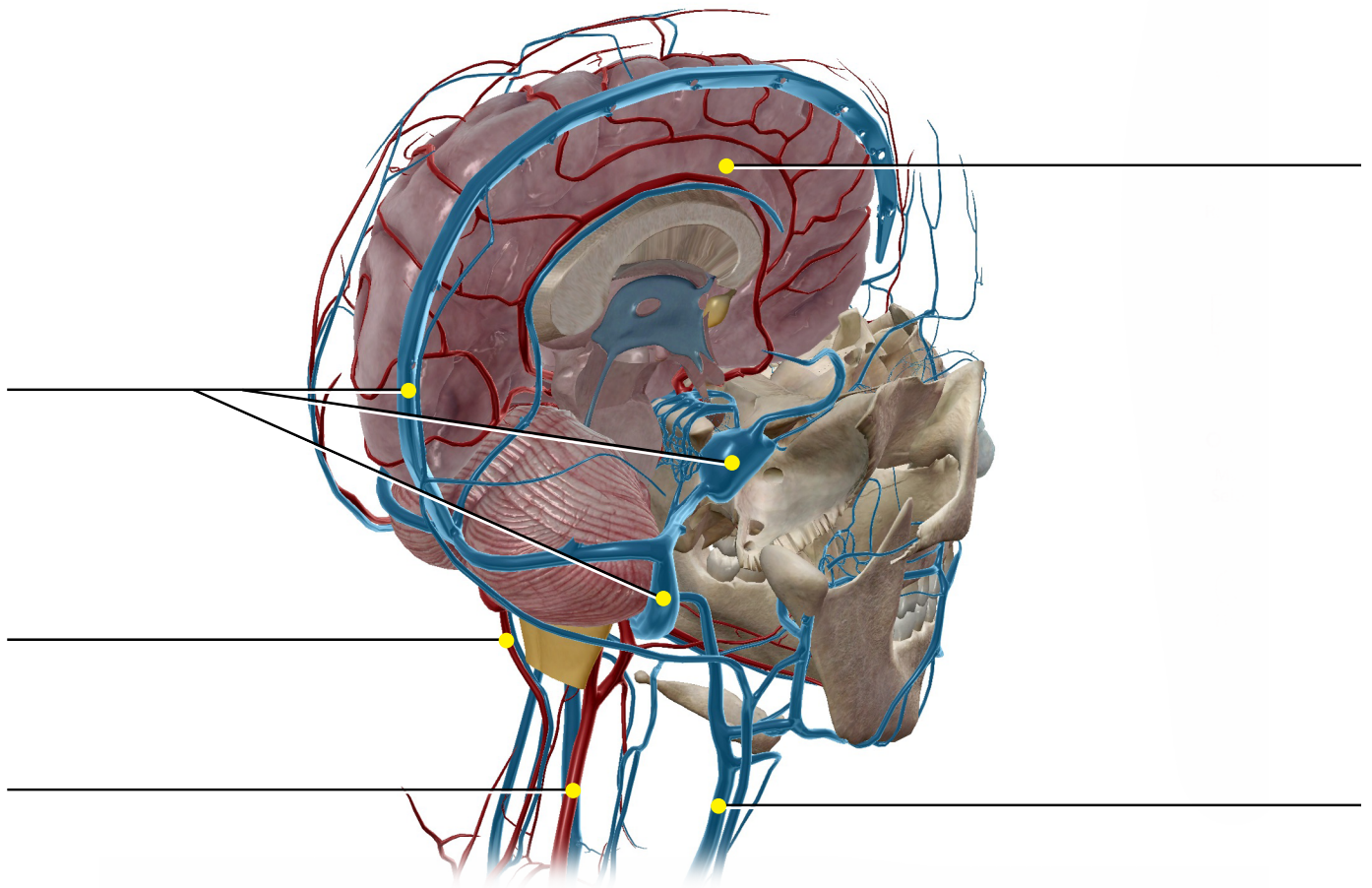
Module 20.4 Ventricles of the Brain



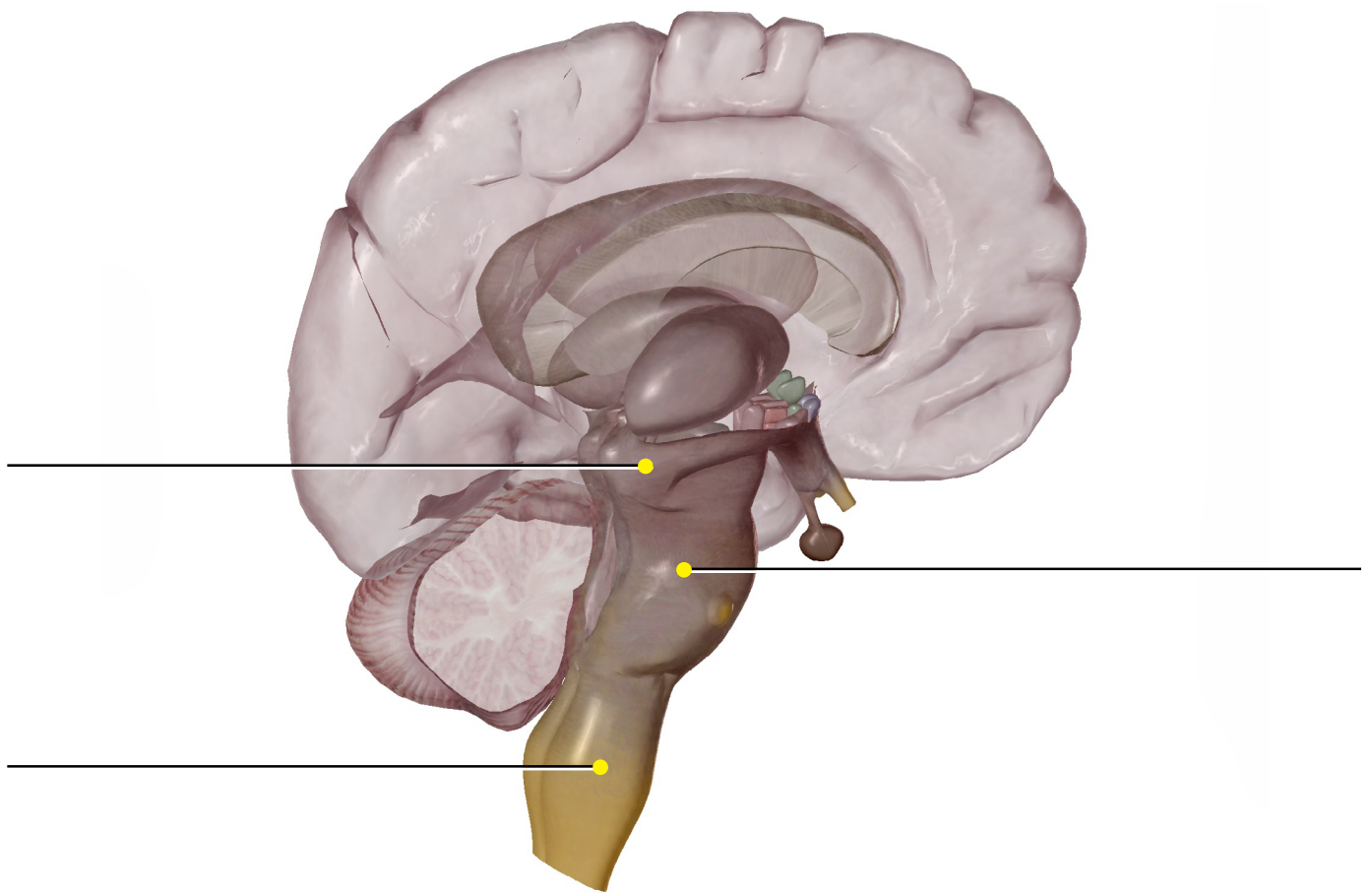
Module 20.5 Cerebrospinal Fluid



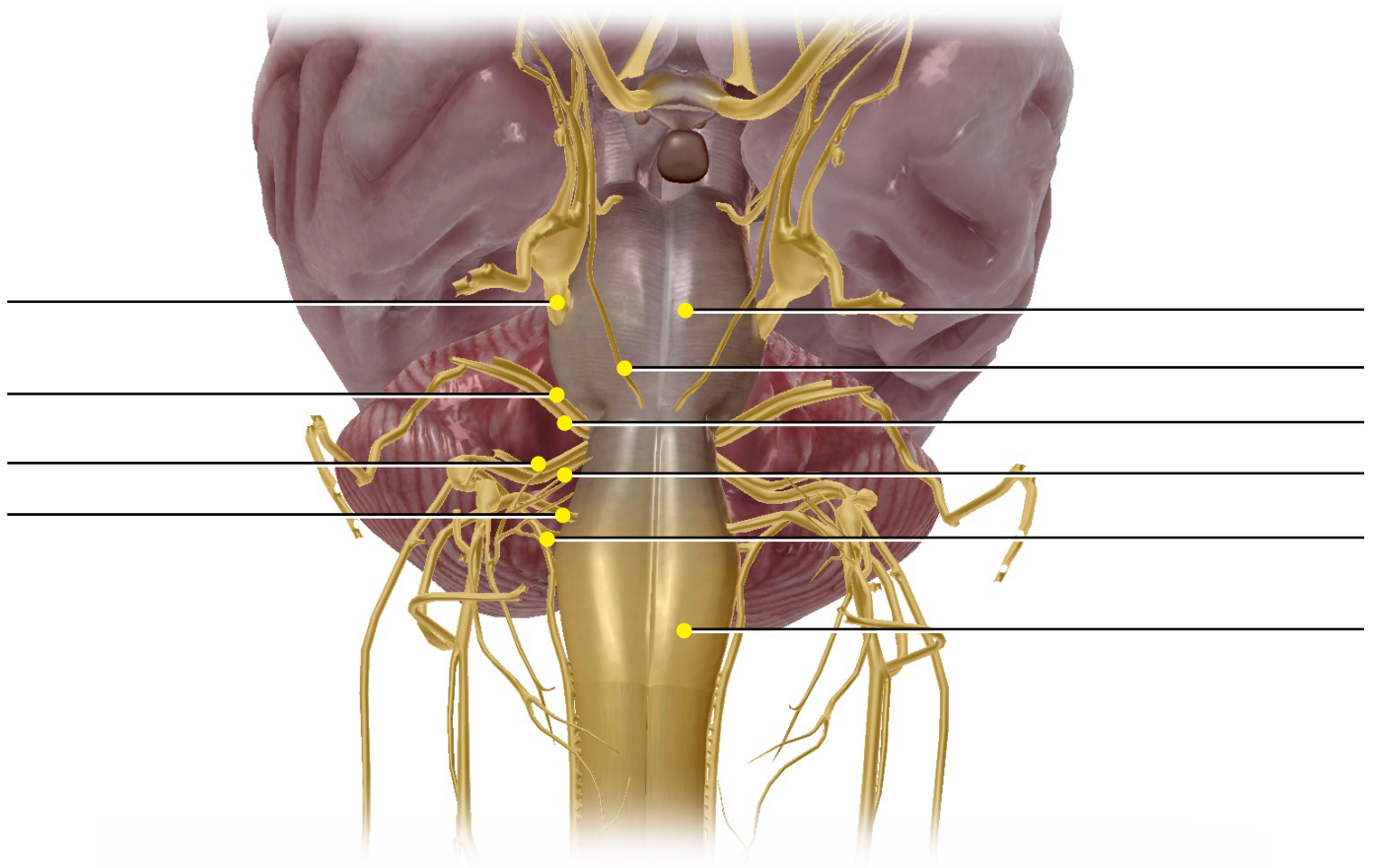
Module 20.6 Blood Supply to the Brain



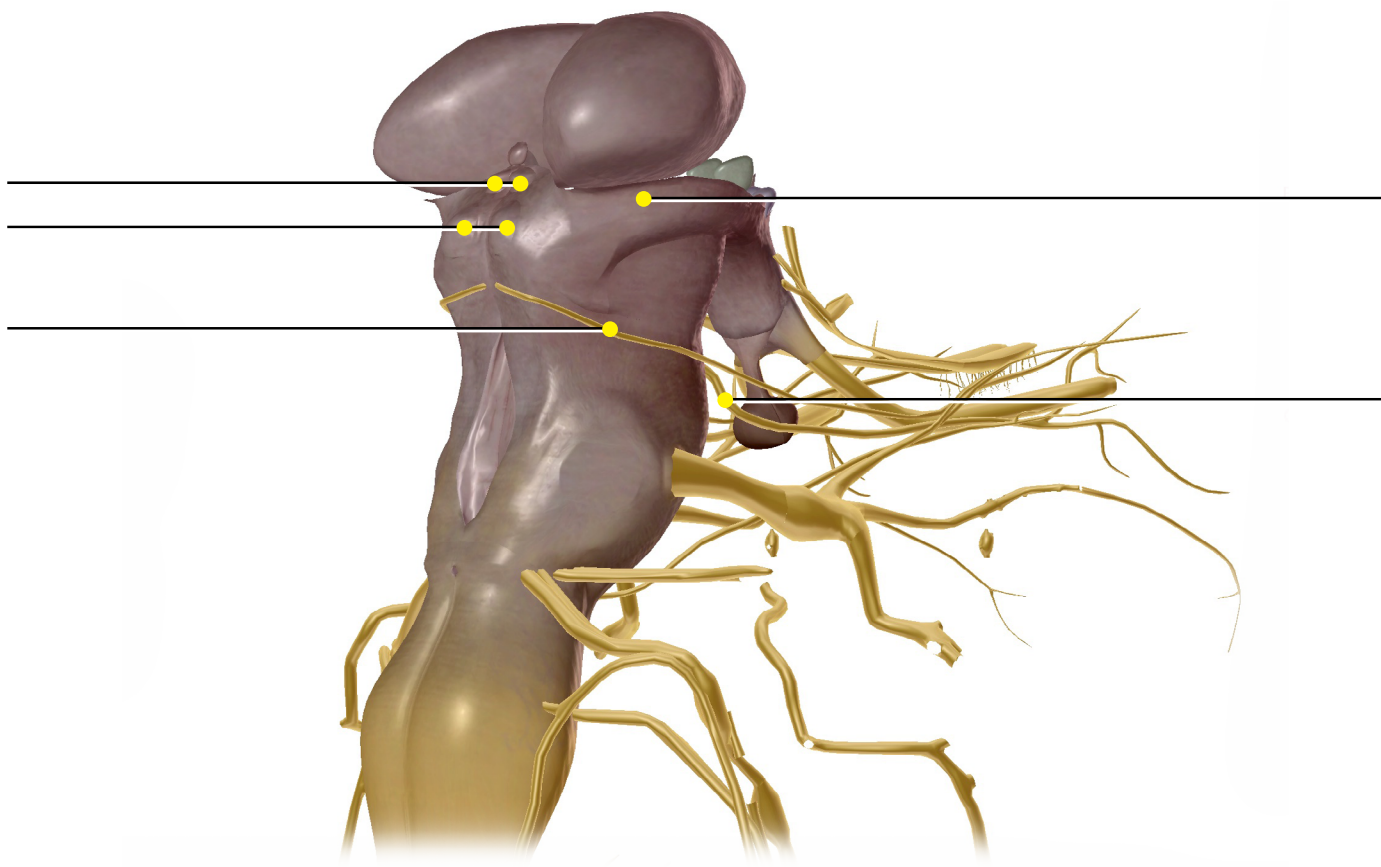
Module 20.7 Brain Stem



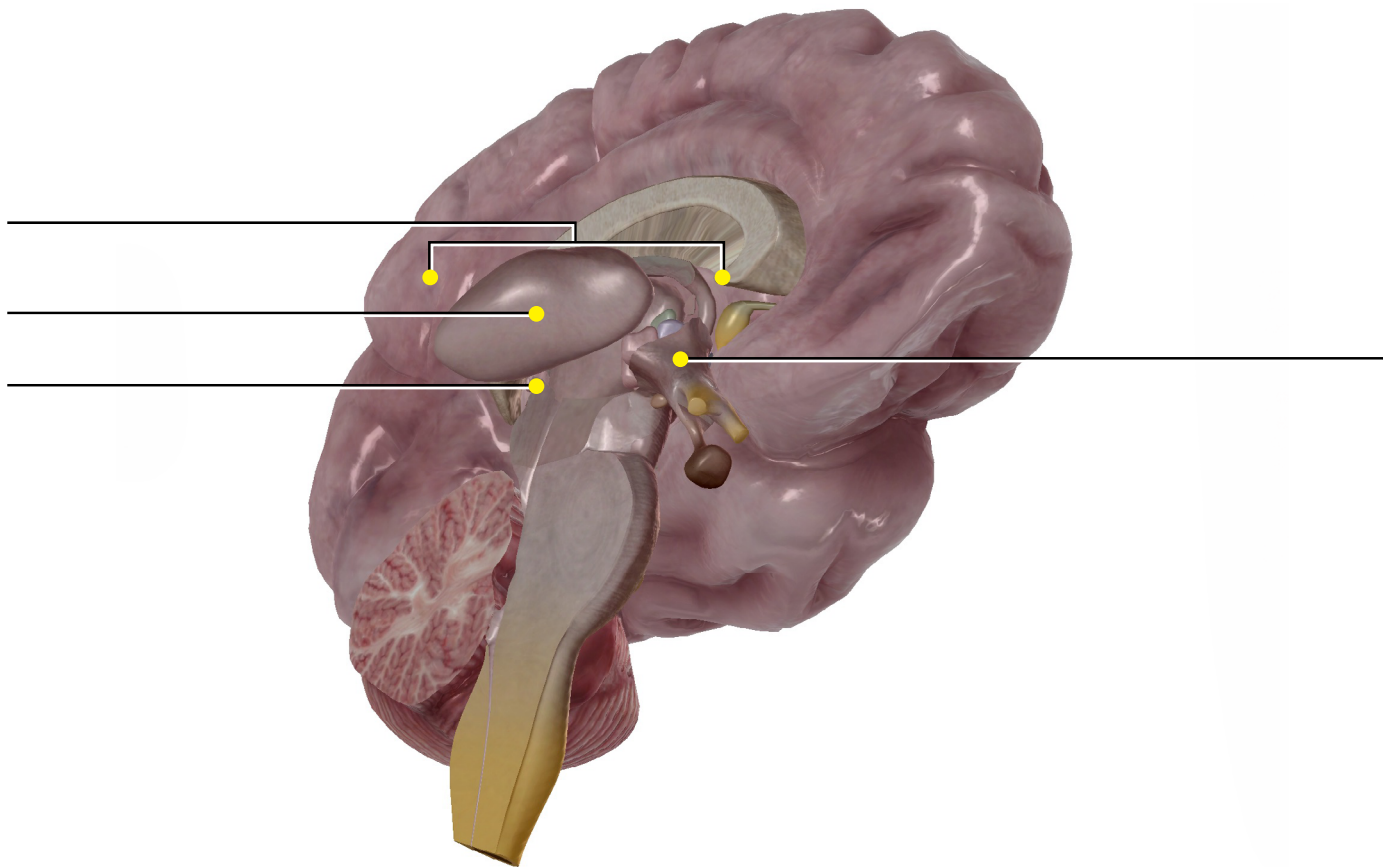
Module 20.8 Medulla and Pons



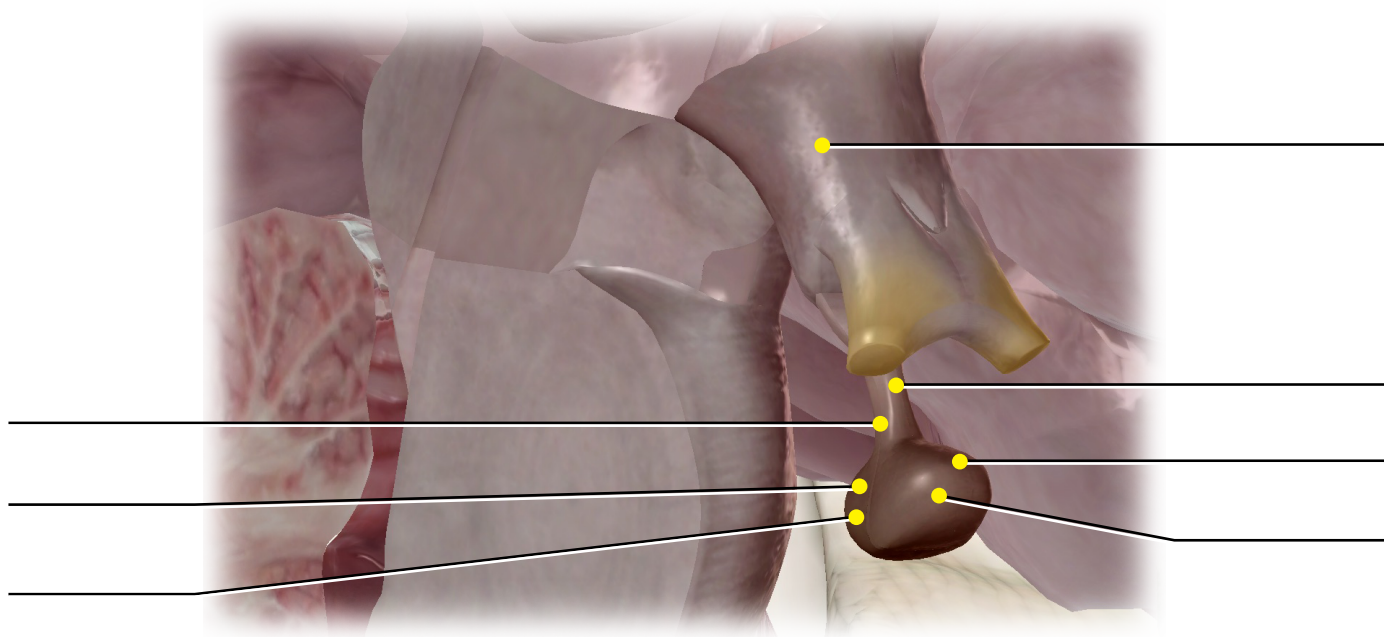
Module 20.9 Midbrain



Module 20.12 Diencephalon



Module 20.15 Pituitary Gland



Module 20.16 Limbic System

