

Sheep Brain Dissection Guide

Explore the structures of a mammalian brain and relate their locations to their functions. Begin with the protective coverings and external landmarks, then examine a midsagittal section to see structures hidden inside. Use careful observation to connect the photographs and video with your own specimen.



Introduction

The brain and spinal cord form the central nervous system. Together, they receive and process information and coordinate responses. Nerves connect this system with sensory organs, muscles, and other parts of the body. A sheep brain provides a useful model because sheep and humans share the same basic mammalian brain organization, although the relative sizes and shapes of particular regions differ.

The domestic sheep, *Ovis aries*, belongs to Kingdom Animalia, Phylum Chordata, Class Mammalia, Order Artiodactyla, and Family Bovidae. Its brain is protected in life by the skull, membranes called meninges, and cerebrospinal fluid.

Using this guide

Read the guide and watch the Mr. E Science demonstration before the lab. Complete the assigned pre-lab, then use this guide during the dissection. Learn the location and function of each required structure. The photographs come from the demonstration and include numbered markers and leader lines. Match each number with its structure in the accompanying key.

Video: <https://www.youtube.com/watch?v=JDEUjsAx82w>

Materials and safe handling

Preserved sheep brain, dissecting tray, blunt probe, forceps, dissecting scissors, teacher-approved cutting tool, protective eyewear, gloves, protective clothing, paper towels, and assigned recording materials. Use colored pencils for drawings and labels as directed.

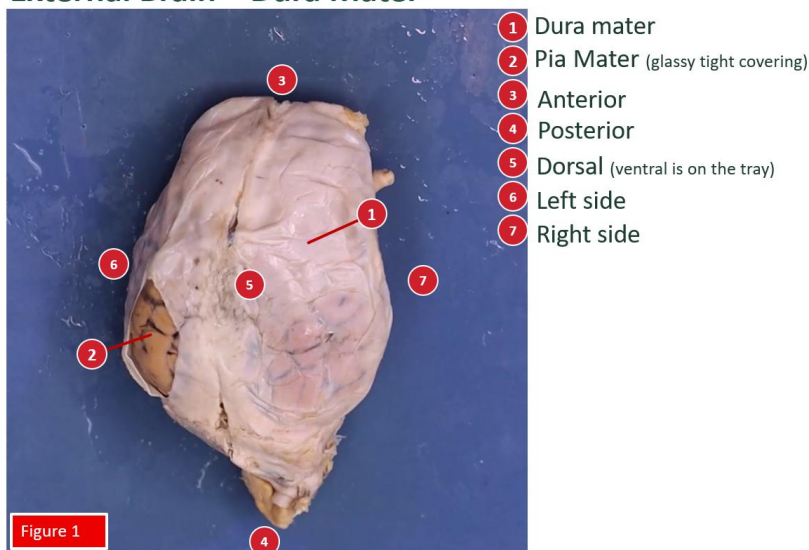
Keep the brain supported in the tray; preserved nervous tissue tears easily. Use the blunt probe for identification rather than puncturing tissue with a sharp point. Keep fingers clear of all cutting paths. Have your teacher demonstrate and supervise the midsagittal cut. Follow classroom directions and the specimen supplier's instructions for preservative handling, ventilation, storage, and disposal. Keep food and drinks away, avoid touching your face, and wash your hands after cleanup.

Orient the brain

1. Before removing tissue, identify the specimen's directions. Anterior, or rostral, is toward the sheep's nose; posterior, or caudal, is toward the spinal cord and tail. Dorsal is toward the sheep's back and the upper surface of its brain; ventral is toward its belly and the base of its brain. Medial means toward the midline, and lateral means away from it.

Right and left refer to the sheep's own sides. The side nearest your right hand changes when you turn the specimen, but its anatomical right side does not. Superior means above and inferior means below; these terms also appear in structure names such as the superior and inferior colliculi. Use dorsal, ventral, anterior, and posterior consistently when orienting this sheep brain.

External Brain – Dura Mater

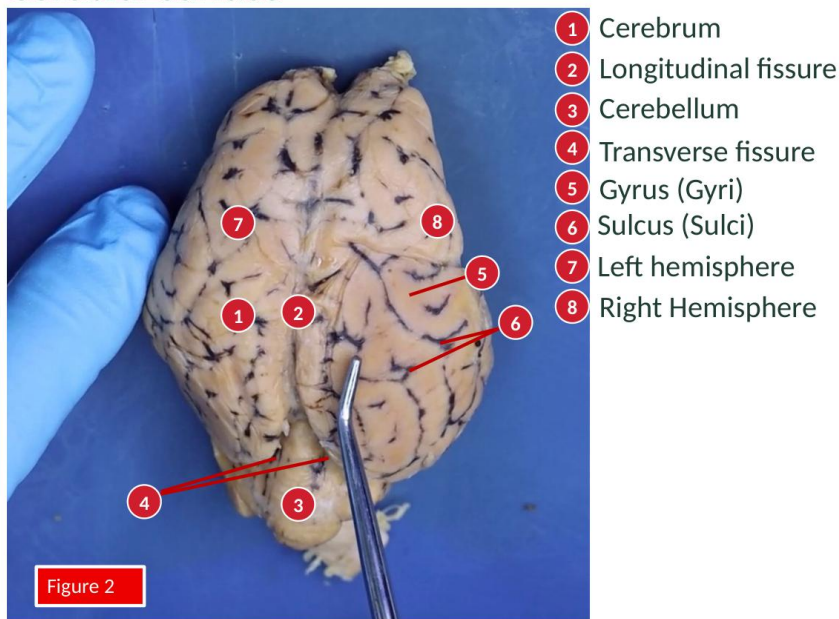


Identify the protective coverings

2. Examine any remaining dura mater before removing it. This tough outer meninx may look like a thick, pale sheet. Beneath it are the delicate arachnoid mater and the pia mater. In life, cerebrospinal fluid occupies the space beneath the arachnoid and helps cushion the brain. The pia closely follows the gyri and sulci; the dura forms larger folds rather than lining every small groove.

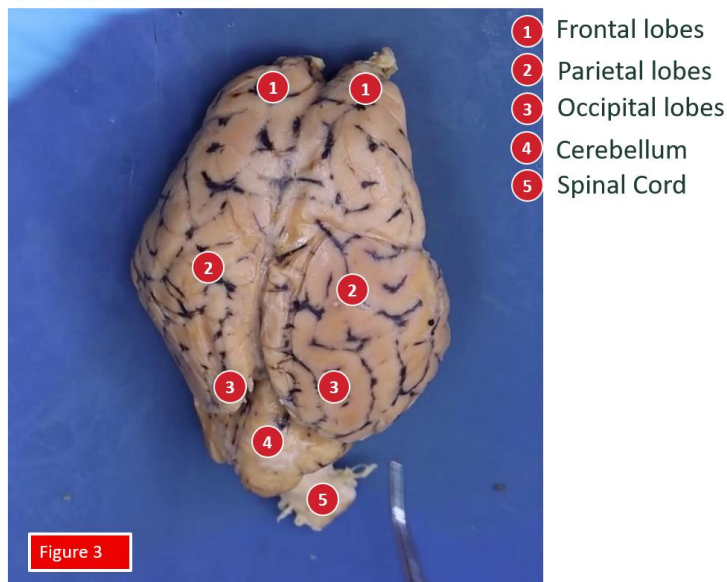
3. If dura remains, lift a small area with forceps and carefully trim it with scissors as demonstrated. Work slowly around the base, preserving nerves and the pituitary gland if present. Do not strip away the thin pia or tear the brain surface. Some purchased brains arrive with much of the dura already removed; record what is actually present.

Cerebral Surface



Examine the dorsal surface

Cerebral lobes



4. Place the dorsal surface upward. Find the large cerebrum, the smaller cerebellum behind it, and the brainstem leading toward the spinal cord. These are the three obvious regions emphasized in the external examination. The diencephalon, including the thalamus and hypothalamus, lies deeper and will be examined after sectioning.

Cerebrum and surface folds

5. Locate the longitudinal fissure separating the right and left cerebral hemispheres. The outer layer of the cerebrum is the cerebral cortex. Its raised folds are gyri (one gyrus), and the grooves between them are sulci (one sulcus). Folding increases the surface area that can fit within the skull.

The cerebrum contributes to sensory perception, voluntary movement, learning, and memory. Locate the general regions of its four major surface lobes: frontal toward the anterior end, parietal on the upper surface behind the frontal region, occipital toward the posterior end, and temporal along the lower sides. Their exact boundaries may be difficult to distinguish on a sheep specimen. Use your teacher's reference rather than treating every groove as a lobe boundary.

Cerebellum and brainstem

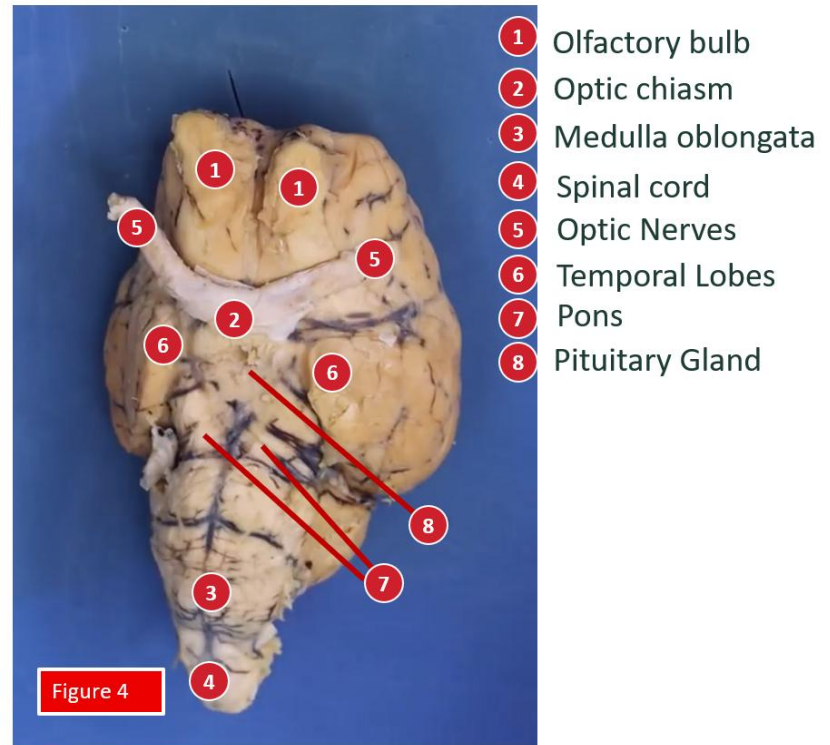
6. Find the transverse fissure between the cerebrum and cerebellum. The cerebellum has many narrow surface folds. It helps coordinate movement, balance, and posture. Locate the medulla oblongata where the brain narrows toward the spinal cord. The medulla is one part of the brainstem; the complete brainstem includes the midbrain, pons, and medulla.

Think About It 1: How does the longitudinal fissure differ from the transverse fissure?

Examine the ventral surface

7. Gently turn the brain ventral side upward, keeping the anterior end identified. Locate the paired olfactory bulbs near the anterior end. These structures, called olfactory lobes in the video, receive information related to smell. They may be damaged or partly missing from a preserved specimen.

Ventral Overview



Optic pathways and pituitary gland

8. Locate the optic nerves and optic chiasm, also called the optic chiasma. The optic nerves carry visual information from the retinas. At the chiasm, some fibers cross to the opposite side; the continuing pathways are the optic tracts. Identify the chiasm by its position and crossing arrangement, not merely by a pale color.

9. Look for the pituitary gland just posterior to the optic chiasm, attached beneath the hypothalamus by a short stalk. This endocrine gland releases hormones involved in growth, reproduction, and regulation of other glands. It is often lost during removal of the brain from the skull. If absent, note its expected position without labeling torn tissue as the gland.

Pons and medulla

10. Locate the pons, a rounded bulge on the ventral brainstem, and follow the brainstem posteriorly into the medulla oblongata and then the spinal cord. The pons relays information among brain regions and participates in breathing regulation. The medulla contains centers involved in vital functions such as breathing, heart rate, and blood pressure. The spinal cord carries information between the brain and body and participates in reflexes.

11. Look for remaining cranial nerve stubs without pulling on them. Mammals have 12 pairs of cranial nerves, designated I–XII. They carry sensory information, motor commands, or both. Many are cut during preparation, so all 12 pairs may not be visible. Identify the nerves your teacher assigns; a full list of names can be studied as an extension. If the cranial-nerve extension is assigned, complete its specimen investigation now, before making the midsagittal cut.

Think About It 2: Why might a preserved brain lack its pituitary gland or some cranial nerves even though the living sheep had them?

Open the brain along the midline

12. Return the dorsal surface upward and locate the longitudinal fissure again. A sagittal section divides a structure into right and left portions; a midsagittal section follows the midline to produce right and left halves. Ask your teacher to confirm the cutting plane before proceeding.

13. With the brain stabilized in the tray, make the teacher-supervised cut along the midline through the cerebrum, cerebellum, and brainstem. Keep hands out of the blade's path. Separate the halves gently and place their cut surfaces upward. Avoid extra cuts until the internal landmarks have been identified and recorded.

Sagittal Sectioned Brain

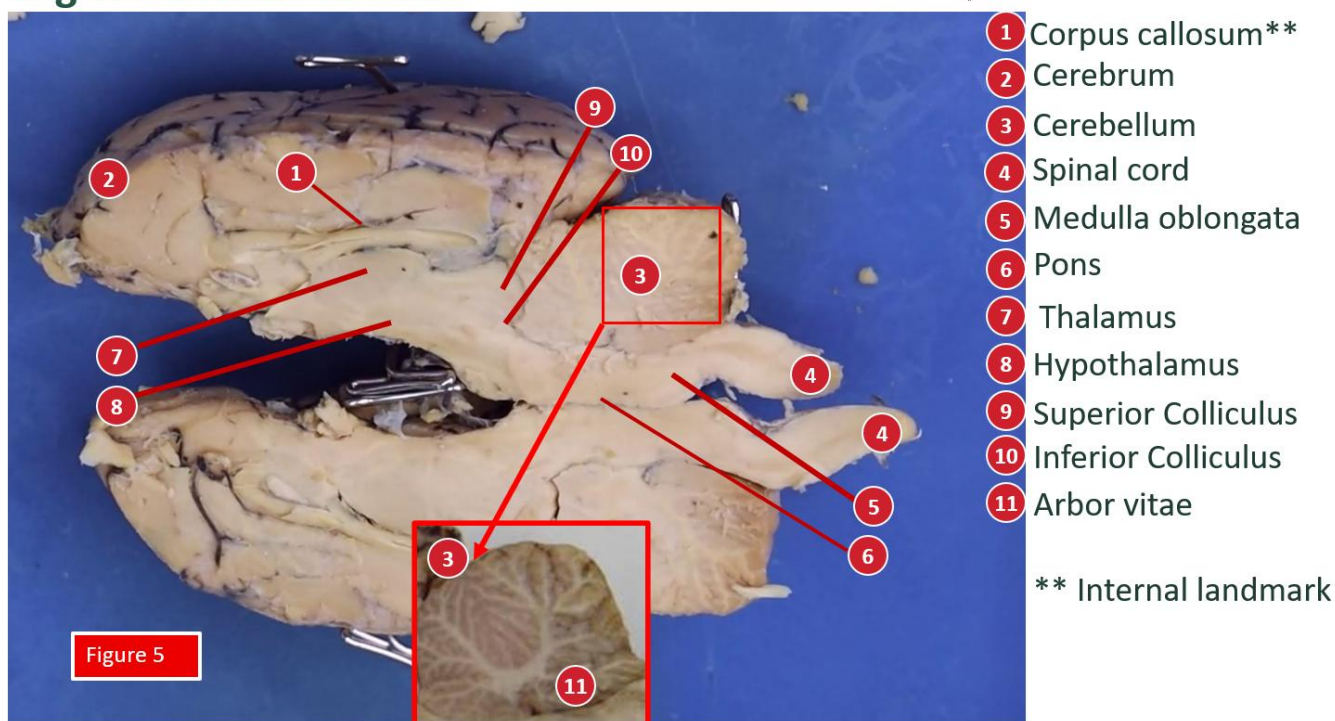


Figure 5. The two halves after sectioning. In the upper half, anterior is left and posterior is right. Use the arching corpus callosum as an internal landmark; compare the cerebrum, central thalamic region, cerebellum, and brainstem in both halves.

Examine the internal anatomy

Corpus callosum and central structures

14. Locate the corpus callosum, the pale, curved band beneath the cerebral cortex. It contains nerve fibers connecting the two cerebral hemispheres. Use it as a landmark for the structures below it. The spaces inside the brain are ventricles, which contain cerebrospinal fluid in life; these may look like narrow gaps after preservation.

15. Find the thalamus in the central region beneath the corpus callosum. It relays and processes much sensory information headed toward the cerebral cortex. Locate the hypothalamus ventral to the thalamus, near the pituitary attachment. The hypothalamus helps maintain homeostasis by regulating functions such as body temperature, hunger, thirst, and hormone release. The thalamus is a brain region, not an endocrine gland.

Midbrain and brainstem

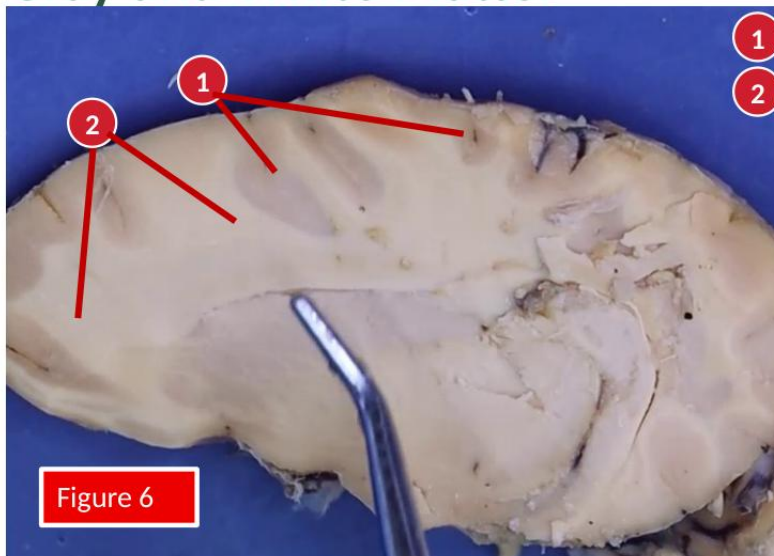
16. Trace the brainstem from the midbrain through the pons and medulla into the spinal cord. The midbrain lies between the diencephalon and pons. If visible, locate the superior and inferior colliculi on its dorsal surface, just anterior to the cerebellum. The superior colliculi participate in orienting responses to visual stimuli; the inferior colliculi are involved in auditory processing. Together, these paired elevations are called the corpora quadrigemina.

Arbor vitae and tissue organization

17. Examine the cut cerebellum for the branching pale pattern called the arbor vitae, meaning “tree of life.” These branches are white matter carrying signals to and from the cerebellar cortex. The surrounding cerebellar cortex is gray matter.

18. Compare gray and white matter in the cut cerebrum. Gray matter contains many neuron cell bodies, dendrites, and synapses; white matter consists largely of axons, many wrapped in myelin. Myelin gives white matter its lighter appearance. The cerebral cortex forms an outer gray layer, with much white matter beneath it. Gray matter also occurs in deeper groups of neurons, so it is not confined to the brain’s surface.

Gray and White Matter



1 Cerebral cortex (gray matter)

2 Cerebral white matter

Figure 6. A further exposed cerebral section shows differences between the outer cortex and deeper tissue. Preservation and lighting affect color contrast; use location and tissue relationships as well as color.

Think About It 3: How do the corpus callosum and arbor vitae illustrate the role of white matter in communication?

A sheep brain in a living animal

Working together. A sheep lowers its head to graze, hears a sudden noise, and turns toward it. Even this simple event requires many parts of its nervous system. Sensory receptors detect changes outside and inside the body. Neurons carry electrical signals along their axons and usually communicate across tiny junctions called synapses by releasing chemical messengers. Networks of neurons process this information and produce responses. Different brain regions have specialized roles, but everyday behavior depends on communication among them.

The cerebrum and its lobes. The cerebral cortex helps the sheep interpret sensations and direct voluntary movements. The frontal region contributes to movement planning and control. The parietal region processes information such as touch and body position, helping the animal sense where its legs are. The occipital region processes visual information, while the temporal region contributes to hearing and, with deeper structures, memory. These regions cooperate when the sheep recognizes a familiar feeding area and moves toward it. Learning changes connections among neurons, allowing experience to influence later behavior.

Sensory information and the thalamus. Smell begins when receptors in the nose respond to chemicals. Signals reach the olfactory bulbs and then other brain regions that interpret odors. Visual signals travel from the retinas through the optic nerves, chiasm, and tracts. Most sensory pathways, including those for vision, hearing, and touch, relay through the thalamus on their way to the cerebral cortex. The thalamus helps process and direct that information. Smell is an exception to this initial thalamic relay. Detecting a stimulus and recognizing what it means involve several connected regions.

Coordinating movement. Walking over uneven ground requires more than commands to contract muscles. The cerebellum compares information about intended movement with feedback from the body and balance organs of the inner ear. It helps adjust the timing and strength of muscle activity so movements remain smooth and coordinated. The sheep can lower its head while keeping its footing because posture and movement are continually adjusted. The arbor vitae carries signals within the cerebellum. In the cerebrum, the corpus callosum allows the two hemispheres to share information.

Maintaining internal conditions. The hypothalamus helps maintain homeostasis, the regulation of internal conditions within workable limits. Changes in temperature or the concentration of body fluids can trigger responses that help restore balance. Thirst encourages drinking, while temperature regulation can involve changes in behavior and body activity. The hypothalamus also links the nervous and endocrine systems through the pituitary gland. Pituitary hormones travel in the blood and influence growth, reproduction, water balance, and other endocrine glands. Nervous signals and hormones therefore help coordinate the animal on different time scales.

Automatic functions and rapid responses. The brainstem keeps essential activities coordinated while the sheep eats, rests, or moves. The medulla contains centers involved in breathing, heart rate, and blood pressure. The pons helps regulate breathing and relays signals among brain regions. In the midbrain, the superior colliculi help orient the eyes and head toward visual events, while the inferior colliculi process sound information. These pathways can help an animal respond quickly to a change around it. The spinal cord carries signals between the brain and body and coordinates some reflexes, such as withdrawing a limb from a painful stimulus before conscious awareness is required.

Gray and white matter in action. The gray and white areas you observe have complementary roles. Gray matter contains many cell bodies and synapses where neurons receive and process signals. White matter contains bundles of axons that connect processing regions. Myelin insulates many of these axons and increases the speed of signal transmission. When a sheep sees an obstacle and steps around it, information must move between sensory, movement, and coordination pathways. The visible folds and bands are therefore parts of an interconnected system. Damage to a connecting pathway can disrupt communication even when the regions it joins remain intact.

Protecting an active organ. Brain tissue needs a continuous supply of oxygen and nutrients from the blood to support its activity. The meninges protect and support the brain, while cerebrospinal fluid surrounds it and fills its ventricles, providing cushioning and buoyancy. In a preserved specimen, these structures no longer function, but their relationships show how the living organ was organized. As you identify each part, connect its location and pathways with what it helped the sheep do.

Compare the sheep brain with a human brain reference. Notice the elongated sheep cerebrum and the different proportions of the cerebral hemispheres, olfactory structures, and cerebellum. Shared structures can be identified in both species, but differences in shape or relative size alone do not establish a simple ranking of intelligence.

Optional Extension: The Twelve Cranial Nerves

Complete this section only if assigned by your teacher. Study the nerves before making the midsagittal cut. Your goal is to connect each nerve's name and number with its main function and identify any nerve roots that remain on your specimen.

How cranial nerves work

Sheep and humans have 12 pairs of cranial nerves, numbered I–XII with Roman numerals. Each pair normally includes a right and left nerve. They carry information between the brain and structures such as the eyes, ears, facial muscles, and tongue. The vagus nerve also reaches organs in the chest and abdomen.

Sensory nerves carry information toward the brain. Motor nerves carry commands to muscles or glands. Mixed nerves contain both sensory and motor fibers. Most cranial nerves connect with the brainstem. Nerves I and II are associated with the forebrain; nerve XI includes roots from the upper spinal cord.

Names and main functions

No.	Nerve	Type	Main functions
I	Olfactory	Sensory	Smell; carries signals from receptors in the nose to the olfactory bulb.
II	Optic	Sensory	Vision; carries signals from the retina toward the brain.
III	Oculomotor	Motor	Moves most eye muscles, raises the upper eyelid, and helps constrict the pupil.
IV	Trochlear	Motor	Moves the eye through the superior oblique muscle.
V	Trigeminal	Mixed	Sensation from much of the face and mouth; controls chewing muscles.
VI	Abducens	Motor	Moves the eye outward through the lateral rectus muscle.
VII	Facial	Mixed	Facial movements; taste from the front of the tongue; helps control tears and saliva.
VIII	Vestibulocochlear (Acoustic)	Sensory	Hearing and balance; carries signals from the inner ear.
IX	Glossopharyngeal	Mixed	Taste from the back of the tongue, throat sensation, swallowing, and some saliva production.
X	Vagus	Mixed	Swallowing and vocalization; carries signals from internal organs and helps regulate heart and digestive activity.
XI	Accessory (Spinal accessory)	Motor	Controls muscles that move the head, neck, and shoulders.
XII	Hypoglossal	Motor	Controls tongue movements used in handling food and swallowing.

Cranial nerves working together

A cranial nerve is a bundle of nerve fibers, not a single neuron. The sensory and motor fibers within a mixed nerve carry different messages. Sensory fibers bring information toward the brain, while motor fibers carry commands outward. This two-way communication lets the brain use incoming information to adjust a response. The Roman numerals identify the nerves; they do not rank their importance.

Consider a sheep taking a mouthful of grass. The olfactory nerve (I) carries smell information, and the optic nerve (II) carries visual information. The trigeminal nerve (V) provides sensation from much of the mouth and controls chewing muscles. The hypoglossal nerve (XII) moves the tongue to position food. Facial (VII) and glossopharyngeal (IX) pathways contribute taste information and help regulate saliva. Swallowing then requires coordinated activity involving several nerves, including IX and X. One familiar behavior therefore depends on several sensory and motor pathways working together.

Some cranial-nerve functions occur without conscious effort. For example, pathways involving the oculomotor nerve (III) help narrow the pupil in bright light. The vagus nerve (X) carries information from internal organs and helps regulate heart and digestive activity. These automatic functions help maintain suitable internal conditions while the animal attends to its surroundings. During dissection, use the table to connect each visible nerve with a function rather than memorizing its name alone.

The old school memory rhyme

“On Old Olympus’ Towering Top A Finn And German Viewed Some Hops.”

Use the first letter of each word to remember nerves I–XII: O O O T T A F A G V S H. The rhyme uses two older names: Acoustic for VIII (now usually vestibulocochlear) and Spinal accessory for XI (also called accessory). The rhyme helps with order; you still need to learn what each nerve does.

Optional specimen investigation

1. Place the brain ventral side up with the anterior end away from you. Locate the olfactory bulbs, optic chiasm, pons, and medulla. Use a labeled reference and a blunt probe; gently point to structures without pulling on nerve stumps.
2. Start at the anterior end. Locate the olfactory bulbs associated with nerve I. The bulbs are brain structures, not the tiny olfactory nerve fibers themselves; those fibers are often torn away during removal. Look for the optic nerve stumps leading into the optic chiasm. The chiasm is where some optic fibers cross, not a separate cranial nerve.
3. Examine the sides and underside of the brainstem for remaining nerve roots. The trigeminal nerve, V, may be recognizable as a relatively large root on the side of the pons. Use your reference and teacher’s help for the smaller roots. Do not identify a nerve by size alone.
4. Record each assigned nerve’s Roman numeral, name, main function, and whether it is visible, uncertain, or not visible. Use colored pencils and straight leader lines on a ventral-view sketch or teacher-provided photograph. Label only structures you can support with observations.

Many nerves are cut or damaged during specimen preparation. You may not find all 12 pairs. Record what is present rather than digging into the brain to search for missing nerves.

Think About It

4. How do the optic nerve (II) and the eye-movement nerves (III, IV, and VI) contribute differently to vision?
5. Why is the trigeminal nerve classified as mixed?
6. How does the vagus nerve differ from nerves that serve mainly the head and neck?

High school challenge

Group the nerves by function: sensory only—I, II, VIII; motor—III, IV, VI, XI, XII; mixed—V, VII, IX, X. Explain why a mixed nerve needs both incoming and outgoing fibers. Then choose one everyday activity, such as eating, and describe how at least three cranial nerves work together.

Complete the investigation

Before cleanup, show your teacher the required external and internal structures. Be able to orient the specimen and explain each structure's function. For assigned drawings, use colored pencils, clear titles identifying the view, and straight leader lines. Label diagrams and photos carefully. Record a structure as "not visible" when it is missing or cannot be confidently identified, rather than presenting a reference drawing as your own observation. Return or dispose of the specimen as directed. Place tissue and preservative in designated containers, clean the tray and tools, wipe the work surface, remove gloves, and wash your hands.

Think About It Answers

1. The longitudinal fissure separates the cerebral hemispheres. The transverse fissure separates the cerebrum from the cerebellum.
2. The pituitary gland and cranial nerves may be cut, torn, or left behind when the brain is removed from the skull and prepared.
3. Both contain axons that carry signals. The corpus callosum connects the cerebral hemispheres; the arbor vitae carries signals to and from the cerebellar cortex.
4. Nerve II carries visual sensory information from the retina. Nerves III, IV, and VI control eye muscles that direct the eyes toward what the animal is viewing.
5. The trigeminal nerve contains sensory fibers from the face and mouth and motor fibers controlling chewing muscles.
6. The vagus extends into the chest and abdomen, carrying sensory information and helping regulate internal organs, including the heart and digestive tract.

Sources and image notes

Ted Ehrheart, Mr. E Science sheep brain dissection video, supplied transcript, original pre-lab and lab handout, and photo review collection dated September 7, 2026. All dissection photographs in this guide are from the supplied Mr. E Science collection.

David H. Hall, Dissection Guide to the Mammalian Brain, illustrated by Glen Folsom, RANACO, 1999. Supplied booklet consulted as a reference; its artwork is not reproduced.

Terminology and functions checked against OpenStax, Anatomy and Physiology, sections 13.4 and 16.3. The cranial-nerve extension was written for this guide; reference illustrations not reproduced.

<https://openstax.org/books/anatomy-and-physiology/pages/13-4-the-peripheral-nervous-system>

<https://openstax.org/books/anatomy-and-physiology/pages/16-3-the-cranial-nerve-exam>

Anatomy reference: <https://openstax.org/books/anatomy-and-physiology-2e/pages/13-2-the-central-nervous-system>

Meninges reference: <https://openstax.org/books/anatomy-and-physiology-2e/pages/13-3-circulation-and-the-central-nervous-system>

Specimen reference: <https://knowledge.carolina.com/discipline/life-science/anatomy-and-physiology/sheep-brain-dissection-2/>