ACTIVITY 7: NERVOUS SYSTEM HISTOLOGY, BRAIN, CRANIAL NERVES

LABORATORY OBJECTIVES:

1. Histology: Identify structures indicated on three different slides or images of nervous system tissue. These images are in the PowerPoint Presentation. Some of these structures are also visible on the classroom model of a neuron.
    a. Cross section of a nerve slide
    b. Spinal cord smear slide
    c. Teased, myelinated nerve fiber slide
2. Identify listed structures of the human brain on classroom models.
3. Dissect a sheep brain and identify structures listed.
4. Identify the 12 pairs of cranial nerves by name and number on a model and on the sheep brain.
5. Observe the cranial meninges and identify listed structures involved in cerebrospinal fluid circulation.

A. Nervous System Histology

Cross section of a nerve slide:	Spinal cord smear slide:	Teased myelinated nerve fibers slide:
axon endoneurium perineurium epineurium fascicle myelin sheath	multipolar neuron axon axon hillock dendrites nucleus cell body (soma) chromatophilic substance glial cell	axon myelin sheath neurofibril nodes Schwann cell (oligodendrocyte) nucleus

B. Brain

Cerebrum:	Diencephalon:	Brainstem:	Cerebellum:
Structures to identify: gyrus (pl. gyri) sulcus (pl. sulci) gray matter white matter longitudinal fissure cerebral hemispheres corpus callosum frontal lobe precentral gyrus central sulcus postcentral gyrus parietal lobe parieto-occipital sulcus occipital lobe lateral sulcus temporal lobe fornix septum pellucidum	pineal gland thalamus interthalamic adhesion hypothalamus mammillary body infundibulum pituitary gland optic chiasm optic tracts third ventricle	mesencephalon cerebral peduncles corpora quadrigemina superior colliculi inferior colliculi pons medulla oblongata cerebral aqueduct fourth ventricle	vermis cerebellar hemispheres arbor vitae

C. Cranial and Spinal Meninges and CSF circulation

Cranial meninges & spaces:	Spinal meninges & spaces:	Ventricles:
Structures to identify: blood vessels -- superior sagittal sinus transverse sinus dura mater cranial dural septa falx cerebri tentorium cerebelli falx cerebelli subdural space arachnoid subarachnoid space pia mater	*Structures to identify:* epidural space dura mater subdural space arachnoid subarachnoid space pia mater	*Structures to identify:* lateral ventricles third ventricle cerebral aqueduct fourth ventricle central canal (of spinal cord)

D. Cranial Nerves:

	Name	Function (S= sensory; M= motor)	Foramina
I	olfactory	S = olfaction (smell)	cribriform plate of ethmoid bone
II	optic	S = vision	optic canal
III	oculomotor	M = four extrinsic eye muscles contraction; opens eyelid	superior orbital fissure
IV	trochlear	M = superior oblique eye muscle contraction	superior orbital fissure
V	trigeminal	S = sensation from anterior scalp, nasal cavity, face, mouth, tongue, part of external ear M = chewing (mastication) muscles	superior orbital fissure foramen rotundum foramen ovale
VI	abducens	M = lateral rectus eye muscle contraction	superior orbital fissure
VII	facial	S = taste from anterior two-thirds of tongue M = muscles of facial expression	internal acoustic meatus
VIII	vestibulocochlear	S = hearing (cochlear branch); equilibrium (vestibular branch)	internal acoustic meatus
IX	glossopharyngeal	S = touch and taste on posterior tongue; visceral sensation from carotid bodies M = one muscle in pharynx	jugular foramen
X	vagus	S = visceral sensation from pharynx, larynx, carotid bodies, heart, lungs, most abdominal organs; sensory information from ear M = most pharynx muscles, larynx muscles; innervates heart, lungs, and most abdominal organs	jugular foramen
XI	accessory	M = trapezius muscle; sternocleidomastoid muscle	foramen magnum
XII	hypoglossal	M = tongue muscles	hypoglossal canal

Instructions for Sheep Brain Dissection

Before you start the dissection, you will need to obtain a dissecting tray, scalpel, and sheep brain from your instructor or the laboratory assistant.

1. Observe the gross structure of the sheep brain. (nerves, dura mater, blood vessels, etc.) Notice how tough the dura mater is.
    a. Place the sheep brain on the tray so the Inferior surface is facing up.
    b. Find the pituitary gland, if present (notice the capillary beds both posteriorly and lateral to the pituitary gland)
    c. Find the trigeminal nerves (CN V).

2. Now you will need to carefully remove the dura mater without breaking off the pituitary gland. **(Note: If the sheep brain doesn't have dura mater skip to step 3)**
    a. First, you will need to cut the trigeminal nerves and the capillaries.
    b. Next, cut around the optic chiasm, pituitary gland, and trigeminal nerve.
    c. Now make a cut in the dura mater between the olfactory bulbs and olfactory tracts. Gently pull the dura mater away from the brain. The best way to do this is to pull the dura in a posterior, superior direction. Be sure to gently cut any remaining connections as you pull the dura mater away from the brain.

3. **Inferior View of the Sheep Brain**: Observe the sheep brain and compare its structures (cranial dural septa, ventricles, nerves, etc.) to the human brain structures.
    a. Position the sheep brain so the inferior surface is facing you.
    b. Next you will dissect the dura mater and the capillary tufts away from the pituitary gland, being careful not to damaging the cranial nerves or detach the trigeminal nerves from the brain.
    c. Gently lift the dura mater on the posterior side of the pituitary gland until you can see the small nerves that go through the deep surface of the dura mater.
    d. Use your scalpel to detach the nerves at the point where they enter the dura mater. (**Make sure you are cutting the nerve where it comes in contact with the dura, not where it attaches to the brain!)**
    e. Remove as much of the dura as possible, making sure you keep the pituitary intact.
    f. Identify the following structures.

cerebellum	medulla oblongata	pituitary gland
cerebral peduncle	olfactory bulb	pons
frontal lobe	optic chiasm	temporal lobe
longitudinal fissure	optic nerve (CN II)	hypothalamus

    g. Next, observe the **mammillary body**, a part of the hypothalamus. Do this by carefully lifting the pituitary gland. (Note: The human brain has two mammillary bodies but the sheep brain only has one)
    h. Now identify the cranial nerves. (Note: Cranial nerves IX-XII might not be visible because it might have been torn off when it was being removed from the skull)

4. **Superior View of the Sheep Brain:** Place the brain on the dissecting tray so the superior side is facing up. Notice the thin layer of **arachnoid** that covers the surface of the brain but does not dip into the sulci of the brain. Also notice the vast amounts of blood vessels that are between the arachnoid mater and the pia mater. The space the blood vessels occupy is also where cerebrospinal fluid flows in the sheep.

Identify the following structures:

arachnoid mater	cerebrum	spinal cord
blood vessels	gyrus	sulcus
cerebellum	longitudinal fissure	

Now, pick up the brain, hold it with the cerebellum facing you, and carefully pull the cerebellum away from the cerebrum.

Identify the following structures:

cerebellum	inferior colliculi*	pineal gland
cerebrum	superior colliculi*	

*superior colliculi + inferior colliculi = corpora quadrigemina

Midsagittal and Coronal Sections of the Sheep Brain

Note: Some of you will dissect a midsagittal section of the sheep brain; and some will dissect a coronal section. Ask your instructor which section you are to dissect before you begin cutting. Make sure you observe both dissections, even though you are only performing one.

Midsagittal Section:

1. Place the sheep brain on your dissecting tray with its superior surface facing you. Starting on the anterior end, place your scalpel in the longitudinal fissure and cut the brain in half along the midsagittal plane.

2. Once you have cut the brain in half, identify the following structures on the cut, midsagittal surface.

Identify the following structures:

central canal	fornix	pituitary gland
cerebellum	fourth ventricle	pons
cerebral aqueduct	mammillary body	spinal cord
cerebral peduncle	medulla oblongata	superior and inferior colliculi
cerebrum	optic chiasm	thalamus, with interthalamic adhesion
corpus callosum	pineal gland	septum pellucidum

Coronal section:

1. Place the sheep brain on your dissection tray with the inferior side facing you. Next, identify the pituitary gland. Use your scalpel to cut the brain in half along the coronal plane.
2. Once you have cut the brain in half, identify the following structures on the cut surface.

Identify the following structures:

cerebral peduncle	hypothalamus	pons
cerebrum	thalamus	third ventricle
corpus callosum	lateral ventricles	cerebral nuclei
fornix	longitudinal fissure	cerebral cortex