

LESSON STUDY

2016--2017 CATL Teaching and Learning Grant Final Report

Part 1: Background

Title: Using Team--based Learning to Teach Neuroanatomy in Human Anatomy and Physiology Laboratory

Authors	Email Address	Department
James Schanandore	jschanandore@uwlax.edu	Biology
Sumei Liu	sliu@uwlax.edu	Biology
Christine Schwartz	cschwartz@uwlax.edu	Biology
Ryan Stapley	rstapley@uwlax.edu	Biology

Submission Date: May 20, 2017

Course Title: Human Anatomy and Physiology Laboratory I

Course Description: The Human Anatomy and Physiology I (BIO 312) is the first course in a two-semester course series of Human Anatomy and Physiology (BIO312/BIO313) that serves over 400 students per semester, mostly sophomore and junior students with an interest in health professions. The laboratory is an important component of the course series. The lesson study was conducted in the BIO 312 laboratory during weeks 6-9 of the fall 2016 semester, which covered the neuroanatomy lab. In this lab, students learned structures of the brain, spinal cord, cranial and spinal nerves. Historically, students have had difficulty understanding the different levels of brain organization. Incorporating a team--based learning (TBL) module into this lab has the potential to engage students during the lab period, encourage teamwork and discussion, and allow the instructor to provide immediate feedback on any confusion the students may have.

Abstract: Students in the Human Anatomy and Physiology Laboratory at UWL are responsible for learning a large amount of material, particularly in the neuroanatomy lab. TBL is an active learning approach that has potential to engage students, allow instructors to provide immediate feedback, and help students to learn anatomy effectively. We conducted a lesson study using TBL in the neuroanatomy lab, which included both individual and group activities, along with pre-lab and post-lab

assessment. Students achieved higher mean post-test scores two weeks after the TBL module compared to the pre-test scores ($p < 0.001$). In addition, students in the TBL group achieved higher mean scores in the unit lab practical examination and the neuroanatomy-specific questions within the lab practical ($p < 0.001$). Importantly, feedback from outside observers and student surveys indicated positive attitudes about TBL. We concluded that incorporating more TBL modules in this course may help engage students, encourage teamwork, help students learn laboratory materials, and potentially improve student performance.

Part II: The Lesson

Student Learning Goals for the Neuroanatomy Lab:

Lesson- specific goals:

- 1) Identify and state the function of four major regions of the brain and major structures within each region.
- 2) Identify the major components of the spinal cord.
- 3) Identify the major components of a nerve and understand the composition, structure and function of a nerve.
- 4) Identify and state the name, number and function of the first six cranial nerves.
- 5) Understand the function of spinal nerves and how they connect to the spinal cord.

Broad, developmental goals:

- 1) Develop a vocabulary of appropriate terminology to effectively communicate information related to human anatomy and physiology.
- 2) Make a connection between the anatomical structure and the physiological function of the structure.

Lesson Plan:

Studies investigating the value of TBL have gathered strong evidence showing that student performance improves by such teaching practice. Much of this data comes from introductory courses such as introductory biology. It is only in recent years that TBL has been utilized in anatomy courses at both undergraduate and graduate levels (Vasan et al., 2009, 2011; Livingston et al., 2014; Huitt et al., 2015). In this lesson study, we incorporated the TBL approach into a neuroanatomy lab of BIO 312. The steps of the TBL module are illustrated in Figure 1.

To better prepare students prior to lab and allow them to immediately begin lab activities upon entering class, we recorded a pre-lab lecture (step 1 in Fig. 1) that students were required to watch before class. In addition, students were required to complete a pre-lab reading assignment (step 1 in Fig. 1). This pre-lab lecture video would acquaint students with the proper nomenclature used to describe different features of the nervous system and ensure consistency among instructors. In this way, students would be better informed to take instruction during lab and enable better communication with the instructor and their peers concerning the brain dissection. This pre-lab video also addressed common problems that arise during dissection such as how and where to

make a proper dissection cut along the brain and how to remove specific structures without damaging others. This information is currently available in the lab manual but students will benefit from an additional demonstration video which they can reference during the lab or when they are studying outside of the lab. With the advent of this pre-lab video and an additional pre-lab reading assignment, we hope that students would complete the lab material in a more timely fashion and allow students more time for in--class activities and questions concerning the material.

At the beginning of the lab, students took a pre-lab quiz (i.e. individual readiness assurance test; step 2 in Fig. 1). This pre-lab quiz worked in a two-fold manner. First, it provided instructors with an assessment of the students' base knowledge coming into lab. This was compared with their scores on a post--lab quiz (which was administered two weeks later; step 6 in Fig. 1) for measuring improvement. Second, this pre-lab quiz would cue students into how questions would be presented on their unit exam and highlight important learning objectives that are presented in this lab.

During the lab period, students worked through group activities that promote TBL. The group activities had the students explore the structures of the nervous system as a team. We developed guiding activities to walk the students through the sheep brain dissection and other lab components. A team readiness assurance test (step 3 in Fig. 1) was given in the middle of the lab, which ensured that the students work in a group and that the high performing students helped the at -risk students. The instructor checked the results of the team readiness assurance test and provided immediate feedback (step 4 in Fig. 1). Additionally, after this team readiness assurance test, the students engaged in a team application question (step 5 in Fig. 1), which was designed to promote understanding of neuroanatomy, make connections between structure and function, and provide ties to lecture- based material.

To test the effectiveness of the TBL, a post--lab quiz was administered two weeks later after the TBL module (step 6 in Fig. 1), prior to the unit exam which was administered three weeks after the module. The timing of this quiz was not announced to the students in order to assess retention of the material without exam- level studying and preparation. In addition, we compared student performance on the relevant questions from the unit exams with that from previous years to assess if TBL helped students learn neuroanatomy.

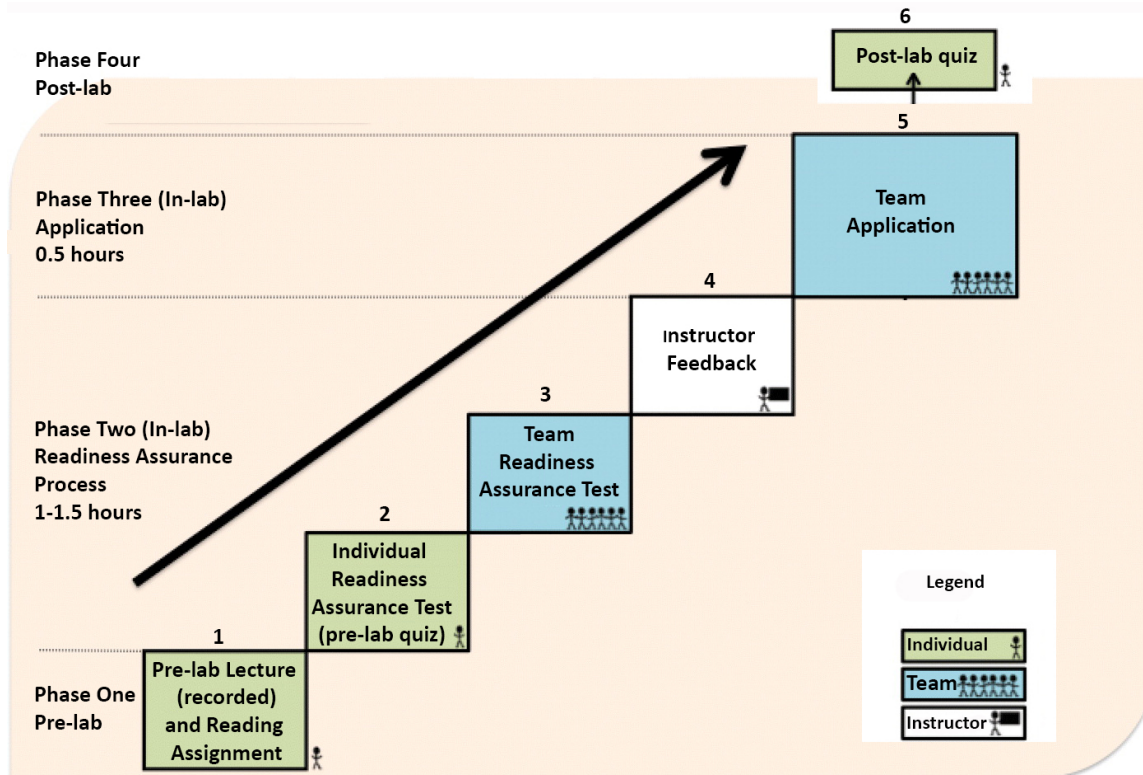


Figure 1. Phases of the TBL module. The TBL module was developed based on a practical guide by Parmelee et al (2012), which includes four phases: pre-lab preparation, in-lab readiness assurance process with instructor feedback, in-lab application, and post-lab quiz (Figure modified from Parmelee et al 2012).

Part III: The Study

Approach:

The primary purposes of incorporating the team-based learning approach into the Human Anatomy and Physiology lab are to engage students and to provide immediate feedback about questions/confusion the students may have. To evaluate if we have achieved these primary goals, we conducted in-class observations, a student survey, and several assessments.

Observations of TBL labs. We incorporated in-class observations to see if students were engaged in the lab, working together, and understanding the material. Each lab was observed by two observers, which included members of the lesson study, other Human Anatomy and Physiology lab instructors, student teaching assistants, or outside observers. The outside observers provided different perspectives on the lesson and how students learned in the lesson. Observers were provided with an overview of the lesson study and goals prior to their observation date. Each observer attended a lab section that was using TBL and made both objective and subjective observations on a provided handout. Two observers were present for each lab section, but typically observed different groups of students in the class. Objective observations included a

ranking scale while subjective observations provided space for observer comments. The observers did not interact with students, but were able to observe their actions, conversations, and interactions with the instructor.

Student perceptions of TBL. We anticipated that TBL would improve students' attitudes toward collaboration and teamwork. To assess the students' perceptions of TBL, we administered a survey that we adapted from Vasan et al (2009), Persky and Pollack (2001), and Huitt et al (2014). With this survey, we inquired about students' perceptions on how TBL helps them learn course materials, prepare for lab exams, develop critical thinking skills, and change attitudes toward working with peers. This survey was given after the lab unit exam (week nine).

Assessment of knowledge gains with TBL. We also anticipated that TBL would help students understand brain organization, clarify confusion about different levels of brain organization, and improve student performance. To assess whether the TBL module resulted in a short-term gain in knowledge, we used the Individual readiness assurance test (given at the beginning of the neuroanatomy lab as part of the TBL module) as a pre-lab quiz. We administered a post-lab quiz with the same set of questions two weeks later and compared student performance on the pre- and post-lab quizzes. We also administered a team readiness assurance test toward the end of the neuroanatomy lab. In addition, we compared student performance on the relevant questions from the lab unit exams with similar questions from previous years where students did not participate in the lesson study to assess student learning gains.

Compilation of lesson study data. Members of the TBL team met with the observers after the TBL labs were all completed to compile the observation data and receive feedback from the observers. We focused on whether the TBL module helped to engage students, promoted teamwork, and encouraged discussion among students and also between students and the instructor. The team members also met later during the fall semester to analyze student survey data, lab unit exam, and student performance on the pre- and post-lab quizzes. We plan to make revisions based on the analysis and repeat the lesson study in the fall semester of 2017.

Findings:

Student Performance

This study shows that TBL provided learning gains in the neuroanatomy lab. Students in the TBL labs performed significantly better on the post-quiz, which was taken two weeks after completing the TBL neuroanatomy lab, compared to the pre-quiz, taken prior to the TBL neuroanatomy lab (Fig. 2A). Additionally, students that participated in the TBL neuroanatomy lab did significantly better on the unit laboratory exam compared to students that were taught in a traditional way, both overall and specifically on the neuroanatomy questions (Fig. 2B). These results suggest that using TBL in the neuroanatomy lab improved student understanding and retention of the lab material.

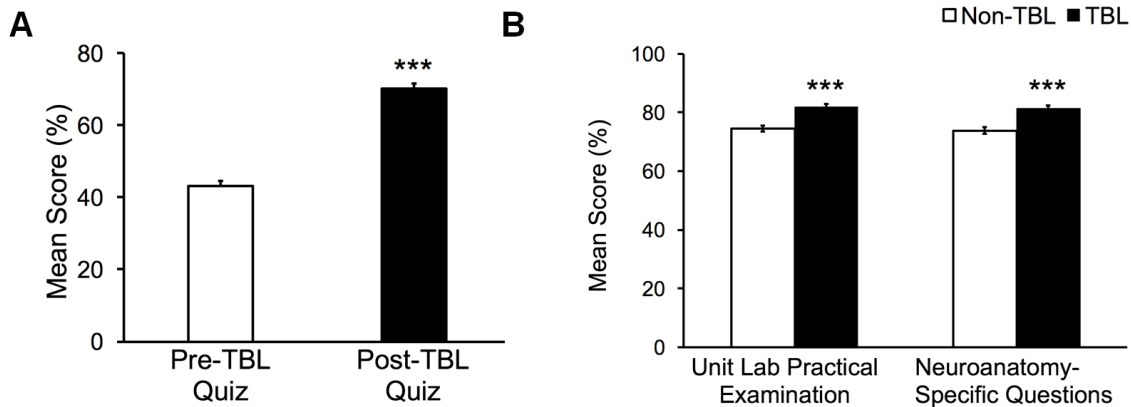


Figure 2. Student performance in quizzes and examinations. (A) Students in the TBL group achieved higher mean scores two weeks after the TBL module comparing to the pre-TBL scores ($p < 0.001$). (B) Students in the TBL group achieved higher mean scores in the unit lab practical examination and the neuroanatomy-specific questions within the lab practical ($p < 0.001$).

Student Evaluation of TBL

Results from a survey administered after the unit laboratory exam indicated that students that participated in the TBL neuroanatomy lab were satisfied with the laboratory and found it helpful in a variety of ways (Fig. 3). Overall student perceptions on TBL were very positive (Q1-Q5). Most students had a positive attitude toward teamwork and actively participated in the TBL discussion (Q6-9). In students' self-reflection (Q10-12), it is surprising to see that a large proportion of the students didn't complete the required pre-lab reading assignments. Effort will be taken to ensure that students complete these assignments as they replace the pre-lab lecture.

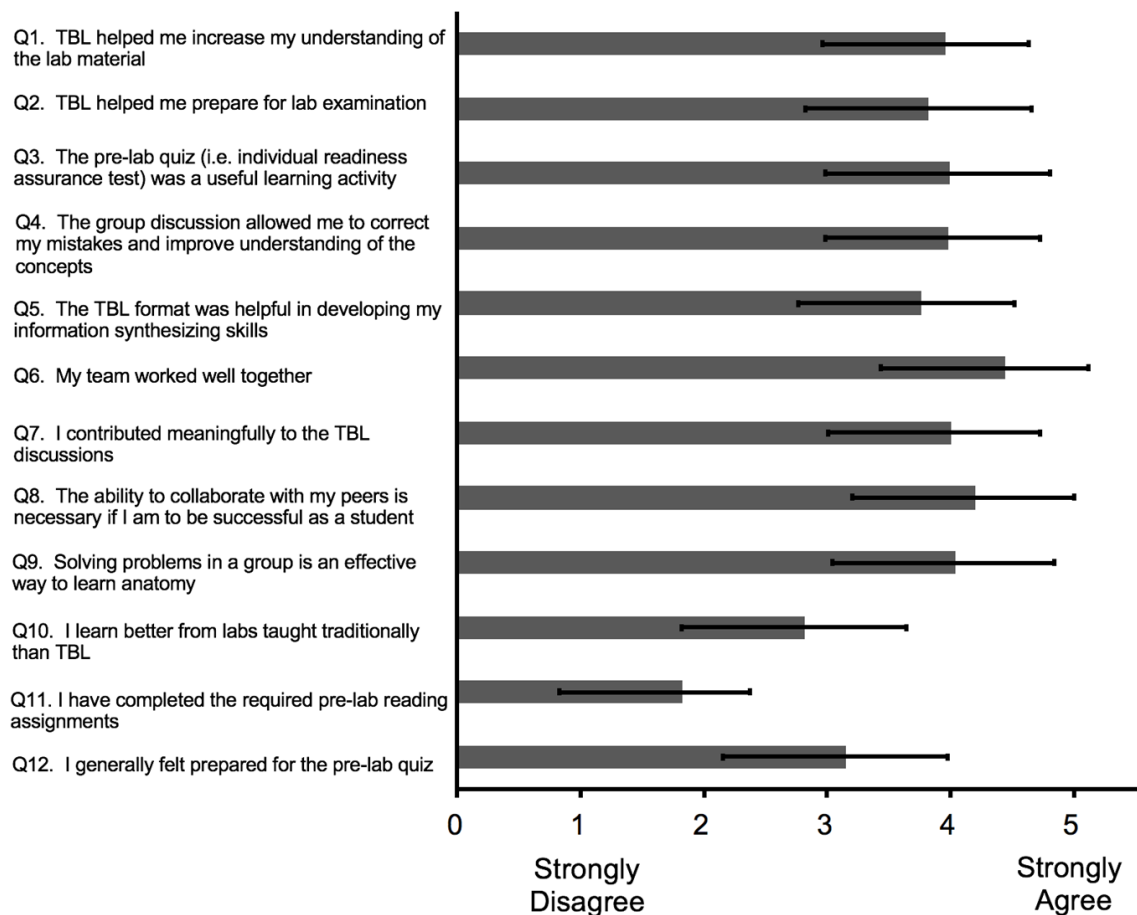


Figure 3. Student evaluation of TBL. Students took a survey four weeks after participation in the TBL neuroanatomy survey. The survey included questions about their perceptions of the lesson study and an accompanying rating scale (Q1-Q5, 1=Strongly disagree and 5=Strongly agree). The data compiled here shows the mean and standard error for all students surveyed.

Observer Evaluation of TBL

The quantitative feedback received from the observers of the TBL neuroanatomy lab sections were generally very positive (Fig. 4). However, the observations of student interactions with the lab instructor indicated that some groups relied too heavily on the lab instructor for help with the lesson (Q6), so efforts will be made to help address this and promote a higher level of group independence.

Additionally, the qualitative feedback from the observers was also generally positive (Fig. 5). The improvements focused on expanding the provided materials (like the video and the guide) to include more content, provide more direction, and assign specific student roles. The observations about what worked well indicated that the video, teamwork, and feedback portions of the lesson were valuable and well received by students.

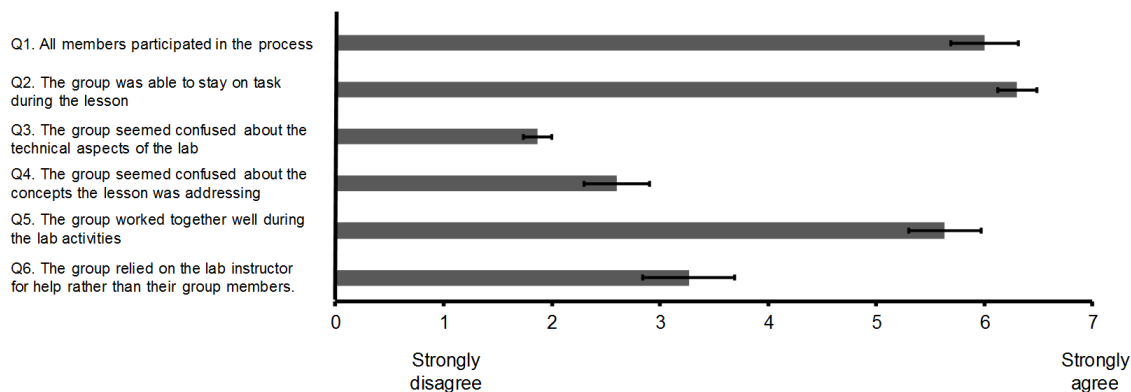


Figure 4. Observer evaluation of TBL. Observers were given an observation sheet with questions about the lesson and an accompanying scale for rating the student groups (Q1-Q6, 1=totally disagree and 7=totally agree). The data compiled here shows the mean and standard error for n=16 class observations.

Q7: What needs to be changed?

Observer comment	Frequency
More activities are needed for human brain (students focused mostly on sheep)	4/15
Use the guide to instruct students to physically find brain structures, as some students simply answered the questions on the guide	3/15
Provide all students with a distinct role in the laboratory process	3/15
The dissection video should have stopping points to facilitate the location of structures	2/15
Provide the undergraduate teaching assistants with a larger role and/or more training	2/15

Q8: What worked well and should remain the same?

Comment	Frequency
The video was very helpful, especially in the dissection process	7/15
The team test and the subsequent instructor feedback worked very well and students seemed responsive	4/15
Students interaction went well (peer teaching, working together)	3/15

Figure 5. Specific observer comments about TBL. In Q7-Q8 of the observer form used above, the observers were asked for additional comments (in their own words) on how to improve the lesson (Q7) and what about the lesson worked very well (Q8). The comments that appeared across multiple observations are included here, along with the frequency of the comment across observations.

In the future we plan to add more activities for human brain anatomy, improve the pacing of the lab procedure to better match the student's pace, develop a better means to provide instructor feedback to the students, improve the integration of the multimedia into the lesson presentation, and expand TBL to include other anatomy labs such as the skeletal and muscular systems.

References:

Huitt TW, Killins A, Brooks WS. 2015. Team-based learning in the gross anatomy laboratory improves academic performance and students' attitudes toward teamwork. *Anat Sci Educ* 8:95-103.

Krontiris-Litowitz J. 2008. Using truncated lectures, conceptual exercises, and manipulatives to improve learning in the neuroanatomy classroom. *Adv Physiol Educ* 32:152-156.

Livingston B, Lundy M, Harrington S. 2014. Physical therapy students' perceptions of team-based learning in gross anatomy using the Team-Based Learning Student Assessment Instrument. *J Educ Eval Health Prof* 11:1-10.

Parmelee D, Michaelsen LK, Cook S, Hudes PD. 2012. Team-based learning: A practical guide: AMEE Guide No. 65. *Med Teach* 34:e275-87.

Persky AM, Pollack GM. 2011. A modified team-based learning physiology course. *Am J Pharm Educ* 75:204-211.

Vasan NS, DeFouw DO, Compton S. 2009. A survey of student perceptions of team-based learning in anatomy curriculum: Favorable views unrelated to grades. *Anat Sci Educ* 2:150-155.

Vasan NS, DeFouw DO, Compton S. 2011. Team-based learning in anatomy: An efficient, effective, and economical strategy. *Anat Sci Educ* 4:333-339.

Appendix

Lesson Materials:

Student Materials

Three materials were provided to the students:

1. Pre-lab reading assignment
2. Pre-lab video demonstration of sheep brain dissection
3. Student instruction for the neuroanatomy lab

1. Pre-lab reading assignment

Use your lab manual or other reputable resources to read & complete this prior to lab.

Exercise 7 (pgs 33-36)

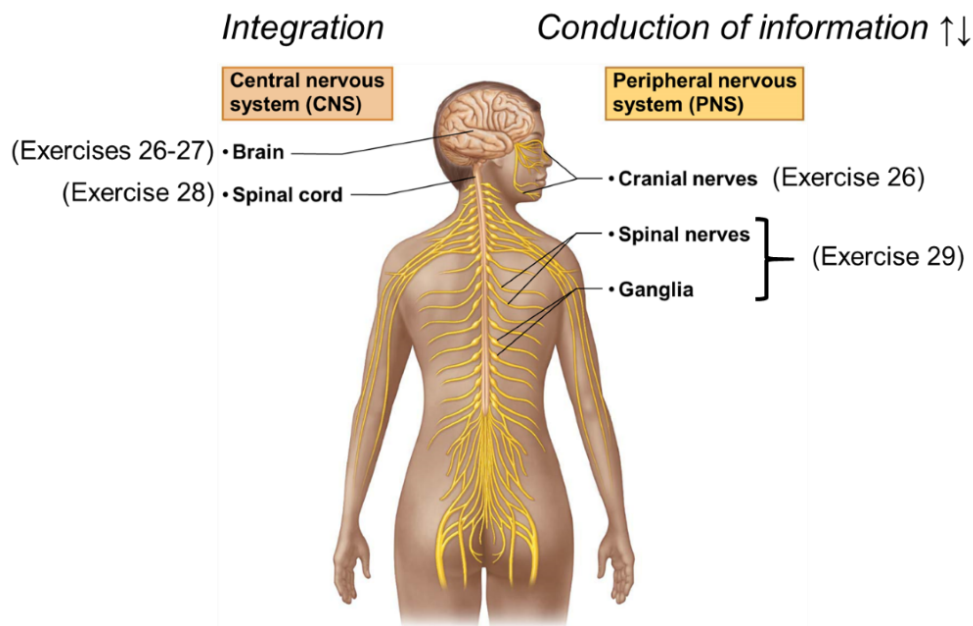
Exercise 26 (pgs 153-162)

Exercise 27 (pgs 163-168)

Exercise 28 (pgs 169-172)

Exercise 29 (pgs 173-174 ONLY, remainder will be tested with muscles)

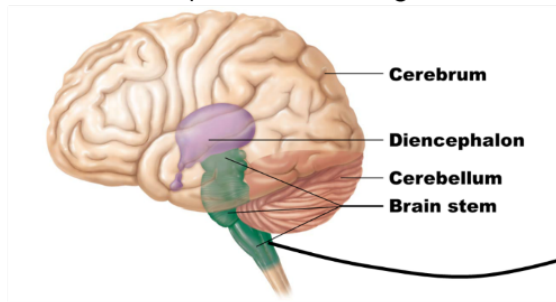
In this unit, we will learn about the anatomy and basic functions of the **NERVOUS SYSTEM**, as outlined below:



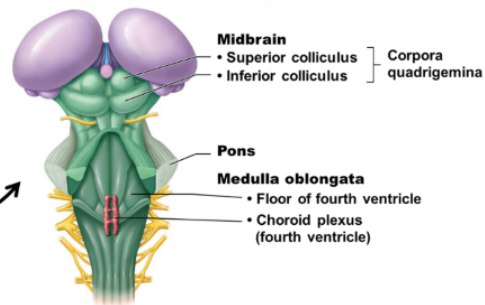
The **peripheral nervous system** carries input to and output from the **central nervous system**, which *integrates* all inputs and *generates* the output.

CENTRAL NERVOUS SYSTEM: Brain & Spinal cord

The brain is composed of **4 main regions**



Each of those **4 main regions** contains many **sub-regions, and structures.**

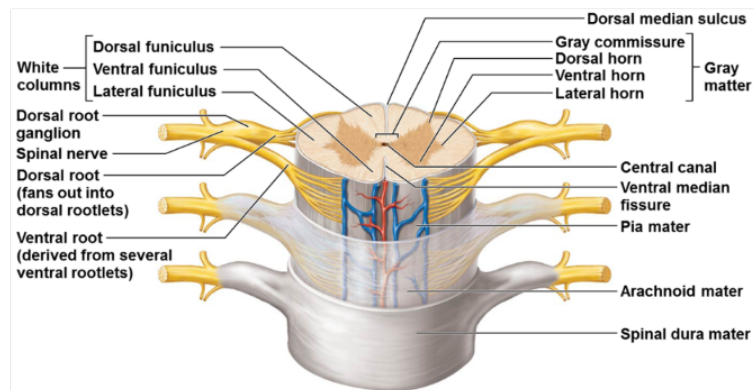
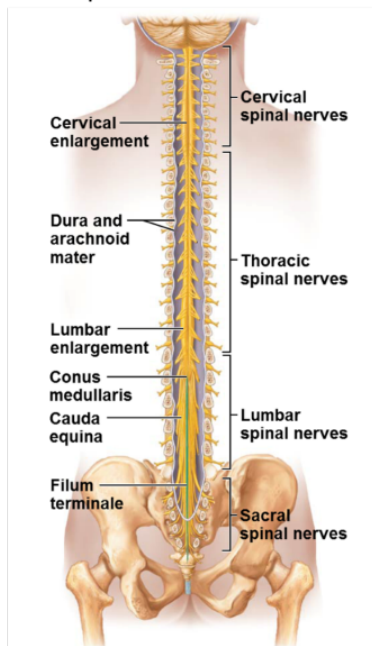


Example here is showing the dorsal view of brain stem, which includes three *sub-regions*: Midbrain, Pons, Medulla oblongata. Each sub-region also has additional structures within it.

Name one structure found in the *diencephalon*:

Name one structure that is found in *both hemispheres* of the brain (i.e. is paired):

The spinal cord also has **main regions** with *structures*, both externally and internally

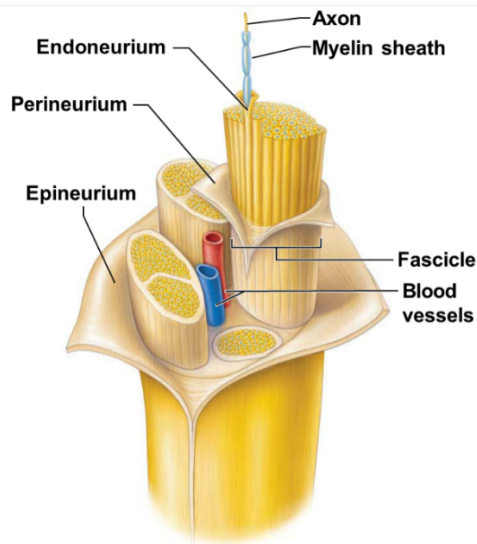


Both the spinal cord and the brain have **protective coverings** called *meninges* surrounding them and **spaces** within them (*ventricles* and *canals*) for cerebrospinal fluid to flow.

Aside from meninges, what else is important for protecting the central nervous system structures?

PERIPHERAL NERVOUS SYSTEM: Cranial and spinal nerves

Nerves consist of bundles of axons and connective tissue wrappings



TODAY:

Sheep brain dissection

Human brain and spinal cord specimens & models

Histology of nerve/spinal cord/neurons

2. Pre-lab Video Demonstration of Sheep Brain Dissection

Please watch this video before you come to the lab. This video demonstrates how to do sheep brain dissection and get you prepared for the lab. The video is saved on the Mediasite. You may need your UWL NetID and password to access the video.

Here is the link:

<https://mymedia.uwlax.edu/Mediasite/Play/cf07e7374db3465994111b8358ddd59b1d>

3. Student Instructions for the Neuroanatomy Lab (Exercises 7 & 26-29)

Week six (Oct. 10-14, 2016)

We will use a team-based learning approach in the neuroanatomy lab. You are expected to work closely with your team members during this lab period. We encourage all team members to collaborate and contribute meaningfully to the group activities. Please use your lab manual, pre-lab reading assignment, and/or the recorded video as guidance and follow the sequence in this instruction (i.e. sheep brain dissection (exercise 27) --> spinal cord (exercise 28) --> nerves (exercise 29) --> histology of nervous tissue (exercise 7) --> human brain (exercise 26)). There will be a team readiness assurance test in the middle of the lab. Your instructor and the lab TA will check the results of the team readiness assurance test and provide immediate feedback. Although the test is not part of your lab grade, it will help you to understand neuroanatomy and prepare you for the lab exam.

Directions: Sections 1-7 are for sheep brain dissection (Exercise 27 in your lab manual). After removing the dura mater of the sheep brains, complete Sections 1&2 before moving on.

Section 1: Meninges and Pituitary Gland (Exercise 27 in your lab manual)

Identify the following layers of the meninges:

Meninges

- Dura Mater** (describe in your own words)
- Arachnoid Mater** (describe in your own words)
- Pia Mater** (describe in your own words)

Which layer seems to be the thinnest?

Which layer is the most resilient?

Pituitary Gland

What structure connects the pituitary gland to the brain?

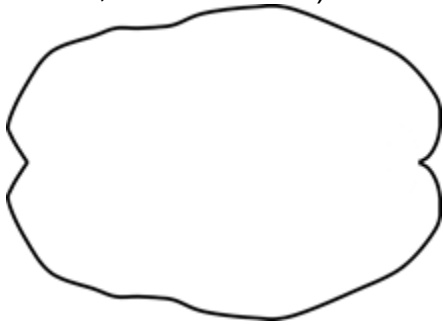
Section 2: Cranial Nerves (Exercise 27 in your lab manual)

Identify the first 6 pairs of cranial nerves and accompanying structures: Figure 27.2

Olfactory Nerve (Cranial Nerve 1) (The olfactory nerves are tiny sensory nerves of smell, which cannot be seen because they were torn when the brain was removed. The olfactory nerves synapse with neurons in the olfactory bulbs. Axons of neurons in the olfactory bulbs form olfactory tracts, which project to the brain)

- Olfactory Nerve
- Olfactory Tract
- Olfactory Bulb

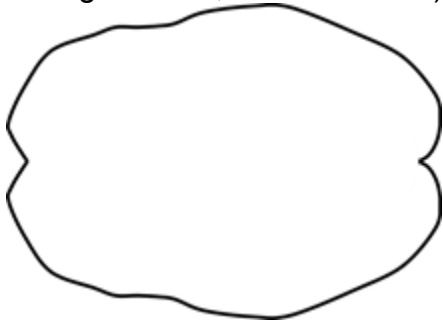
Draw the olfactory bulb and olfactory tract in relation to the brain. (Only draw a rough sketch, about 30 secs)



Optic Nerve (Cranial Nerve 2) (The optic nerves undergo a partial cross-over at the anterior border of the hypothalamus, forming the prominent optic chiasma. Axons continue on as optic tracts, enter thalamus, and synapse at the lateral geniculate body)

- Optic Nerve
- Optic Chiasma
- Optic Tract

Draw the optic nerve, optic chiasma, and optic tract in relation to the brain. (Only draw a rough sketch, about 30 secs)



Find the following cranial nerves

- Oculomotor (Cranial Nerve 3)
- Trochlear (Cranial Nerve 4)
- Trigeminal (Cranial Nerve 5)
- Abducens (Cranial Nerve 6)

Of the four pairs of nerves above, which is the most lateral? Which appears to be the largest?

Before continuing, finish the dissection and sagittal section of one sheep brain as shown in your lab manual and video. Leave the other sheep brain intact so that you can review the cranial nerves and surface structures.

The brain is divided into four major regions: **Cerebrum, Diencephalon, Brain Stem, and Cerebellum.**

Section 3: Cerebrum Region (Exercise 27 in your lab manual)

The cerebrum contains the following structures, please find them on your specimen:

Figure 27.1

- R & L Cerebral Hemispheres
- Longitudinal Fissure
- Frontal, Parietal, Temporal and Occipital Lobes
- Olfactory Bulb and Tract
- Gyri & Sulci
- Corpus Callosum (genu, body, splenium)
- Fornix
- Septum Pellucidum

What structure(s) connects the two hemispheres of the cerebrum?

What function does the cerebrum provide?

Which matter (white matter or gray matter) is located on the outside of the cerebrum?

Section 4: Cerebellum Region (Exercise 27 in your lab manual)

The cerebellum has the following structures, please find them on your specimen: **Figure 27.1**

- R & L Cerebellar Hemispheres
- Vermis
- Arbor Vitae

The arbor vitae are made up of white matter. Which part of the neuron would be found here?

Section 5. Diencephalon Region (Exercise 27 in your lab manual)

The Diencephalon has the following sub-regions and structures. Please find them on your specimen.

The **Thalamus** is a sub-region of the diencephalon and contains the following structures: **Figure 27.3, 27.4**

- Intermediate Mass**
- Lateral Geniculate Body**
- Medial Geniculate Body**

The **Epithalamus** is a sub-region of the diencephalon and contains the following structure:

- Pineal Gland**

The **Hypothalamus** is a sub-region of the diencephalon and contains the following structures:

- Mammillary Body**
- Pituitary Gland** (not part of hypothalamus, but connected to it by **infundibulum**)

Which structure connects the two halves of the thalamus together?

The diencephalon provides what function in the brain?

Which geniculate body is more superior (lateral geniculate body or medial geniculate body)?

Use directional terms to describe the location of the mammillary body in relation to the hypothalamus.

Use directional terms to describe the location of the pineal gland in relation to the thalamus?

Section 6: Brain Stem (Exercise 27 in your lab manual)

The brain stem is divided into three sub-regions: **Midbrain, Pons, and Medulla Oblongata**.

The **Midbrain** is a sub-region of the brain stem and contains the following structures: **Figure 27.3, 27.4, and 27.5**

- Cerebral Peduncles**
- Corpora Quadrigemina**-further divided into smaller structures known as:
 - two **superior colliculi**
 - two **inferior colliculi**

The **Pons** is a sub-region of the brain stem and has the following structure: **Figure 27.2, 27.3**

-Trapezoid Body

The **Medulla Oblongata** is a sub-region of the brain stem: **Figure 27.3**

Which structure connects the brain stem to the thalamus?

Section 7: Ventricles (Exercise 27 in your lab manual)

There are four interconnected, hollow chambers in the brain known as ventricles that contain **cerebrospinal fluid**. Each ventricle contains a vascular structure called the **choroid plexus**. **Figures 26.2, 26.5, and 27.3**

- Lateral Ventricles** (The right and left lateral ventricles are located within the cerebrum and make up ventricles one and two. The two lateral ventricles are separated by a thin membrane called the **septum pellucidum**)
- Third Ventricle**
- Fourth Ventricle**

The ventricles are interconnected by foramen and canals.

- Interventricular Foramen* (connects the lateral ventricles to the third ventricle)
- Cerebral Aqueduct** (connects the third ventricle with the fourth ventricle)

In which of the four major brain regions are each of these ventricles/canals found?

- Lateral Ventricle
 - Third Ventricle
 - Cerebral Aqueduct
 - Fourth Ventricle
-

Section 8: Spinal Cord (Exercise 28 in your lab manual)

The spinal cord consists four regions, which contain additional structures. Please identify them on the picture provided at your table: **Figure 28.1**

- Cervical Region**
 - Cervical Enlargement**
- Thoracic Region**
- Lumbar Region**
 - Lumbar Enlargement (or Lumbosacral Enlargement)**
 - Conus Medullaris (or Medullary Cone)**
 - Cauda Equina (continues to the sacral region)**
- Sacral Region**
 - Filum Terminale (or Terminal Filum)**

How can you identify the superior portion of the spinal cord?

What membranes continue from the brain into the spinal cord? Can you identify each membrane?

Section 9: Spinal Cord and Nerve Histology (Exercises 7, 28-29 in your lab manual)

The histology of the spinal cord (Exercise 28) consists of the following structures. Please use your ipad to identify these structures: **Figure 28.4**

- Posterior Median Sulcus (groove)**
- Anterior Median Fissure (groove)**
- Ventral, Lateral and Dorsal Horns**
- Ventral, Lateral and Dorsal Columns (Funiculi)**
- Central Canal**
- Dorsal Root Ganglion**
- Dorsal Root**
- Ventral Root**
- Gray Commissure**

How can you identify which portion of the spinal cord is anterior?

Which matter (white matter or gray matter) is on the outside of the spinal cord? How does this differ from the brain?

The histology of the nerves (Exercise 29) consists of the following structures. Please use your ipad to identify these structures. Note: peripheral nerves listed in table 29.1 will be covered later this semester. **Figures 29.1, 29.2 and 29.3**

- Epineurium**
- Perineurium**
- Endoneurium**
- Fascicle**
- Axon**
- Neurolemma (or myelin sheath)**

The histology of the nervous tissue (Exercise 7) consists of the following structures. Please use your ipad to identify these structures. **Figures 7.1, 7.2, 7.3, and 7.4**

- Multipolar Neuron (cell body, nucleus, nucleolus, processes)**
- Unipolar Neuron (cell body, nucleus, nucleolus)**
- Glial Cell (neuroglia)**

Which type of neurons (multipolar or unipolar) is located in the anterior horns of the spinal cord? Which type (multipolar or unipolar) is located in the dorsal root ganglia?

Section 10: Team Readiness Assurance Test (Please check with your instructor)

Section 11: Human Brain (Exercise 26 in your lab manual)

Please get a human brain from your instructor and identify major structures on the human brain.

Please compare the human brain with the sheep brain and describe at least two differences in the anatomy.

Section 12: Team Application: Effects of stroke on brain function.

Application Objectives: Predict functional consequences of a stroke in the brain.

Background/Review Information: As you have learned in lecture the nervous system is made up neurons, which are the functional units of this system. Just like any cell a neuron needs oxygen to maintain activity. A stroke by definition limits or prevents blood flow to certain parts of the brain. For the brain, this is critical because the brain receives about 15% of the blood pumped by the heart and consumes about 25% of the oxygen. Additionally, the cell bodies consume about 94% of the oxygen that comes to the brain and the axons only 6%. Consider this information as you predict answers the following questions.

1. What is the fundamental reason why we see functional declines, such as the inability to lift an arm, when a stroke occurs?
2. When a stroke occurs why do we observe that sometimes one arm is affected and the other is fine?
3. Now consider how strokes affect cranial nerves. Earlier in lab you identified the location of cranial nerves. Think about this information as you answer the following question. Which major region of the brain is being affected by a stroke if a person loses control of eye movement and pupil constriction?

Section 12: Team Application (Another option):

JB is a 32-year-old male police officer. When responding to a disturbance, he was shot in the back. He was immobilized and taken to the hospital by ambulance. X-rays revealed that the bullet entered the vertebral column at the level of the sixth thoracic vertebra (T6). As a result, the spinal cord at this level was completely transected.

1. What are the major functions of the spinal cord?

2. Describe the orientation of the gray matter and the white matter in the spinal cord. How does this differ compared to that of the cerebrum and cerebellum?
 3. What types of neurons are found in the spinal cord? Where in the gray matter are these cell bodies located? What are the functions of these neurons?
 4. What types of neuronal axons are found in the dorsal roots projecting of the spinal cord? The ventral roots?
 5. What impairments will result from this injury? Which regions of the body will be affected?
-

Study Materials

Instructor Guidelines/Timeline:

Week 4 (Sept. 26-30, get student informed consent)

1. Explain to students about the lesson study and use of team-based learning approach in the neuroanatomy lab.
2. Obtain student consent. Instructors who teach the lab using the team-based learning module will need to make enough copies of the Informed Consent form for your lab sections. The Informed Consent form can be found in the CATL Lesson Study shared folder – Documents for instructors.
3. Please let the students know that participation in the lesson study is optional. Students will receive the same instruction even they decide not to participate in the lesson study.

Week 5 (Oct. 3-7, this is the week when we give lab quiz 2)

1. Remind students about the pre-lab reading assignment and the recorded video that demonstrates sheep brain dissection. Share the file and the link to the video with students either by email or by D2L site (Personally, I think email works better because not all lab sections will use these materials and we do not want to confuse students).
2. Remind observers for observation time, location, and lab content.

Week 6 (Oct. 10-14, lesson study)

1. At the beginning of the lab, let students take the pre-lab test (i.e. Individual Readiness Assurance Test) to assess if they have prepared for the lab. The pre-lab test will take about 10 min (1 min/question). The PPT file can be found in the CATL Lesson Study shared folder – Documents for instructors.
2. Students will work in groups and follow the Student Instructions for the Neuroanatomy Lab. The file can be found in the CATL Lesson Study shared folder – Documents for students. Please make enough copies for your own lab sections.
3. Team readiness assurance test. The file can be found in the CATL Lesson Study shared folder – Documents for instructors. Please make enough copies for your own lab sections.
4. Instructor and lab TA provide feedback on the team readiness assurance test.
5. Instructor provides a human brain to each group and let them compare structures on the human brain and the sheep brain
6. Team application question

Week 7 (Oct. 17-21, debriefing meeting)

1. Instructors meet with the observes to discuss and analyze the lesson

Week 8 (Oct. 24-28, post-lab test)

1. Let the students take the post-lab test (timing of this quiz should not be announced to the students prior to the test)

Week 9 (Oct. 24-28, lab quiz 3)

1. Student survey (I would recommend to do it in the lab, right after lab quiz 3, to ensure a high response rate)

Week 10-14 (Nov. 7- Dec. 14)

1. Analyze data and revise the team-based learning module
2. Re-implement the team-based learning module in Spring 2017

Final reminder: Please make enough copies of the following files for your own lab sections.

1. Informed consent form
2. Student instructions for the neuroanatomy lab
3. Team readiness assurance test
4. Student survey
5. Observation guidelines

Observer Guidelines:

The reason for having several instructors observe the class is to gather as much information about the lesson as possible. We have tried to obtain volunteers that are both familiar and unfamiliar with the lab to get a variety of perspectives. Your primary task is to observe how the students respond to the lesson and focus on how the LESSON worked. The observation specifically focuses on how students learn from the experience and not on how the instructor teaches the lesson.

You will be observing groups of approximately 4 students throughout the class period. Please do not interact with students in your group, i.e., do not correct misconceptions, clarify instructions, give help or guidance, etc.

The primary learning goal for this unit is for students to understand the organization and detailed anatomy of the nervous system. A broader goal for the course is to also help facilitate the connection between anatomical structure and physiological function, promoting a better connection between material covered in lecture and material covered in lab. Prior to lab, they were provided with a short pre-lab reading assignment and video. Upon arriving in lab, they will take a short pre-lab quiz to assess initial understanding. Then, they will be working together as a team to complete several lab activities, using the Student Instructions for the Neuroanatomy Lab and their course materials as a guide. After these activities, they will demonstrate their understanding of the concepts in this unit through a team readiness assurance test and through working on a team application question. The lesson study was designed to encourage and facilitate teamwork and promote active learning. [Please refer to your copy of the lesson plan for the specific and detailed sequence of instructional activities.]

Please take detailed notes on your group's activity using the provided observation sheet. Please be on the lookout for peer teaching (one student helping another student learn) and references to material covered in the lecture portion of the

course. Please also be sure to note any aspects of the lesson or material that cause problems or result in fragmented understanding or misconceptions.

In addition to focusing on how students' understanding of nervous system organization and anatomy during the lesson, please also note such things as:

- *Use of course materials.* Did they re-watch the pre-lab video while working on the activities? Had they answered the pre-lab reading assignment questions and discuss those at all? Did they rely mostly on their lab manual?
- *Student engagement in the lesson.* Describe students' level of engagement/interest in the lesson, (e.g., energetic exchange of ideas and comments, non-participation, dutiful compliance to the task, tone of the interactions)
- *Quality of group dynamics* (positive and negative)—dominating members, quiet members, some students getting ahead of others in the tasks, derailing of the process (discussion of unrelated topics), goal-oriented, built on one another's ideas, questioned, gave examples, clarified, etc.
- *Connections to lecture.* Did they mention relevant lecture material or other related information (nervous system diseases/disorders, relevant personal stories), etc.
- *Surprises or unexpected activity* that had an influence on student thinking or behavior.

NERVOUS SYSTEM UNIT LESSON STUDY

Observer Reactions to the Lesson (Used a Likert scale from 1-7)

1. All members participated in the process
2. The group was able to stay on task during the lesson (i.e., did not derail or discuss irrelevant information)
3. The group seemed confused about the technical aspects of the lab (i.e., how to do the activities, etc.)
4. The group seemed confused about the concepts the lesson was addressing (i.e., did not demonstrate an understanding of nervous system organization)
5. The group worked together well during the lab activities (i.e., engaged in peer teaching, asked each other questions, actively discussed, etc.)
6. The group relied on the lab instructor for help rather than their group members.
7. Given your observations, what aspects of the lesson need to be changed? How could the lesson be improved?

Observer Notes:

https://uwlax.sharepoint.com/sites/catlessonstudy/_layouts/15/guestaccess.aspx?guestaccesstoken=ZiFbmkI4qCehUMQYQrVpNchbjyz3ULQH7mxsfu7upSM%3d&docid=2_07e290d81a7cf4fef8bd940ac57368a56&rev=1

Pre-Lab Test:

https://uwlax.sharepoint.com/sites/catlessonstudy/_layouts/15/guestaccess.aspx?guestaccesstoken=5%2bk5yjc6SF%2b%2foMCZBcutnj9gUcmXclRSKLjqzZEE%2bsM%3d&docid=2_09a56fb26cea540dfb1292f77123d9df9&rev=1

Post-Lab Test:

https://uwlax.sharepoint.com/sites/catlessonstudy/_layouts/15/guestaccess.aspx?guestaccesstoken=5%2fMszzQUOibITzXA09JIn7Nq9JcgTdGJYFgTpyieOi4%3d&docid=2_0a6c159cbafca4bec936287de19e133ab&rev=1

Dissemination:

- OPID Teaching and Learning Conference 2017. La Crosse, Wisconsin, April 20-21: Poster
- Experimental Biology 2017. Chicago, Illinois, April 22-26: Poster
- UW – La Crosse Annual Conference on Teaching and Learning 2017, August 29th, Poster