Biology 4: The Brain

Brain Lab Table of Contents:
- Expected Learning Outcomes . . . 1
- Introduction . . . . . . . . . . 2
- Activity 1: Sheep Brain Dissection . . 2
- Activity 2: Human Brain Observation . 7

Expected Learning Outcomes
At the end of this lab, you will be able to
- Use dissection skills to locate and identify structures on the sheep brain; and
- examine and identify structures on human brains.

Figure 1: Brain, from Saladin, Human Anatomy
Introduction

The human brain remains one of the most mysterious structures, with secrets that elude scientists even after decades of intense research. Mammalian brains have much in common. We will locate structures on the sheep brain, and then compare the features to human brains.

Activity 1: Sheep Brain Dissection

For the exam, you are responsible for every structure in bold font.

1. Obtain a sheep brain (shared by two people) and place it on the dissecting tray. You will also need bamboo sticks to point out structures.

Note: YOU DO NOT NEED TO CUT ANYTHING UNTIL STEP #14.

2. The brain and spinal cord are covered by layers called meninges. When the brain is removed from the skull, the outermost covering, the dura mater, often adheres to the cranial bones, and therefore is not present on the sheep brain. Identify the web-like arachnoid that adheres to the surface like wet tissue paper, and has visible blood vessels (usually black because of the preservative). The surface of the brain is covered by the thin, shiny pia mater.

3. Identify the cerebral hemispheres, separated by a long crack, the longitudinal fissure. The wrinkled surface of the cerebrum is produced by rounded hills called gyri (single= gyrus) and grooves called sulci (single= sulcus).

4. Gently spread the cerebral hemispheres apart at the longitudinal fissure, and observe the shiny white corpus callosum, the white matter structure that serves to connect the right and left cerebral hemispheres. You will see this from a different perspective when you cut the brain in half.

5. On the underside (ventral) portion of the brain, note the prominent olfactory bulbs at the anterior part of the brain. A shiny, narrow, whitish path extends posteriorly
from each bulb. These **olfactory tracts** carry information about smell to deeper parts of the brain.

6. Find the “X,” the **optic chiasma**, on the ventral surface. The anterior part of the “X” is formed by the **optic nerve**, Cranial Nerve II.

7. Posterior to the optic chiasma, one usually finds a pinhole (the **infundibulum**), which normally connects to the **pituitary gland**; the pituitary is rarely present because it is sheared off when the brain is removed from the cranium. Posterior to the pituitary gland location is a U-shaped flap called the **mamillary bodies**. This is one portion of the **hypothalamus**; more of the hypothalamus will be seen when you cut the brain in two.

8. The ventral surface of the **midbrain** consists of the **cerebral peduncle**, a white matter connection between the cerebrum and the lower parts of the brainstem. Often, two prominent white strings emerge—the **oculomotor nerves**, Cranial Nerve III. The oculomotor nerve supplies most of the muscles that move the eyeball.

9. The **pons** are two bumps posterior to the midbrain. “Pons” means bridge, and the white matter connects the cerebrum and midbrain to other parts of the hindbrain and the spinal cord.

10. The **medulla oblongata** consists of two adjacent portions separated by a groove. The medulla oblongata contains internal gray matter areas that regulate basic life functions such as heart rate and breathing. The medulla is continuous with the **spinal cord**. The spinal cord begins at the foramen magnum.

11. Locate the large **cerebellum**, with its distinctive external pattern of shale-like grooves.

12. Gently pull the cerebellum down and away from the brainstem. You can now see the dorsal portion of the midbrain, with its four distinctive bumps called the **corpora quadrigemina**. The two superior bumps are the **superior colliculi** (colliculi=hills), and the two inferior bumps are **inferior colliculi**. These portions of the midbrain control visual and auditory reflexes.
13. The **pineal gland** is a small round structure visible above the corpora quadrigemina. It produces melatonin, a hormone associated with seasonal rhythms and sleep.

**CUT THE BRAIN IN HALF, ANTERIOR TO POSTERIOR.**
Cut from the front to the back through the longitudinal fissure, using a large knife. You will now be able to view the sagittal section of the brain.

![Figure 2: Sheep Brain, Sagittal Section](http://anatomycorner.com/main/wp-content/images/brain_lateral_view04.jpg)

14. Locate the corpus callosum, which you saw from the superior view when you examined the interior of the longitudinal fissure. Ventral to the corpus callosum, find the empty space. This is the **lateral ventricle**. There are two lateral ventricles, separated by a thin, fragile curtain called the **septum pellucidum**. In life, the lateral ventricles are filled with cerebral spinal fluid.
15. The bottom, or ventral, border of the lateral ventricles is bounded by the **fornix**.

16. Find the round **thalamus**, and, ventral to it, the less clearly bounded **hypothalamus**.

17. Locate the **third ventricle**, a tunnel-like space that is one of the fluid-filled cavities of the brain. It is bounded by the thalamus and hypothalamus, and connects posteriorly to the **cerebral aqueduct**. Cerebrospinal fluid (CSF) flows through the aqueduct to the **fourth ventricle**, located between the cerebellum and spinal cord. From the fourth ventricle, the CSF flows into the **central canal** of the spinal cord.

18. The **cerebellum** has interior white matter that branches in a beautiful, treelike pattern. The white matter is called **arbor vitae** (the “tree of life”).

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*Figure 3: Ventricles of the Human Brain from Saladin, Human Anatomy*
19. Finally, use the knife to make a tranverse cut through the front part of the cerebrum. This will reveal the thin **gray matter** of the cortex and the underlying **white matter** that consists of myelinated nerve tracts.

**Checkpoint:**

With your lab partner, choose five structures that were in bold print. Place a colored pin in each. Show the brain to the instructor and name each of the structures. You may work with your lab partner but each partner must do some of the presentation to the instructor.

20. After you have been checked off by the instructor, rinse and dry the pins, put the brain in a small plastic bag, and either take it home or store it in the lab refrigerator. (Note: If you choose to take it home, do not store it near food. It may be stored almost anywhere that is out of reach of pets, etc.) If you leave it in the lab, write your names on the bag and place it in a tray with other brains from your lab. Finally, wash the dissection tray and place it on the racks as per your instructor’s directions.

**Activity 2: Human Brain**

Note the differences between the sheep and human brains. The sheep brain is arranged in a horizontal fashion, with the spinal cord emerging from the foramen magnum parallel to the ground. In contrast, the human brain has a distinctive flexure that causes the spinal cord to point toward the ground. The difference is due to the position of the head and neck associated with bipedality. Another obvious difference between the human and sheep is the enormous size of the human cerebrum, which dwarfs the other brain structures.

Observe the human brains and locate the following structures.

On the whole, uncut brain:
- **dura mater** (located in the skull cap)
- **arachnoid**
- **cerebral hemispheres**
- **longitudinal fissure**
- **gyri** and **sulci**
- **hypothalamus** (**mammillary bodies**)
- **medulla oblongata**
- **cerebellum**
On the hemi-sected brain:
- corpus callosum
- lateral ventricle
- thalamus (massa intermedia)
- pineal gland
- medulla oblongata

On the coronal sections:
- gray matter
  - cerebral cortex
  - basal nuclei (You do not need to name specific nuclei, which are named in figure 4.)
- white matter
- lateral ventricle
- third ventricle