

The background of the cover is a dark blue, abstract illustration. It features a stylized representation of a brain and spine, with glowing, translucent blue structures. Numerous small, bright blue and white circular particles are scattered throughout the scene, particularly concentrated around the brain and spine, giving the impression of neural activity or microscopic structures.

Comprehensive Laboratory Manual and Education Sets for Pre-Collegiate

Brain and Spine Surgery Skills and Techniques Instruction

2023 Edition

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Experiment 1: Spine Physiology Simulation - Wooden Spine Model

Learning Objectives:

- Describe the gross anatomy of the spinal cord and identify its regional variations.
- Identify the anatomical features of the vertebrae and sacrum.

Material:

- Spine Model

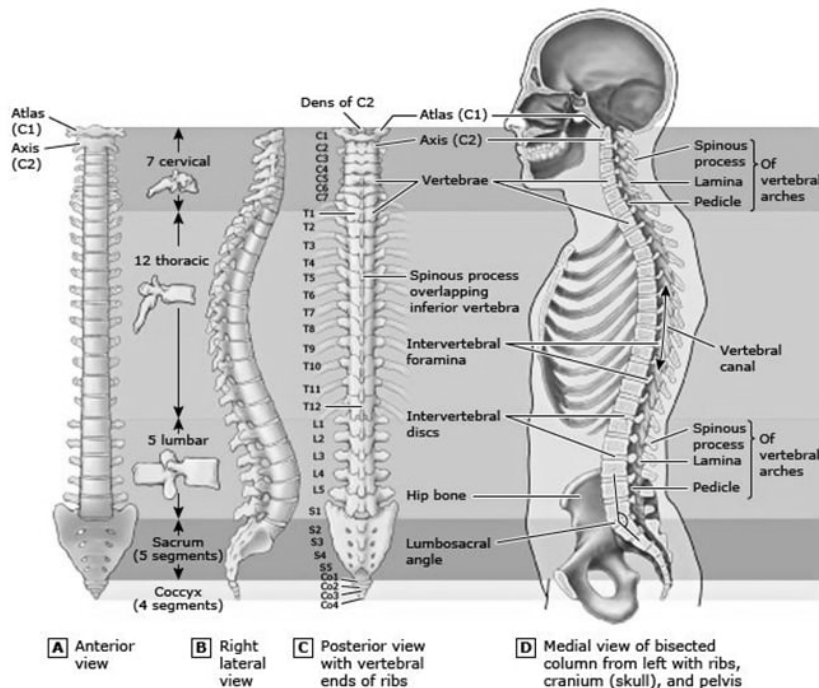
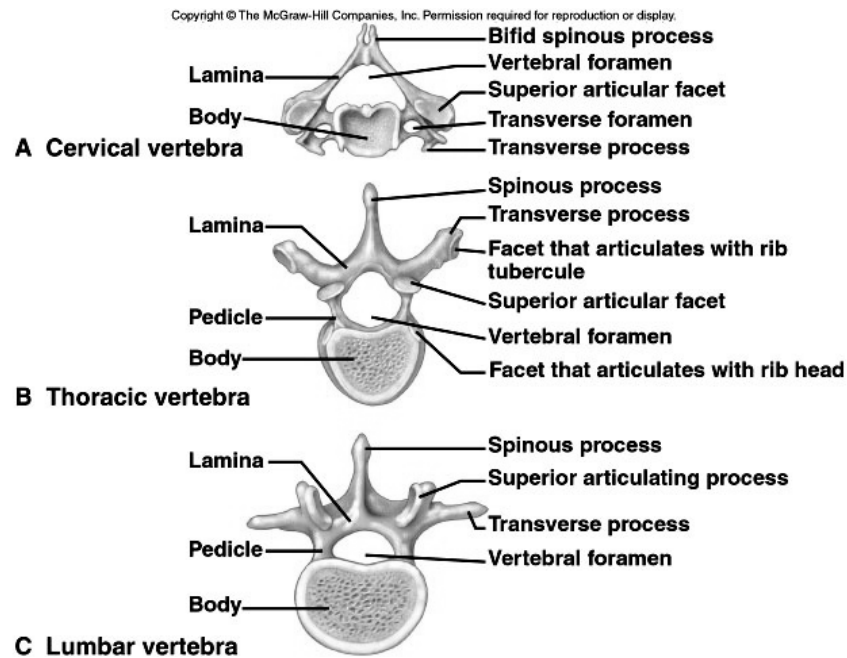
Introduction:

In this lab, you will be examining the vertebral column. The spinal cord serves as the connection between our peripheral nervous system and the brain. The central region of gray matter is primarily composed of cell bodies and unmyelinated axons. The outer region of white matter is composed mainly of myelinated axons ascending, carrying sensory information, to the brain, or descending, carrying motor information, from the brain to the target tissues.

The vertebral column supports the body's weight and helps transmit forces between the upper and lower extremities. The muscles of the abdominal wall act on the vertebral column to create movements such as lateral bending, rotation, flexion, and extension at the trunk. These muscles are also constantly working to stabilize the trunk and vertebral column both with movement and at rest. The bones of the thoracic cage connect directly or indirectly to the thoracic vertebrae and together form a protective "cage" around the thoracic and some abdominal organs.

Pre-Lab Questions:

With the given photos, answer the following:



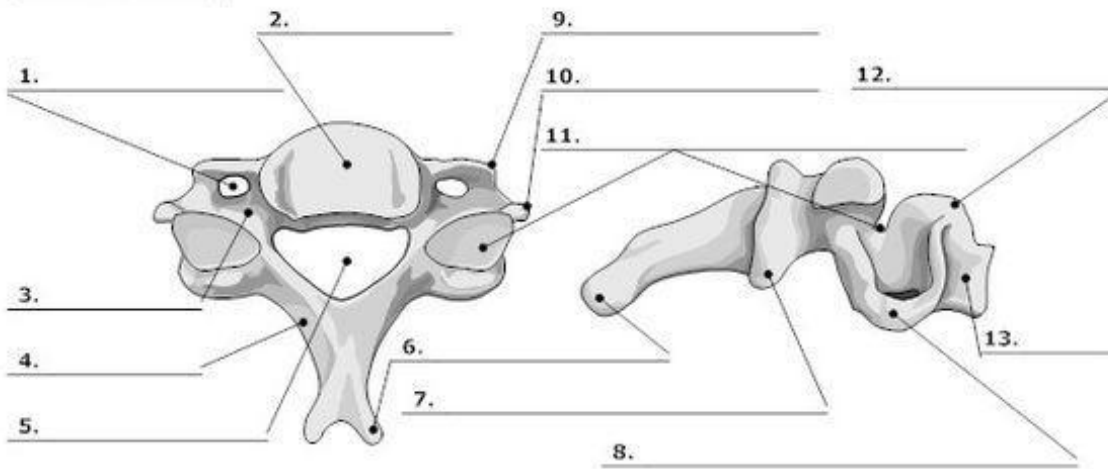
1. What are the three regions of the spine? Identify key differences between the three regions of the spine.
2. Identify the following in the cervical, thoracic, and lumbar cross section vertebra:
 - a. Bifid spinous process
 - b. Vertebral foramen
 - c. Superior articular facet
 - d. Transverse process
 - e. Body
 - f. Lamina
 - g. Facet that articulates with rib tubercle
 - h. Facet that articulates with rib head
 - i. Pedicle
 - j. Superior articulating process

Vertebral Column: Vertebra

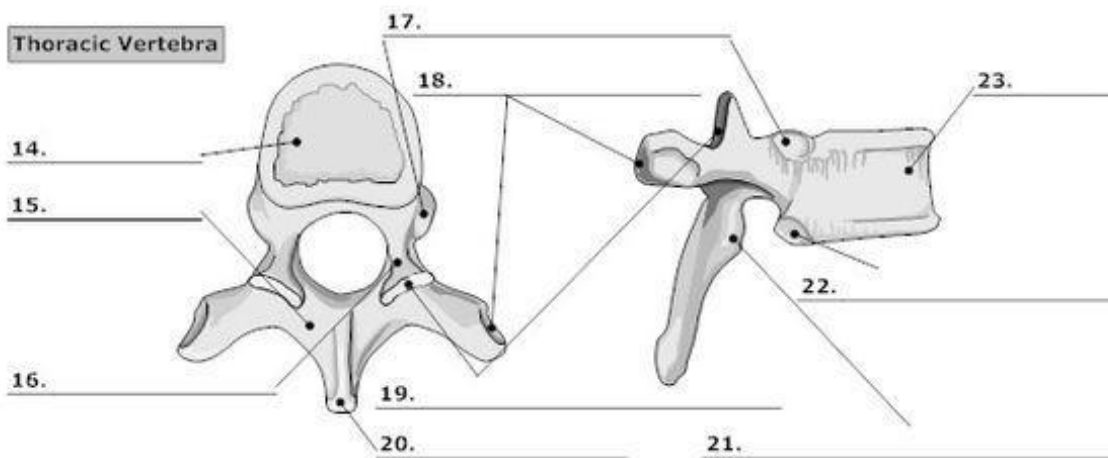
superior view

lateral view

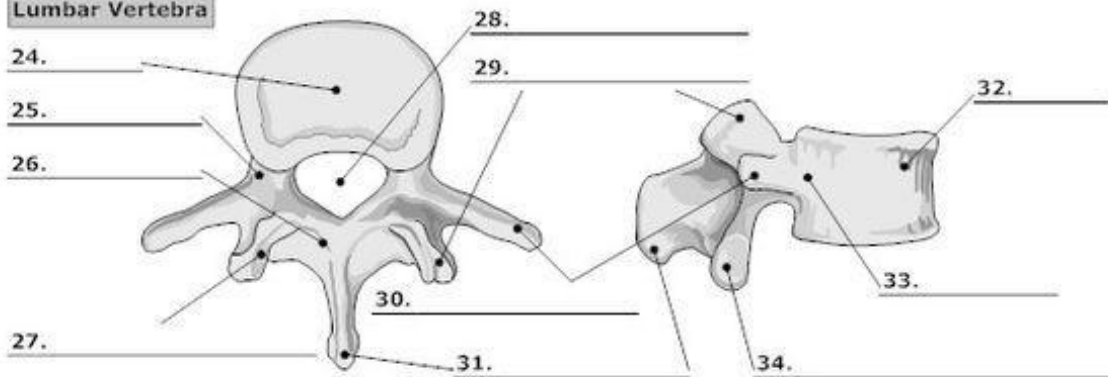
Cervical Vertebra



Thoracic Vertebra



Lumbar Vertebra



LifeART Collection Images Copyright © 1989-2001 by Lippincott Williams & Wilkins, Baltimore, MD

Lab:

1. Identify the particular structures indicated with the spine model.
 - a. Cervical Spine
 - b. Thoracic Spine
 - c. Lumbar Spine
 - d. Sacrum
 - e. Coccyx
 - f. Spinous Process
 - g. Transverse Process
 - h. Intervertebral Disc
 - i. Spinal Cord
 - j. Vertebral Body
 - k. Lamina
2. Count how many vertebrates are on the spine model: _____ vertebrae
3. What is the role of the central canal in the spinal cord, and where is it located?

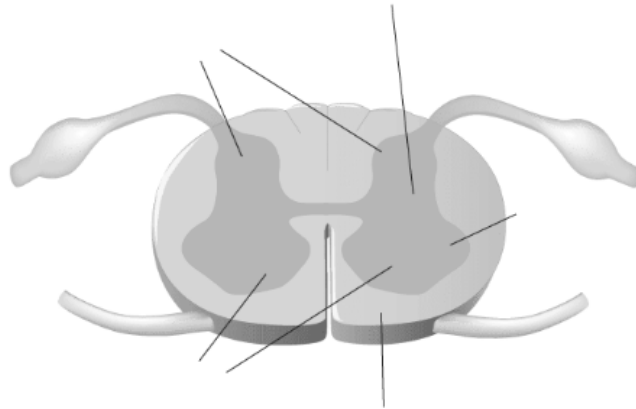
Post-Lab Questions:

The spinal cord is a long cylindrical structure that runs from the base of the brain to the lower back.

We examined a cross- sectional view of the spinal cord and identified the following anatomical features

- 1) **Gray matter:** This is a butterfly-shaped region in the center of the spinal cord that contains the cell bodies of neurons. It is responsible for processing and integrating incoming sensory information and coordinating motor output.
- 2) **White matter:** This is the outer region of the spinal cord that contains myelinated nerve fibers. It relays sensory and motor information between the brain and the body
- 3) **Dorsal horn:** This is the posterior region of the gray matter that receives incoming sensory information from the body such as pain, temperature, and touch
- 4) **Ventral horn:** This is the anterior region of the gray matter that sends out motor commands to the body, such as muscle movement and gland secretion
- 5) **Dorsal root:** This is a bundle of sensory fibers that carries information from the body to the spinal cord. It enters the spinal cord on the posterior side, adjacent to the dorsal horn
- 6) **Ventral root:** This is a bundle of motor fibers that carries information from the spinal cord to the body. It exits the spinal cord on the anterior side, adjacent to the ventral horn
- 7) **Central Canal:** This is a small, fluid-filled channel that runs through the center of the spinal cord and serves as a pathway for cerebrospinal fluid.

Identify the anatomical features seen in a cross-sectional view of the spinal cord.



1. What is the overall shape of the spinal cord in a cross-section view?
2. What are the three major regions of a cross-sectional view of the spinal cord and what is their function?

Identification of anatomical features seen in a cross-sectional view of the spinal cord is an important aspect of understanding the structure and function of this critical organ. We have gained a deeper appreciation for the spinal cord and its role in the nervous system!

References:

“Anatomy and Physiology of the Spine.” *UPMC*,

<https://www.upmc.com/services/rehab/rehab-institute/conditions/spinal-cord-injury/basics/anatomy#:~:text=The%20body%20and%20the%20arch,and%20the%20intervertebral%20disks%20together.>

“A Patient's Guide to Anatomy and Function of the Spine.” *University of Maryland Medical Center*,

<https://www.umms.org/ummc/health-services/orthopedics/services/spine/patient-guides/anatomy-function#:~:text=It%20gives%20your%20body%20structure,you%20to%20control%20your%20movements.>

“Central Nervous System: Brain and Spinal Cord.” *Queensland Brain Institute - University of Queensland*, 17 July 2018,

<https://qbi.uq.edu.au/brain/brain-anatomy/central-nervous-system-brain-and-spinal-cord#:~:text=In%20the%20brain%20C%20grey%20matter,cords%20that%20extend%20from%20neurons.>

Experiment 2: Diagnosing Spinal Cord Injuries

Overview:

Students are given a variety of medical scenarios involving spinal cord injuries, and will put themselves in the shoes of a doctor. They will then proceed to diagnose the patient using the information provided in class.

Materials:

- Pencil
- Laptop (if you wish to use one)

Pre-Lab Questions:

1. What are the three main functions of the spine?
 - a.
 - b.
 - c.
2. Describe the structure of the spine.
3. Describe complete and incomplete spinal injuries.

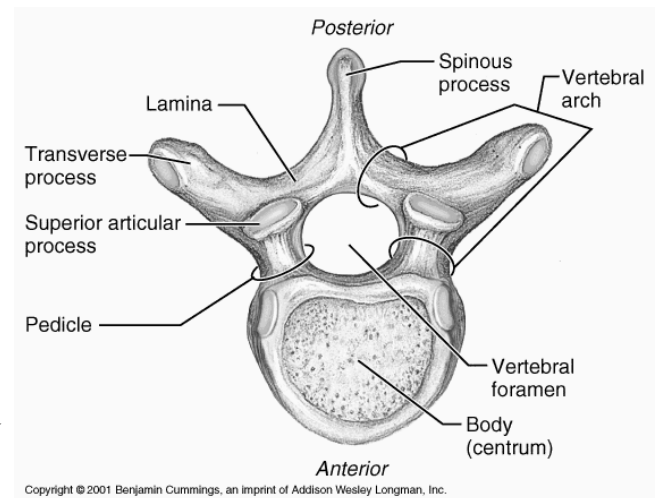
Introduction:

Basic Components of the Spine

The spine serves some of the most important functions of the human body. The three primary functions of the spine are to protect the spinal cord, nerve roots, and several of the body's internal organs; to provide the body structural support and balance; and to enable flexible motion. The spine consists of many vertebral structures that all play a role in how the spine functions and are, therefore, important for doctors and surgeons to understand in order to properly diagnose and treat any injuries that may occur in the spine.

Take a look at the following diagram and descriptions on some of the key vertebral structures in the spine:

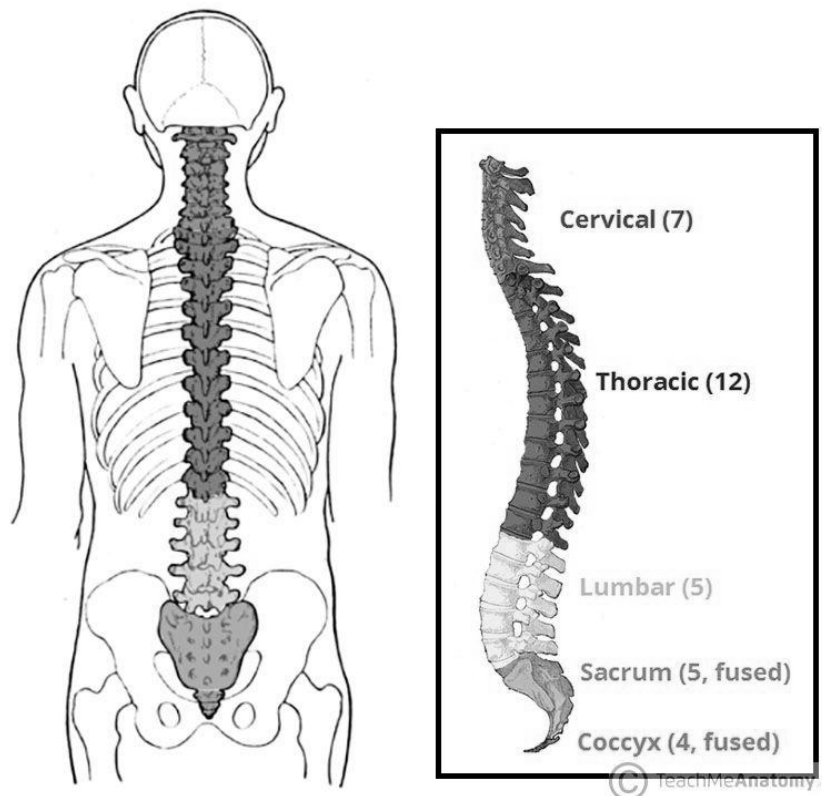
- **Body:** largest part of the vertebra.
- **Pedicles:** two short processes made up of strong cortical bones that protrude from the back of the body.
- **Lamina:** the flat plates of the bone that extend from the pedicles on either side and join at the midline.
- **Processes:** there are three types of processes (articular, transverse, and spinous). They serve as connection points for ligaments and tendons.
- **Vertebral Foramen:** the pedicles form a hollow passageway between vertebrae which allow a place for nerve roots to branch out from the spinal canal.



Pay close attention to the location and functions each part of the spine holds. As you will soon see, the spine has five different sections that each have different shaped vertebral structures. Be familiar with finding the vertebral structures on each section's vertebra.

Sections of the Spine

The main component of the spine is composed of the cervical spine, thoracic spine, lumbar spine, sacrum spine, and coccyx. The structure of the spine connects different parts of the musculoskeletal system. The importance of the 'S' shaped structure is to help absorb any body shocks to the body while it protects the spine from injury.



The diagram above labels the different parts of the spine. Below are some important functions and information about each of the sections that make up the human spine:

- Cervical spine
 - Made up of seven bones (C1-C7 vertebrae).
 - Allow the spine to move freely and work as shock absorbers.
 - There are two spinal nerves called *foramina* which provide movement and feeling the muscle, skin, and tissue.
- Thoracic Spine:
 - Made up of twelve vertebrae (T1-T12 vertebrae).
 - Affects the muscles in the upper chest and mid-back.
- Lumbar Spine
 - Consist of 5 bones in the lower back (L1-L5 vertebrae).
 - Located below the thoracic vertebra and above the sacrum bone.
- Sacrum
 - The S1-S5 vertebrae fuse together to form the sacrum.
 - Helps support the spinal column.
- Coccyx
 - Located below the sacrum.

- Composed of 3-5 vertebral segments.
- Supports body weight while sitting down.

Make sure to keep a note of the location and function of the spine because it will help you build a better foundation of spinal cord injuries.

Location and Grade of Spinal Cord Injuries

Spinal cord injuries are not necessarily back injuries. Spinal cord injuries can arise from traumatic injury from the vertebrae that could potentially sever or split the cord. Injuries to the spinal cord could be either *complete* or *incomplete*. Complete injuries can result in paralysis or loss of function (ie. quadriplegia or paraplegia). Incomplete injuries infer partial damage to the spinal cord.

Classifying the location of a spinal cord injury is denoted by the letters shown below:

- C: refers to the cervical cord
- T: refers to the thoracic cord
- L: refers to the lumbosacral cord
- S: refers to the cauda equina (lower end of the spinal cord)

Spinal cord traumas are also graded by their severity and damage. The list below shows the different grades professionals use to categorize different injuries:

- Asia A: Full loss of both motor function and sensory sensation.
- Asia B: Full loss of motor function but some sensory sensation is preserved.
- Asia C: Motor function is preserved below injury (at least half of the key muscles have a grade of less than 3—improper functioning).
- Asia D: Motor function is preserved below the injury (at least half of the key muscles has a muscle grade of at least 3—proper function).
- Asia E: Normal; no presence of injury.

Treatments for Spinal Cord Syndromes

There are several special treatments for Spinal Cord Syndromes:

- Hyperbaric oxygen therapy(HBOT): It involves exposing the person to high levels of oxygen in a pressurized chamber. It can help reduce inflammation and promote healing in the damaged spinal cord.
- Epidural Stimulation: It involves implanting electrical devices in the epidural space of the spinal cord, which can help to promote the growth of new nerve connections and improve muscle function.

- Stem Cell therapy: The treatment involves injecting stem cells into the damaged area of the spinal cord. These cells can help to promote the growth of new nerve connections and improve the function of the damaged nerve cells.
- Rehabilitation therapy: The treatment involves physical therapy, occupational therapy, and other therapies to help the person regain as much function as possible.

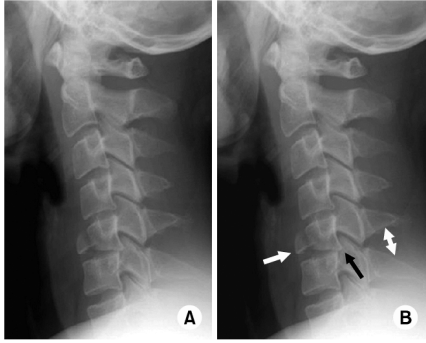
Diagnostic Tests

- X-rays:
 - Reveals vertebral (spinal column) problems.
 - Tumors, fractures or degenerative changes in the spine.
- CT scan:
 - Also known as a CAT scan.
 - Provides a clearer image of abnormalities in comparison to X-ray images
 - CT (computerized tomography) scans use computers to form a series of cross-sectional images that can define bone, disk and other problems.
- MRI:
 - Uses strong magnetic fields and radio waves to produce computer-generated images.
 - Helpful for looking at the spinal cord and identifying herniated disks, blood clots or other masses that might compress the spinal cord.

Procedure:

Read the following scenarios. Using prior knowledge and the information presented above, answer the following questions about each patient and their spinal cord injury. Use all images and symptoms listed when forming your answers.

Scenario 1: John decides to ride his bike on a sunny day. He collides with a truck and flips over, landing on his back. Upon further examination, paramedics believe that he broke a portion of his spinal cord. He is injured very badly. After being taken to the Emergency Room, several scans of his spine are conducted (pictures are shown below).



Symptoms include:

1. Inability to fully speak or breathe properly. John needed ventilator usage until he left the hospital.
2. Paralysis in the torso, hands, wrists, and legs.
3. He experiences this paralysis on both sides of his body.
4. He is still able to move his deltoid and bicep muscles (can raise his arms and bend his elbows).
5. He is also able to fully move his head and neck.
6. Bladder and bowel dysfunction
7. Vitals were normal, respiration rate was a little low.

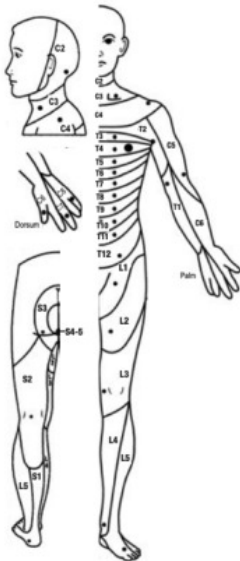
Using the available information, answer the following:

1. Determine if this is a complete or incomplete spinal cord injury.
2. What portion of the spine was affected (Ex: C6, L1, S3, etc).
3. What diagnostic tests should be performed?
4. What form of treatment does the patient require?

Scenario 2: Jane is a 20 year old student, who hit their head on a sandbank while surfing. Her friends were EMTs and took the necessary precautions while waiting for the ambulance to arrive. When they first found her they noted that she was awake and responding, albeit her breathing was weak. Jane reported severe pain to her neck and that she was unable to move her arms and legs. She was then transported to the emergency room.

Symptoms:

1. Blood Pressure: 94/55
2. Heart Rate: 64 bpm
3. Temperature: 95 Degrees Fahrenheit
4. Respiratory Rate: 35bpm (shallow breathing)
5. Drowsy

MYOTOMES	DERMATOMES
<p>C5 Elbow flexors</p> <p>C6 Wrist extensors</p> <p>C7 Elbow extensors</p> <p>C8 Finger flexors</p> <p>T1 Finger abductors (little finger)</p> <p>L2 Hip flexors</p> <p>L3 Knee extensors</p> <p>L4 Ankle dorsiflexors</p> <p>L5 Great toe extensors</p> <p>S1 Ankle plantar flexors</p>	

Using the available information, answer the following:

5. Determine if this is a complete or incomplete spinal cord injury.

6. What portion of the spine was affected? (Ex: C6, L1, S3, etc)

7. What diagnostic tests should be performed?

8. What form of treatment does the patient require?

Scenario 3: Bob was enjoying his vacation in Palm Springs until a big earthquake hit. He fell off a 20 ft diving board and unfortunately sustained a spinal cord injury.

Symptoms upon arrival to the Emergency Room:

1. Foley Catheter insertion (unable to control bladder)
2. Irregular bowel movements
3. Vital signs were stable.
4. Lack of movement in the abdominal and back muscles
5. Numbness in lower extremities



Patient was eventually discharged from the hospital and later received occupational therapy management and physiotherapy management.

Using the available information, answer the following:

9. What portion of the spine was affected (Ex: C6, L1, S3, etc).

10. What diagnostic tests should be performed?

11. What form of treatment does the patient require?

12. How would therapy help this patient?

Post-Lab Questions:

1. Why is it important to understand how to properly diagnose cord injuries?
 - a.
 - b.
 - c.
2. What are the pros and cons for lumbar interbody fusion?
 - a.
 - b.
3. What are the types of treatment for spinal cord injuries? Explain why the treatment is important for.
 - a.
 - b.
 - c.

d.

4. What are the differences between a Spinal Cord Injury and Spinal Cord Syndrome ?

References:

“Management of Spinal Cord Injuries - Case Study Part 1.” *Physiopedia*,
https://www.physio-pedia.com/Management_of_Spinal_Cord_Injuries_-_Case_Study_Part_1.

Experiment 3: Physical Mockup of the Human Brain

Overview:

Students will correctly identify different areas of the brain and correctly identify neurological conditions correlated with the area of the brain highlighted.

Materials:

- Pencil
- Laptop (if you wish to use one)

Pre-Lab Questions:

1. What is the purpose of highlighting different areas of the brain in the physical mockup?
2. What are the major regions of the brain that will be highlighted in the mockup?
3. How are neurological disorders classified and what are some examples?
4. How might the identification of neurological disorders in specific areas of the brain be useful in treating patients?

Introduction:

Medical imaging plays a crucial role in the diagnosis and treatment of various health conditions. Among the most common types of medical devices are Magnetic Resonance Imaging (MRI), Computerized Tomography Scan (CT Scan), and Positron Emission Tomography Scan (PET Scan).

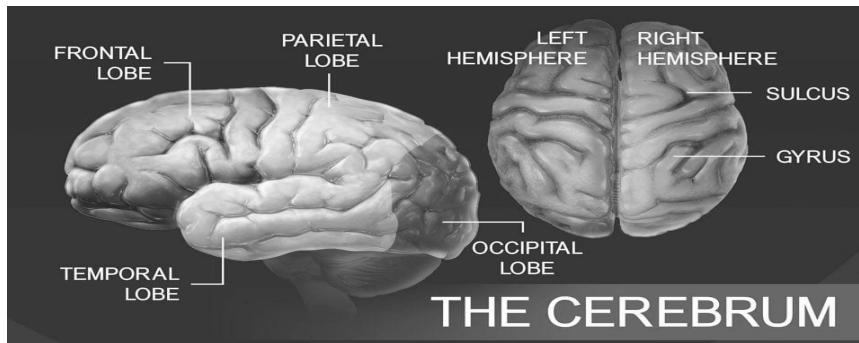
MRI is a noninvasive medical imaging test that uses magnets and radio waves to create detailed images of almost every structure and organ inside the body. This medical device is highly effective in showing organs, blood vessels, bones, and muscles. Unlike other medical imaging tests, MRI does not use radiation. Sometimes, contrast material is injected to enhance the quality of the images, especially when diagnosing tumors, inflammation, certain organs' blood supply, and blood vessels. MRIs are often ordered for recurring headaches, seizures, undiagnosed vision problems, and abnormalities in hormones involving the hypothalamus and pituitary gland.

CT Scan, on the other hand, uses several X-ray images to create cross-sectional images of the body. The machine's circular component spins around the body section to snap pictures from various perspectives. CT scans can be performed with or without contrast, with the latter providing a sharper view of the organs and arteries. This medical device is often used to identify the size and position of any cysts or tumors, cranial or brain anomalies, and the presence of hydrocephalus. CT scans are also ordered to detect muscle and bone problems, such as bone cancers and fractures, and to guide surgical, biopsied, and radiation therapy.

PET Scan uses a radiotracer made of radioactive elements and natural substances such as glucose to detect the radiation emitted as the tracer travels to regions of the body that use glucose as energy. This medical device identifies areas of the body that require more energy and displays "hot spots" or "cold spots." For example, cancer cells use a lot of energy/glucose and will light up as a "hot spot" on the PET scan. PET scans are often ordered to identify cancer, heart conditions, and brain abnormalities. They are frequently paired with MRIs or CT scans to provide additional, detailed information about the condition of internal organs.

In summary, medical devices like MRI, CT Scan, and PET Scan play a vital role in identifying various health conditions. Each medical device has unique features and is ordered depending on the type of health condition and the information needed to make a proper diagnosis.

Different Areas of the Brain

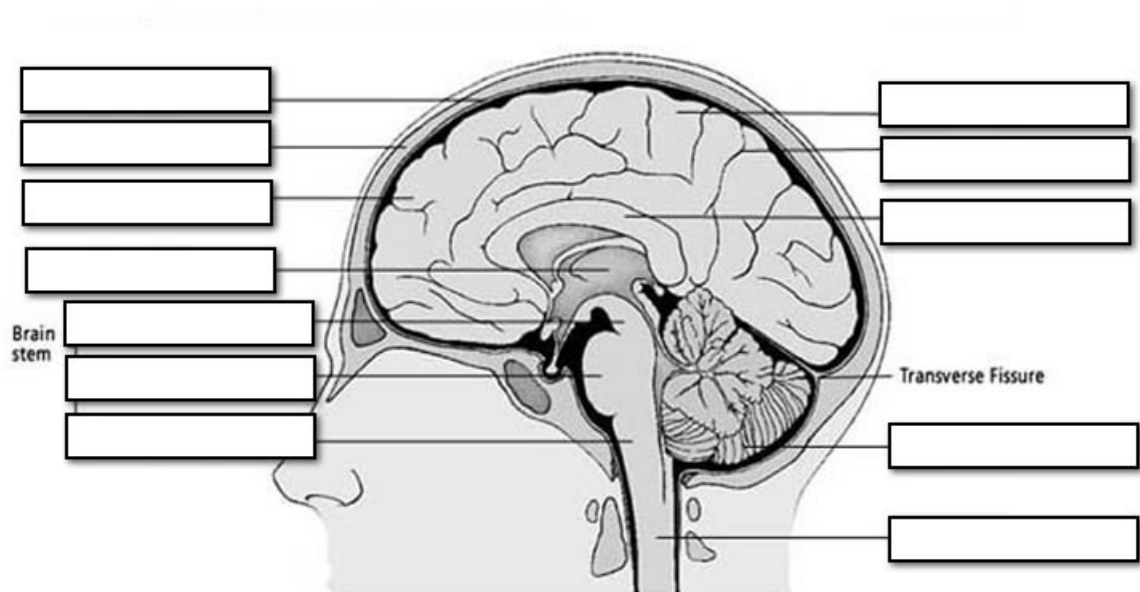


- Frontal Lobe: Located in the front of the brain, this region is responsible for higher cognitive functions such as decision-making, planning, problem-solving, and controlling voluntary movement.
- Parietal Lobe: Located in the upper back part of the brain, this region processes information related to touch, taste, temperature, and spatial awareness.
- Temporal Lobe: Located on the sides of the brain, this region is responsible for processing auditory information, language comprehension, and memory.
- Occipital Lobe: Located in the back of the brain, this region processes visual information and helps with visual perception

Procedure:

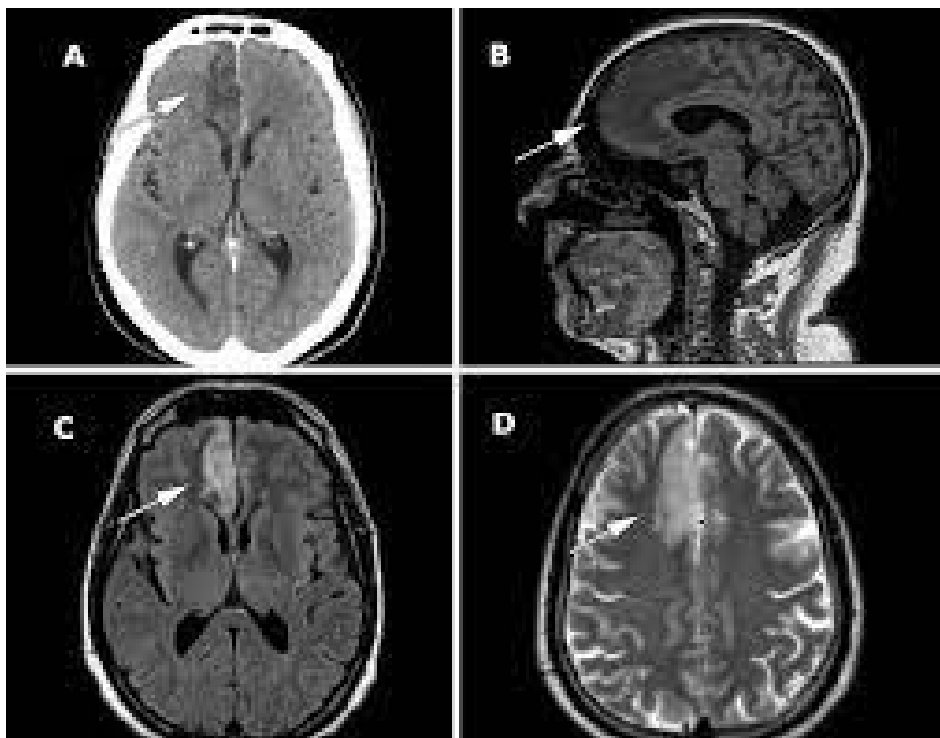
Attempt to identify neurological disorders based on the label.

Activity #1: Label the different parts of the brain.



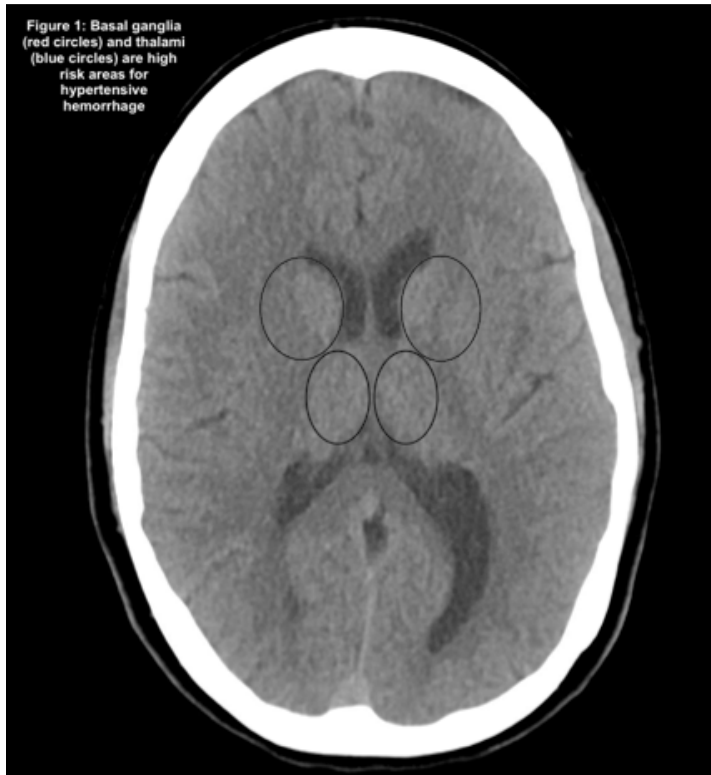
1. Which part of the brain is responsible for processing visual information?
2. Which part of the brain is responsible for hearing and memory?
3. A person with an injury to their frontal lobe may have difficulty with...

Activity #2: Based on the visual representation (EEG, CT, MRI, fMRI), attempt to identify certain parts of the brain based on the images.



1. Identify the type of test performed.
2. What regions of the brain are being examined?
3. Determine what the arrow is pointing to by using prior knowledge.

Activity #3: Based on the visual representation (EEG, CT, MRI, fMRI), attempt to identify certain parts of the brain based on the images.



1. Identify the type of test performed.
2. What regions of the brain are being examined?
3. Determine what the arrow is pointing to by using prior knowledge.

Activity #4: Determine which of the two images is a CT scan and which is an MRI.



Left Image:



Right Image:

Post Lab Questions:

1. How do you read PET scans of cancer patients?
2. How do doctors interpret EEG?
3. What is a PET scan?

References:

- Carter, Rebecca. "MRI vs. CT Scan; Diagnosing Spine & Neck Injuries & Degenerative Diseases: Joseph Spine Institute." *Joseph Spine | Advanced Spine Care*, 13 Oct. 2020, <https://josephspine.com/mri-vs-ct-scan-diagnosing-spine-neck-injuries-degenerative-diseases/>.
- NUEM Blog. "The Ed Guide to Neuroimaging: Part 1." *NUEM Blog*, NUEM Blog, 16 Dec. 2019, <https://www.nuemblog.com/blog/2018/4/20/emergency-neuroimaging>.

Experiment 4: Lumbar Fusion Surgery Simulation Lab

Learning Objectives:

By the end of this lab, students will be able to perform a lumbar fusion surgery simulation using a wooden spine model, nuts, bolts, and screws. Specifically, students will be able to simulate the following procedures: Anterior Lumbar Interbody fusion (ALIF), Posterior Lumbar Interbody Fusion (PLIF), Direct Lateral Interbody Fusion (DLIF), and Transforaminal Lumbar Interbody Fusion (TLIF). Additionally, students will be able to demonstrate knowledge of lab safety, anatomy, and prior techniques taught.

Materials:

Instructed used: bolts, nuts, blots, screws, & wooden spine model

Introduction:

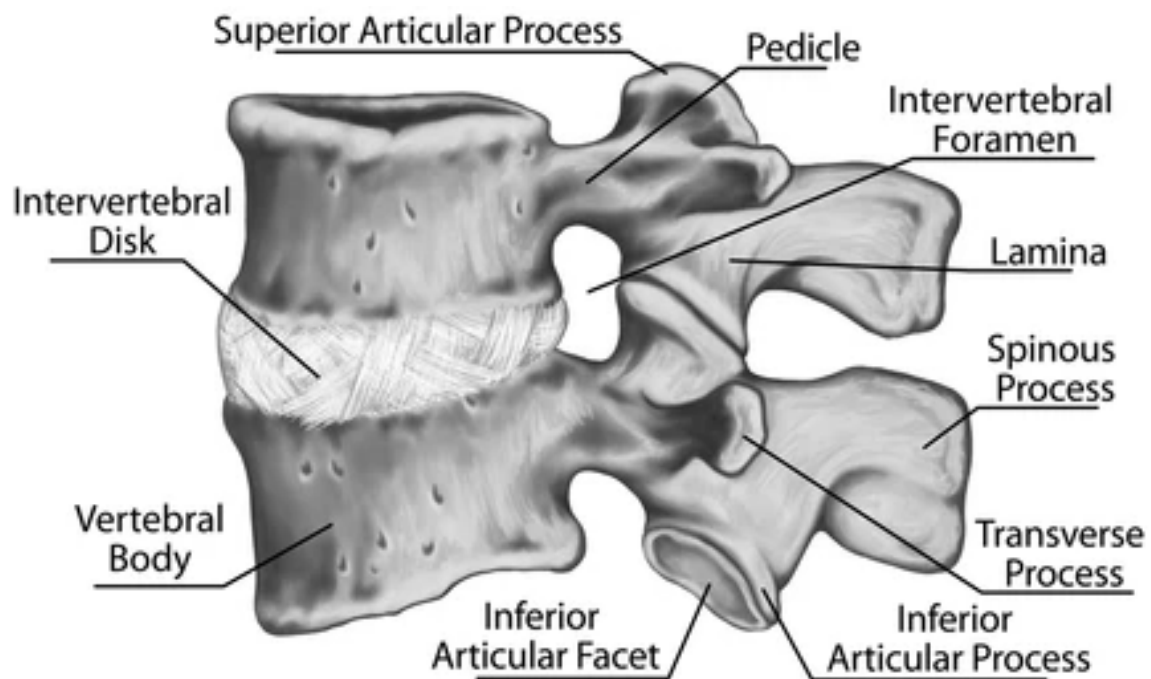
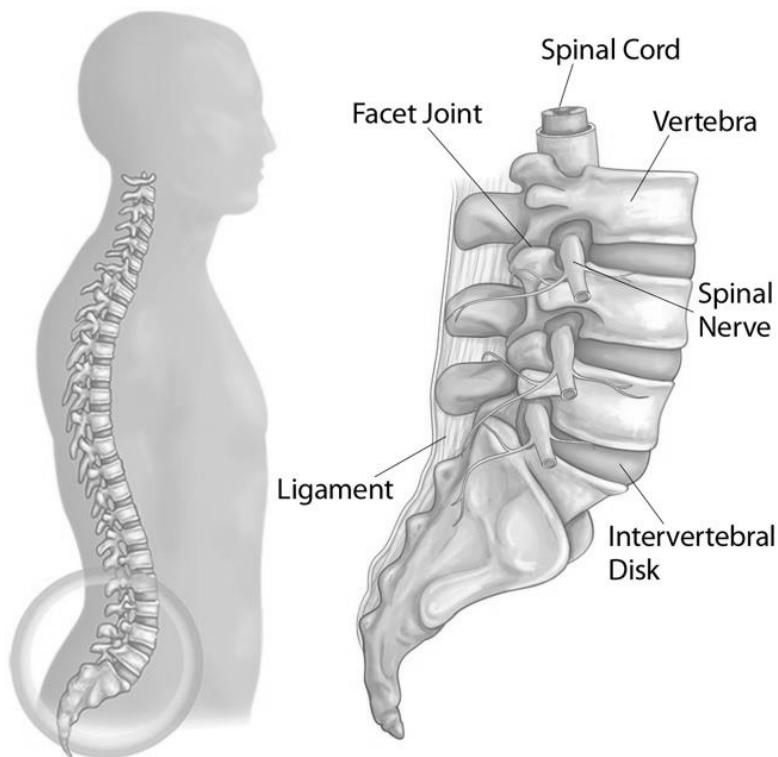
In this lab, you will be able to perform a lumbar fusion surgery, and observe the intricacies that go along with this procedure. To briefly go over the procedures that will be conducted, an ALIF procedure is mainly conducted to stabilize a painful motion segment in the lower back, which is usually caused by lumbar degenerative disc disease. PLIF aims to fuse two levels of the spine by taking a surgical approach from behind the lumbar spine. A DLIF is a minimally invasive surgical procedure for treating leg and back pain also caused by degenerative disc disease. And finally TLIF treats spinal instability or weakness by permanently uniting bones of the lower spine. Although these procedures are very beneficial to many individuals, it's also important to highlight the many risks that are associated with Spinal Fusion surgery. Surgical Site Infection is a risk with any surgery, but it is very uncommon when it comes to spinal fusion surgery. Antibiotics are administered at regular intervals before and during the surgery to eliminate the possibility of infection. Another risk that may be present is excessive bleeding, nerve damage, and the formation of blood clots. There are risks associated with many surgeries, but many people take the risk due to the importance of spinal fusion surgery. After completing this lab, and reading through the introduction, you will be able to know the ins and outs of the procedures and realize why these procedures are so important.

Watch the following videos about ALIF and PLIF

https://www.youtube.com/watch?v=dh1W1_UeguY&ab_channel=AtlanticSpineCenter

https://www.youtube.com/watch?v=DwxRTa6W7eI&ab_channel=ShimSpine

Recap of Anatomy:



shutterstock.com · 405564496

Pre-Lab Questions

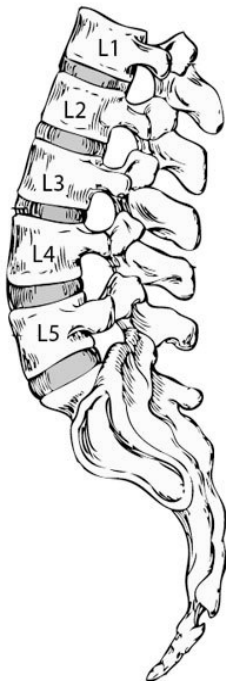
1. What is the difference between Anterior Lumbar Interbody Fusion (ALIF) and Posterior Lumbar Interbody Fusion (PLIF). What is the purpose of Direct Lateral Interbody Fusion (DLIF)? How is it different from the other procedures?
2. What are some potential risks associated with lumbar fusion surgery? How can these risks be minimized?
3. Describe the steps involved in performing a Transforaminal Lumbar Interbody Fusion (TLIF). How does this procedure differ from the others?
4. What are some key considerations for ensuring lab safety during a lumbar fusion surgery simulation?
5. How does a thorough understanding of lumbar anatomy contribute to the success of a fusion surgery?

Lab:

Identify the lumbar region on the provided spine diagram by circling the appropriate section.



Now identify the intervertebral disk, lamina, and vertebral body on the provided spine diagram by circling the appropriate section.



If you have any questions or concerns please do not hesitate to reach out to the lab instructor.

Step 1: Introduction

Explain the goals and objectives of the session. Provide a brief overview of lumbar surgery and the different procedures involved.

Step 2: Safety Precautions

Discuss why safety precautions and guidelines that need to be followed during the lab. This should include proper handling of the surgical instruments, wearing gloves and masks, and the proper disposal of materials.

Step 3: Setup

Set up the workstation with the necessary equipment, including the bolts, wooden spine model, and surgical tools. Ensure that the workspace is clean and sterile

Step 4: Demonstration

Demonstrate the different procedures involved in lumbar surgery using the bolts and wooden spine model. This should include the steps involved in ALIF, PLIF, DLIF, and TLIF procedures.

Step 5: Debrief

Conduct a debrief session to discuss the challenges faced and lessons learned during the lab. Review the objectives and see if they were met. Discuss the importance of safety precautions and the risks associated with lumbar surgery.

Step 7: Conclusion

Conclude the lab by summarizing the key takeaways and emphasizing the importance of proper training and experience before performing any surgical procedures.

1. What is the purpose of a lumbar discectomy?

- a) To fuse two or more vertebrae together
- b) To remove a portion of an injured disc in the lower back
- c) To remove a portion of a healthy disc in the lower back
- d) To remove a portion of the spinal cord

1B. How does it relieve pressure on the spinal cord?

2. (True/False) The instrument used to confirm the correct placement during a lumbar discectomy procedure is an X-ray machine.

3. How does a lumbar discectomy compare to other types of spinal surgeries?

- a) A lumbar discectomy is a minimally invasive procedure that involves removing only a portion of the damaged disc
- b) A lumbar discectomy involves removing a portion of the vertebrae to relieve pressure on the spinal cord
- c) A lumbar discectomy is only used on cases where spinal fusion and laminectomy are not effective

4. What are the steps in preparing for a lumbar discectomy?

a) What are the risks and complications associated with the procedure?

- 1) Infection and Bleeding
- 2) Nerve damage
- 3) Anesthesia-related complications
- 4) All of the above

5. What is the role of the wire and tube in the lumbar discectomy procedure?

- a) How do they facilitate access to the affected areas

6. How are the screws and bolts used in lumbar surgery placed?

- a) What are the common complications associated with their placements?

7. What are the different types of lumbar surgical procedures?

- a) How do they differ in terms of their indications, risks and expected outcomes?

Post-Lab Activity

Good job completing the lumbar surgery lab using bolts and a wooden spine model!!

During this lab you may notice the importance of precision and accuracy in placing the **wire** and **tubes** in the correct location to access other **intervertebral space**. This is crucial to ensure the surgeon can remove the damaged portion of the disc safely and effectively without causing harm to the surrounding tissue and nerves

You were able to observe and perform lumbar fusion surgeries, including **ALIF**, **PLIF**, **DILF** and **TLIF** procedures. These surgeries are performed to stabilize painful motion segments in the lower back, treat leg and back pain caused by degenerative disc disease and permanently unite bones of the lower spine.

You now learned the **potential risks** and complications associated with a **lumbar discectomy**, such as infection, bleeding and nerve damage. It is important to follow proper surgical protocols and post-operative care to minimize these risks and ensure a smooth recovery.

It is important to note that although these procedures have proven to be very beneficial for many individuals, there are risks associated with spinal fusion surgery, including surgical site infection, excessive bleeding, nerve damage, and formation of blood clots.

This lab has provided you with a practical understanding of a **lumbar discectomy procedure** and the skills necessary to carry out the steps involved. We hope this experience has given you a better understanding of the intricacies of lumbar surgery and the risk involved. If you have any questions or concerns please do not hesitate to reach out to the lab instructor.

Post Lab Questions:

1. What is the difference between Anterior Lumbar Interbody Fusion (ALIF) and Posterior Lumbar Interbody Fusion (PLIF)?
2. What is the purpose of Direct Lateral Interbody Fusion (DLIF)? How is it different from the other procedures?
6. What are some potential risks associated with lumbar fusion surgery? How can these risks be minimized?
7. Describe the steps involved in performing a Transforaminal Lumbar Interbody Fusion (TLIF). How does this procedure differ from the others?
8. How does the use of nuts, bolts, and screws in the wooden spine model simulate a real-life lumbar fusion surgery?

9. What are some key considerations for ensuring lab safety during a lumbar fusion surgery simulation?
10. How does a thorough understanding of lumbar anatomy contribute to the success of a fusion surgery?
11. How can the techniques learned in this lab be applied in a real-life surgical setting?
12. How can you determine which lumbar fusion procedure is most appropriate for a specific patient?
13. What are some potential complications that may arise after a lumbar fusion surgery? How can they be addressed?

References:

Images: Chung, D. A. (2021, June 29). Lumbar Spine Lower Back, Anatomy, Function, Problems, vertebra, disc. Lumbar Spine Lower Back, Anatomy, Function, Problems, Vertebra, Disc. <https://www.healthpages.org/anatomy-function/lumbar-spine-lower-back-structure-function/>

Experiment 5: Brainstem Motor Systems Lab

Objective:

The objective of this lab is to understand the gross anatomy of the spinal cord and the spinal nerve, distinguish between spinal and epidural anesthesia, describe the internal structure of the spinal cord, and identify the different parts of the brainstem motor systems and the cranial nerves, their functions, and potential deficits associated with damage to each of them.

Materials:

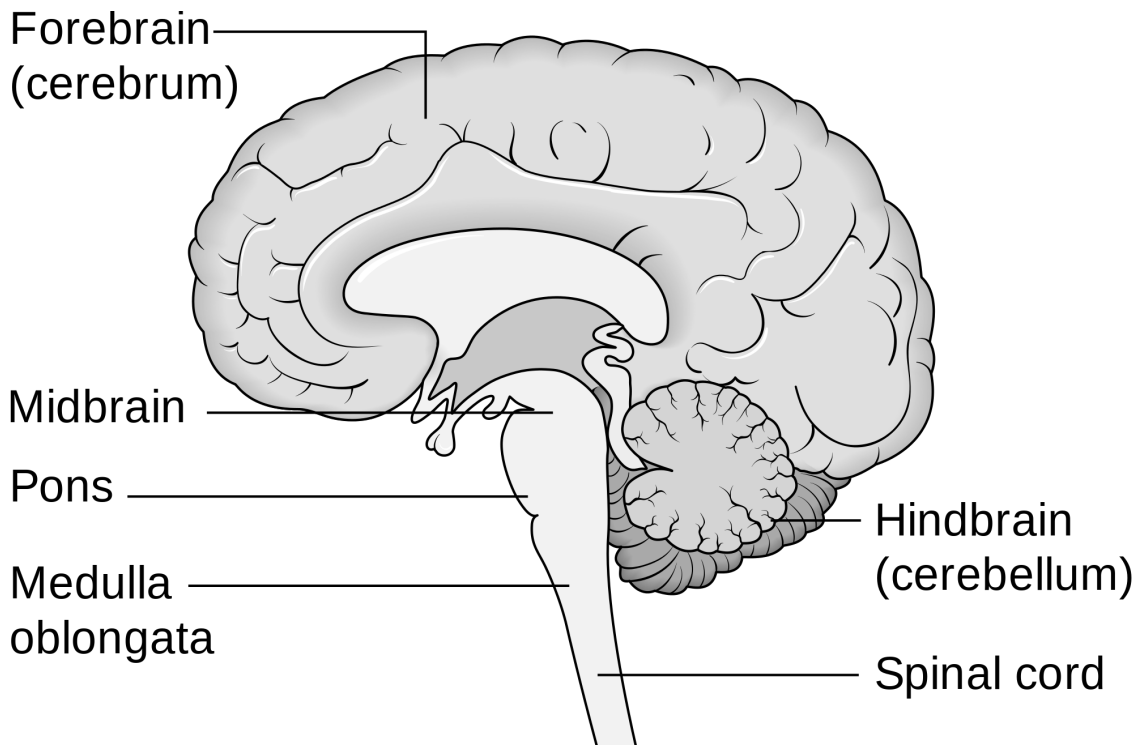
Physical model of the spinal cord and spinal nerve

Introduction:

The brainstem is a stalk-like part of your brain that connects your brain to your spinal cord. The brainstem is located towards the bottom of your brain and is a huge part of your central nervous system. The brainstem has various functions that are key to survival such as regulating body functions such as heart rate and breathing. In addition to this, the brain stem also controls balance, reflexes and coordination. The brainstem is divided into 3 parts, each with integral functions that are needed for survival.

The brainstem motor systems consist of several interconnected components, including the basal ganglia, cerebellum, and various motor nuclei. Each of these structures contributes to different aspects of motor control, such as initiating and planning movements, adjusting movement patterns, and integrating sensory feedback.

The brainstem motor systems also work closely with other parts of the nervous system, including the spinal cord and cortex, to coordinate complex movements and ensure that they are executed smoothly and efficiently. Disorders or injuries that affect these systems can result in a range of motor deficits, including tremors, rigidity, weakness, and loss of coordination.



Midbrain: The top part of the brainstem is crucial for regulating eye movements

Pons: The middle portion of the brainstem coordinates facial movements, balance, and hearing

Medulla Oblongata: The bottom part of the brainstem helps regulate breathing, blood pressure, swallowing, etc.

Spinal Cord: The spinal cord is a long, tubular structure that runs from the base of the brain to the lower back and is responsible for transmitting information between the brain and the rest of the body.

Pre-lab Activity:

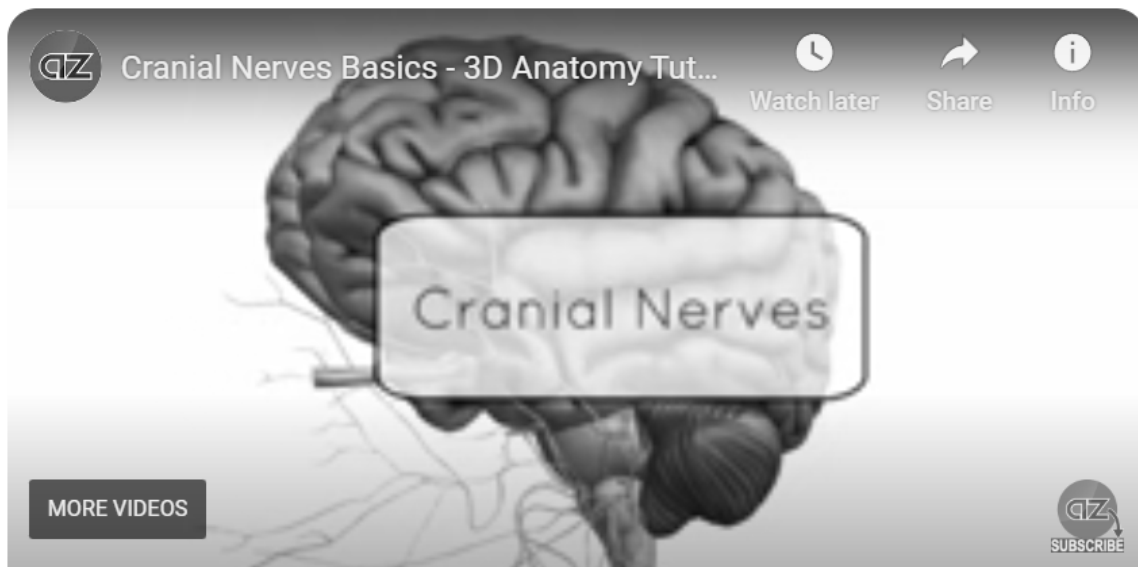
Watch the video for a more in-depth explanation of the prerequisites for our lab activity, and make sure you take notes on this video.

1. Introduction to the spinal cord:

https://www.youtube.com/watch?v=IAwk0pshcDE&ab_channel=UBCMedicine-EducationalMedia

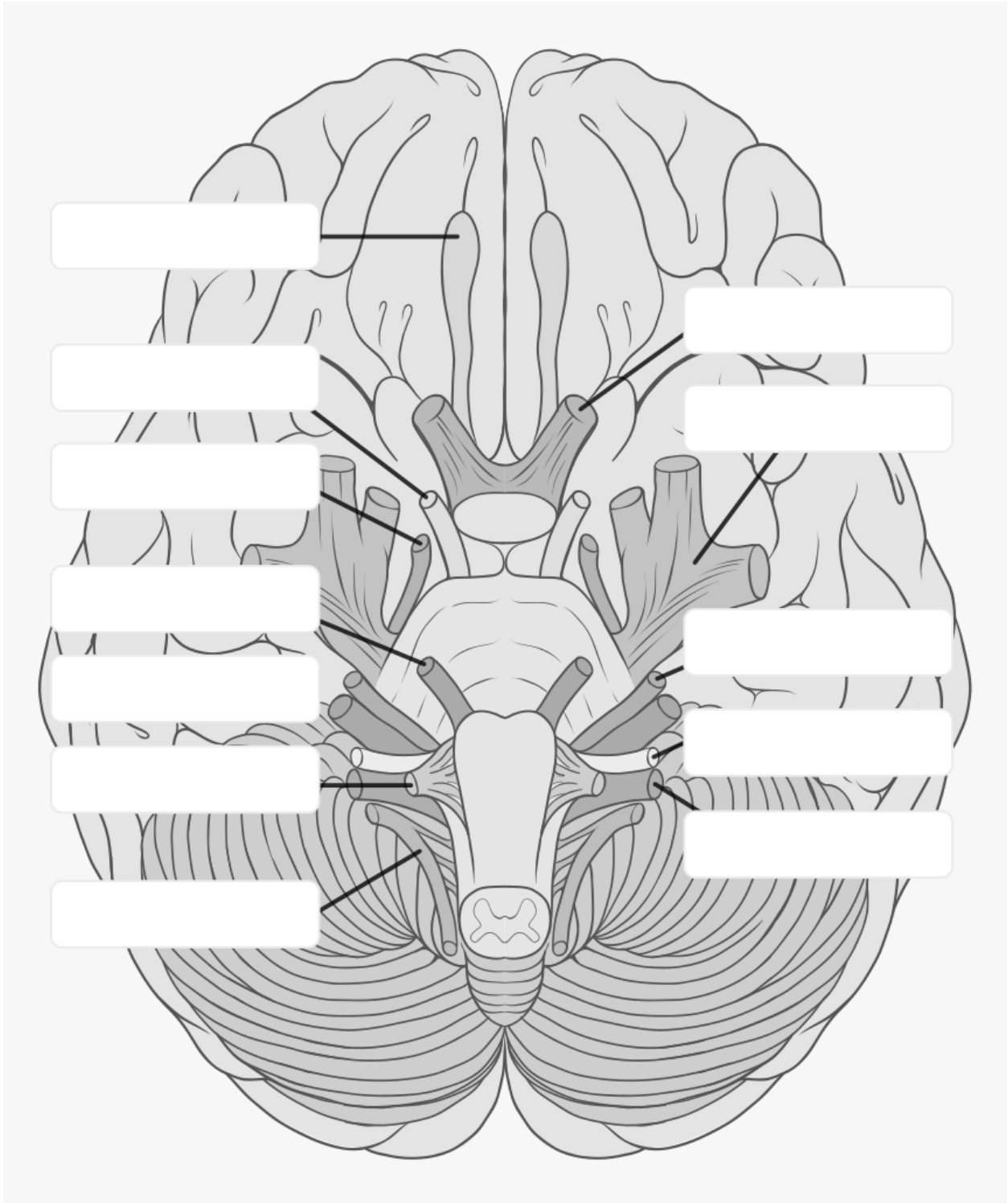
2. Introduction to cranial nerves:

https://www.youtube.com/watch?v=vFp_qNifHzw



Procedure:

1. Describe the gross anatomy of the spinal cord and the spinal nerve.
2. Identify the different parts of the spinal cord. Can you identify the dorsal and ventral roots, dorsal root ganglion, cervical and lumbar enlargements, central canal, conus medullaris, cauda equina, ventral (anterior) median fissure, meningeal layers and their specializations (filum terminale and denticulate ligament)?
3. Distinguish between spinal and epidural anesthesia.
4. Describe the internal structure of the spinal cord.
5. Draw a cross-sectional view of a typical spinal nerve, and include in the diagram a motor neuron and a sensory neuron.
6. Identify the pattern of white and gray matter in each region of the cord, noting which nuclei are found only in restricted parts of the cord.



7. Label each of the 12 cranial nerves on the diagram above

Post-lab Questions:

Part 1.

1. Describe morphology of the brainstem
2. Describe the major external features of the ventral, dorsal and lateral surfaces of the medulla, pons and midbrain.
3. Correlate the external features with the appearance of transverse sections at these levels: caudal and rostral medulla, pons, midbrain.
4. Define the regions comprising the tectum, tegmentum and base in brainstem cross-sections, list the associated major tracts and nuclei, and predict the likely
5. impairments associated with damage to the base and tegmentum at each brainstem level.
6. Identify the major vessels that supply each of the three main brainstem levels, the midbrain, pons, and medulla.
7. Summarize the functions of the brainstem and correlate with the 4D mnemonic (diplopia, dysphagia, dysarthria, dysmetria) for dysfunction due to brainstem damage.

Part 2.

1. Describe the 12 cranial nerves.
2. List the name, number, attachment site, and basic functions of each of the cranial nerves.
3. Identify on specimens the cranial nerves that arise from the forebrain, midbrain and hindbrain.
4. Distinguish between sensory and motor cranial nerve nuclei.
5. Predict the deficit associated with damage to each cranial nerve.

References:

“Neuroscience Summer Remediation Course for MD Students.” *College of Medicine*,
<https://drexel.edu/medicine/about/departments/neurobiology-anatomy/related-programs/summer-medical-neuroscience/>.

Experiment 6: Scrubbing and Sterilization

Overview:

Students will run a simulation of scrubbing before surgery and learn how to sterilize instruments before surgery.

Pre-Lab Questions:

1. What is the first step in prepping for surgery?
2. Why is it important to maintain sterilization before, during, and after surgery?
3. Describe the scrubbing procedure.

Introduction:

Surgical Instruments

Surgeons use a variety of tools and instruments to perform tasks during a surgical procedure. The usage of these instruments have been mastered by surgeons and each hold their own function throughout a surgery. Below is a list of common surgical instruments:

- Scalpel: used to cut tissue and make initial incisions; composed of a blade and handle.
- Forceps: used to grip, retract, or stabilize tissue.
- Retractors: used to keep incisions open and hold back tissues or other items to keep the operating area clear.
- Laparoscopic Equipment: a camera attached to a thin rod; used in minimally invasive surgeries and allows surgeons to take biopsies, removes growths and blockages.
- Suction: used in assisting the clean up of fluid, debris, and surgical smoke from the operating area.
- Staplers and Clips: used to close incisions for a limited period of time.

Preparation for Sterilization

Before sterilization, all medical equipment must be thoroughly cleaned to remove any remaining materials, such as mineral deposits, blood, and tissue. Poor cleaning could cause harm to the instruments or the autoclave.

Steps:

1. Before following instructions for cleaning and lubricating instruments, ensure that the instruments have been cleaned and dried.
2. To clean them, use an enzymatic cleaning solution and an ultrasonic cleaner.
3. Make sure to keep instruments made of different metals apart (mixing will result in oxidation of these metals)
4. Use the right sterilizing techniques for each instrument.

Methods of Sterilization

The most common form of sterilization in the medical field is autoclave sterilization. An autoclave, which is the name for the sterilization device, utilizes steam, heat, and pressure to remove and eliminate harmful bacteria and microorganisms. Surgical instruments are placed into the autoclave which then undergoes three phases: *conditioning*, *exposure*, and *exhaust*.

During the *conditioning* phase, the air is removed from the chamber and the items in the

autoclave are heated to 120 to 135 degrees Celsius. Afterwards, the items undergo the *exposure* phase, where they are steamed for a few minutes under high pressure. Lastly, the steam is removed, the pressure is released, and a vacuum dries the items in the autoclave—the *exhaust* phase.

Autoclave sterilization is both an effective and efficient form of sterilization for surgical instruments. With today's technology, doctors can clean multiple trays of surgical instruments at a time in just a few minutes.

Prepping for Surgery: PPE

Why is PPE used?

Personal Protective Equipment is employed in surgical settings to construct a barrier between the patient and the medical staff. Its use halts the spread of bacteria and infections. The type of PPE is dependent on a risk assessment performed prior to the operation. Some factors that are considered are whether or not there is any potential exposure to blood, infectious diseases, or bodily fluids to the medical professionals on staff.

Wearing PPE

The first step before wearing any type of PPE is to properly scrub in. Afterwards, healthcare professionals will enter a room separate from the operating room to put on their personal protective equipment. At all times, this space should be immaculately clean. Make sure long hair is tied back and all personal objects, like jewelry, have been taken off once you have put on all the required PPE.

The final step in putting on your PPE should be your surgical mask. Several other healthcare professionals, as well as surgeons doing cosmetic surgery like a stomach tuck or breast implants, are required to wear such a mask. The wearer of these masks is shielded from splashes and droplets surrounding the respiratory system by a barrier created by the masks. These masks should not be kept on the patient's neck after the procedure is over; instead, they should be thrown away.

Materials:

For the scrubbing portion:

1. 1 sink with running water
2. 1 tube of soap
3. Nail clippers
4. Lotion (Simulation of bacteria)
5. 1 UV light

For the sterilization portion:

1. 1 scalpel
2. 1 retractor
3. 1 forcep
4. Laparoscopic equipment
5. 1 suction tube
6. Staplers and Clips
7. 1 autoclave

For the PPE closed glove technique portion:

1. PPE Gowns
2. Pairs of surgical gloves

Procedure for Scrubbing

1. Put a large-sized amount of lotion in your hands and lather it onto the skin.
2. Follow the instructions to perform scrubbing as you would before a surgery.
3. After scrubbing is complete, have a lab partner shine the UV light onto your hands to see if you properly removed all of the lotion in your hands.

Scrubbing steps:

1. Open the sponge package and ensure it is not contaminated. Wet your hands and start using the soap to create suds on the hands and forearms.
2. During this time, be sure not to touch any part of the sink or faucet when creating suds. If this occurs, extra time must be allotted to scrubbing in order to prevent contamination.
3. Using a nail-cleaning tool, start clipping and sanitizing nails. The bristle side of a scrub brush may be used to ensure cleanliness.
4. Using the sponge side of the scrub brush, start scrubbing in this order: nails, fingers, palm and top of 1st hand, wrist of 1st hand, palm and top of 2nd hand, wrist of 2nd hand. After this is complete, the forearms can be scrubbed.
5. After scrubbing is complete, rinse hands and arms under the faucet water by passing them through in one direction. Be sure not to touch the sink during this time.
6. Hold your hands up to allow the water to drip and prepare for gowning.

Procedure for Autoclave Sterilization (Ensure that a TA is present before beginning)

1. Wear eye protection, insulated gloves, and protective clothing such as lab coats before beginning.
2. Prepare your materials for sterilization. If any of the materials are made out of glass, ensure that there are no chips or cracks in the instrument. If there is, the glass will burst due to high heats. All items should be placed in their appropriate containers.

3. Load the instruments into the autoclave. **DO NOT OVERFILL THE MACHINE.**
4. Close the autoclave door and make sure that the latch is secure. Double check that the lock is in place and functional.
5. Select the appropriate cycle in the autoclave (if you are unsure, ask a TA).
6. Press start on the autoclave to begin the sterilization process. **DO NOT OPEN THE DOOR WHILE THE AUTOCLAVE IS TURNED ON.**
7. Once the cycle is complete, let the tools cool down in the autoclave for at least 10 minutes.
8. Remove the instruments using insulated gloves and place it on the designated tray.

Procedure to Put on PPE: Closed Gloving Technique

1. Closed gloving technique is one of the many ways that PPE can be worn.
2. Before using the closed gloving technique, a gown should already be worn with the help of another lab partner.
3. Hands should be placed inside the gown cuffs before gloving.
4. Use the right hand to hold the inner lining cuff while holding the right glove (the glove fingers should be pointing towards you).
5. Turn your right hand so that the glove is on your palm with the thumb of the glove placed over the thumb of your hand.
6. In one motion, hold the uppermost rim of the glove with the other covered hand and pull the glove over the first hand.
7. Repeat with the left hand.
8. Refer to the video or a TA if you have any questions.

Post-Lab Questions:

1. What did you learn from this lab?
2. Describe autoclave sterilization of surgical instruments.
3. What is the difference between sterilization and disinfection?

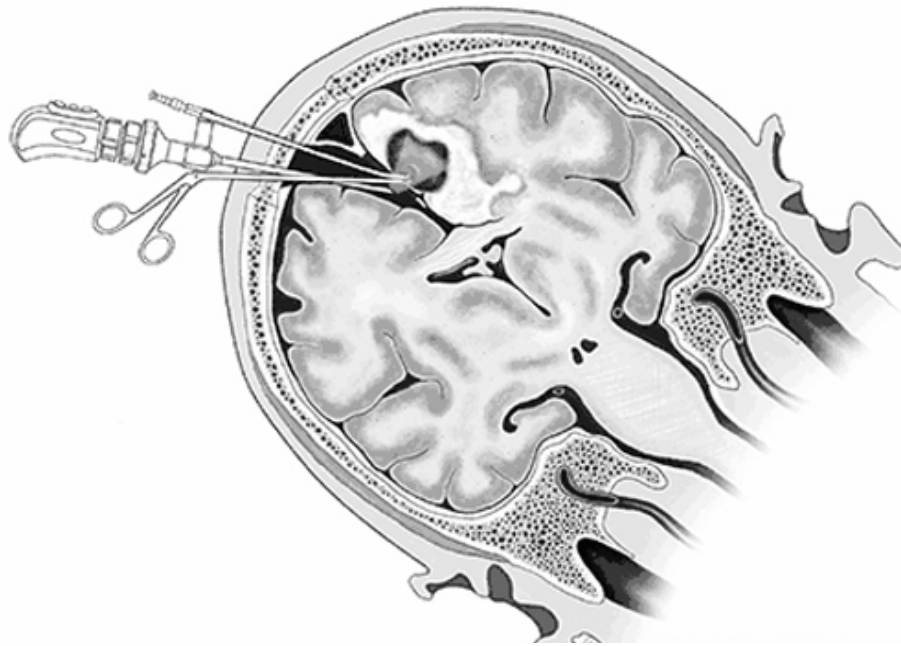
References:

“Procedures for Using Autoclaves.” *MES*,
<https://www.mesaustralia.com.au/blogs/news/procedures-using-autoclaves>.

Experiment 7: Brain Anatomy and Brain Surgery Simulation Lab

Objective:

The objective of a brain surgery simulation lab is to provide a safe and controlled environment where medical professionals can practice and improve their skills in performing brain surgery procedures. Simulation labs can use realistic models and scenarios to replicate the conditions and challenges of real-life surgical situations, allowing doctors, nurses, and other members of the surgical team to gain experience and confidence in their abilities. The ultimate goal of a brain surgery simulation lab is to enhance patient safety and improve outcomes by ensuring that medical professionals are well-prepared and competent in performing complex surgical procedures to evaluate new surgical techniques, test new equipment, and develop protocols for managing challenging cases. The objective of a brain anatomy simulation lab is to provide medical students, residents, and other healthcare professionals with a realistic and interactive learning experience that allows them to explore the structure and function of the brain. Today's lab is to enhance understanding and knowledge of brain anatomy, which is critical for the accurate diagnosis and treatment of neurological disorders and injuries.



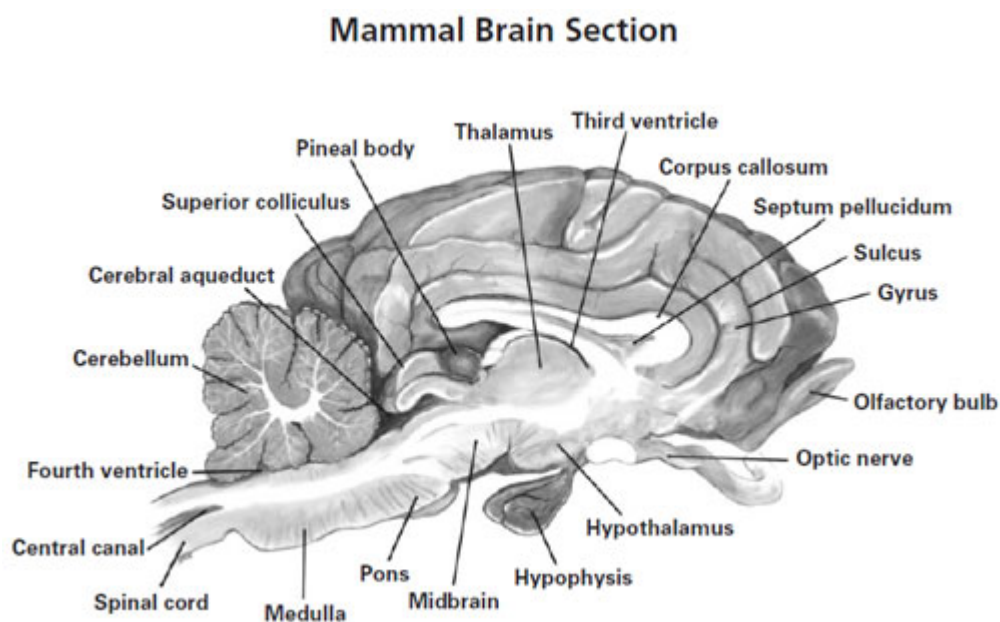
Materials:

Computer, internet connection, link to the websites.

Introduction:

In this lab you will be proceeding with a simulation where you can experience the thrill of being a skilled surgeon in a virtual operating room! We will be exploring the Brain Surgery game, an exciting operator that you can play online and for free. In this game, you will be

taking on the role of a doctor tasked with saving the life of a young woman named Leah who is suffering from an aneurysm. With the help of the operating room nurse, you need to follow the instructions carefully to ensure that the operation is completed successfully and in time to save your patient's life. Throughout this lab, we will be discussing the different elements of the game, including the anatomy of the brain, the tools and equipment used in brain surgery, and the step-by-step process of performing a successful operation. By the end of this lab, you will have a better understanding of what it takes to be a skilled brain surgeon and the importance of paying close attention to detail and following instructions. Now let's dive in and explore the Brain Surgery Game. Let's start! If you have any further questions or concerns, please do not hesitate to reach out to the lab instructor.



Procedure:

Click on the link provided, and go through the simulation. Steps will be displayed as you go through each step. Make sure you have a functioning tablet or laptop to efficiently go through this simulation. If you have any Wi-Fi or technical issues, reach out, we'll come and assist you ! Use this lab to understand and experience surgery and the intricacies that go with being a surgeon.

Pre-Lab Questions:

1. What are the different types of brain surgery that can be performed, and what conditions might they be used to treat?
2. What are the main tools and instruments used in brain surgery, and what is their function?
3. How do advances in technology and imaging affect the practice of brain surgery, and what new techniques or approaches have emerged as a result?
4. How can a surgical team work together effectively during a brain surgery procedure, and what are some common communication strategies used in the operating room?
5. How can a brain surgery lab simulation help train and prepare medical professionals for real-life surgical situations, and what are some key skills that can be developed through simulation training?

Lab:

1. Basic Brain Anatomy:

<http://bit.ly/3ltcFyY>

<https://www.purposegames.com/game/basic-brain-anatomy-game>

2. Brain Surgery Lab Simulation:

<https://www.silvergames.com/en/brain-surgery>



Post Lab Questions:



- 1) Do you think the simulation encapsulated the feeling of being a surgeon?
- 2) After going through the virtual process of surgery, do you think this career is for you?
- 3) Based on the simulation, how important do you think teamwork is in a hospital setting?
- 4) Why do you think working in a hospital is not for everyone?
- 5) What do you think the 3 most important skills are for being a surgeon?

References

“Brain Anatomy and How the Brain Works.” *Brain Anatomy and How the Brain Works* | Johns Hopkins Medicine, 14 July 2021,

<https://www.hopkinsmedicine.org/health/conditions-and-diseases/anatomy-of-the-brain>.

“Mayfield Brain & Spine.” *Brain Anatomy, Anatomy of the Human Brain* | Mayfield Brain & Spine Cincinnati, Ohio, <https://mayfieldclinic.com/pe-anatbrain.htm>.

Pryor, Olivia. “Equipment Essentials to Help You Succeed as a Neurosurgeon.” *Front Range Spine and Neurosurgery*, 14 Sept. 2021,

<https://www.frontrangeneurosurgery.com/2021/04/09/equipment-essentials-to-help-you-succeed-as-a-neurosurgeon/>.

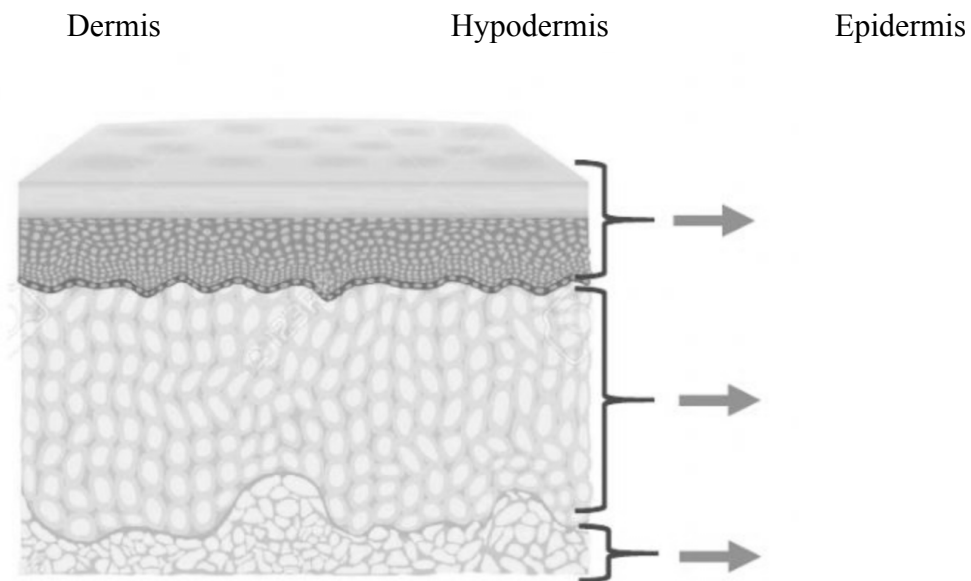
Experiment 8: Incisions and Suturing

Learning Objectives:

- Students will use simulation kits for wounds of different thicknesses and will practice administering techniques they believe are best suited for each injury.
- Students will become sufficient in performing different types of suturing techniques on the simulated skin model (ex: continuous, interrupted, deep, buried, purse-string, and subcutaneous).
- Students will use suturing kits to practice one-handed and two-handed knotting.

Pre-Lab Questions:

1. Look at the picture below, label the parts of the skin:



2. Fill in the blanks using the word bank:

<u>Word Bank</u>				
interrupted	dermis	tightly	large	cut
beneath	knotted	single strand	parallel	
equally	continuous	breaks	fascial layers	removed

Continuous sutures use a _____ of material to create a succession of sutures. The stress of continuous sutures are _____ distributed along the continuous suture strand, it can be applied efficiently and is very strong.

_____ sutures include closing the wound with multiple suture strands, and the material is _____ and _____ off when a stitch is made. This method results in a wound that is _____ closed. The remaining stitches will continue to hold the wound together even if one of them _____.

Deep sutures are positioned well _____ the layers of tissue. Deep sutures could be uninterrupted or stop and start. The _____ are frequently closed with this stitch.

Buried sutures are situated under the area that is to be closed off. This sort of suture is often not _____ and is effective when _____ sutures are utilized deeper in the body.

Purse string suture is a kind of _____ suture that is wrapped around a region and pulled tautly. This form of suture might be utilized in your intestines to secure an intestinal stapling device.

Subcutaneous suture is positioned in your _____ (the tissue layer beneath the top layer of your skin). Short stitches are positioned _____ to the incision in a line. Following that, the stitches are secured at either end of the wound.

3. Why should each knot be as small as possible?

4. How can excessive tension on a knot affect tissue healing?

Introduction:

Types of Sutures

Surgeons must be proficient in different suturing and knotting techniques in order to adapt to different injuries patients may have. In moments where seconds could determine whether or not a patient survives, surgeons must be able to select and perform a suture technique both quickly but delicately.

Here are some of the different types of sutures surgeons must be able to perform:

- Continuous Sutures: uses a single strand of material to create a succession of sutures that equally distribute stress and can be applied efficiently.
- Interrupted Sutures: uses multiple suture strands that are continuously cut and knotted and results in a wound that is tightly closed and more secure.
- Deep Sutures: positioned beneath the layers of tissue (can be continuous or interrupted).
- Buried Sutures: situated under the area that needs to be closed and is usually not removed.
- Purse String Sutures: a type of continuous suture that is wrapped around a region and pulled tautly.
- Subcutaneous Sutures: positioned in your dermis where short stitches are positioned parallel to the incision in a line.

Each of these basic suture techniques overlap and can be used simultaneously to treat certain wounds. Make yourself familiar with these techniques and use your devices to look at images and videos on how surgeons perform each of these sutures.

Knot Tying Techniques

Surgical knots have a variety of uses in surgery and are an essential skill for all surgeons to know and master. In comparison to how you may relate knot tying to tying a shoelace, surgical knots require much more efficiency and precision in order to achieve a firm, but not too tense, knot that secures a suture. Complications could occur if a knot is not properly executed and could potentially worsen an injury.

In this lab, we will be focusing on two types of knots: one-handed and two-handed knots. The two-handed knot is a fundamental skill in surgery and allows for better control of tension across the knot. However, many surgeons utilize the one-handed knot for its speed but give up some security by doing so.

Be sure to use your devices to search for tutorials and videos on how to complete a one-handed and two-handed knot.

Materials:

- Suture Kit
- Pencil
- Gloves
- Computer/ iPad

Procedure:

Obtain a suture kit from your lab instructor, which should contain suture scissors, scalpels, forceps, a suturing pad, and sutures. Familiarize yourself with the components in your kit and be sure to be cautious with any sharp tools. To mimic a surgical setting, obtain gloves from your instructor and wear them while you practice with your suture kit.

Follow the checklist below to gain a better understanding of the different suture and knotting techniques:

- ☐ Using a device, search up a tutorial that demonstrates how to perform a surgical knot using the *one-handed* knot technique. Use the demonstration to practice creating knots on your own kit.
- ☐ After you feel proficient with *one-handed* knotting, do the same thing with the *two-handed* knotting technique.
- ☐ Once you feel you have a good understanding and can perform both knotting techniques, move into learning the suturing techniques. Use your device to search up a tutorial on *continuous sutures* and practice using your kit.
- ☐ Next, look up a video on the *interrupted suture* technique and spend some time practicing with your suture kit.
- ☐ Then, look up both the deep and buried suturing techniques and have a good understanding of their differences and how to perform each one on your suturing kit.
- ☐ Lastly, look up the purse string and subcutaneous techniques and practice performing them both on the suture kit.

Once you have completed all of the steps in this checklist, you should feel proficient in performing the two knot techniques and six different suturing techniques without looking at a tutorial.

Proficiency Test:

After you feel that you've given yourself enough time to practice, call your lab instructor over to take a look. In order to receive full credit, you will need to be able to perform a one-handed knot, a two-handed knot, and complete one of the learned suture techniques on an open wound in your kit.

Your lab instructor will evaluate your technique on how well you complete the knots and how well you suture the wound of your choice. You will not be able to use the tutorial videos during your examination, so practice!

References

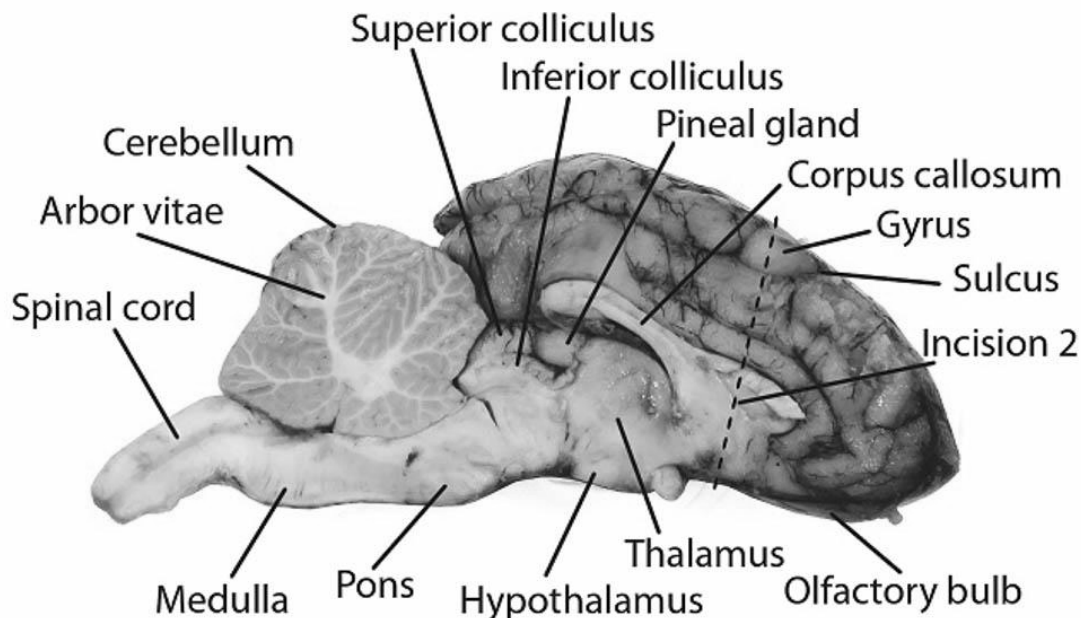
“Brain Surgery - Types, Recovery, & Risks: Made for This Moment.” *Made For This Moment | Anesthesia, Pain Management & Surgery*,
<https://www.asahq.org/madeforthismoment/preparing-for-surgery/procedures/brain-surgery/>.

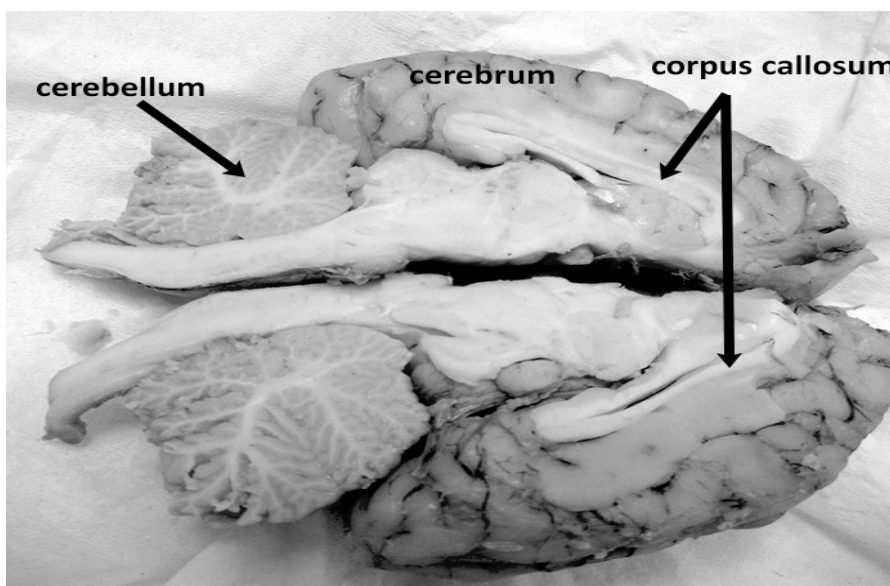
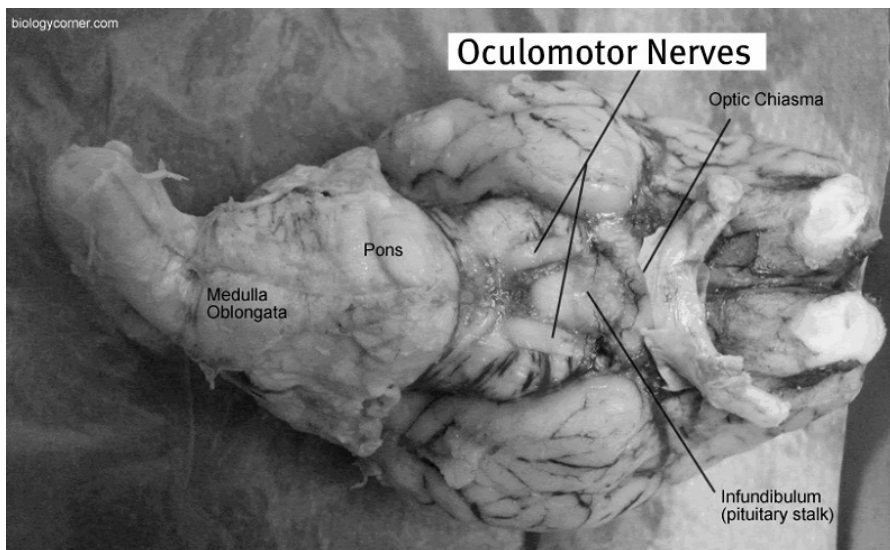
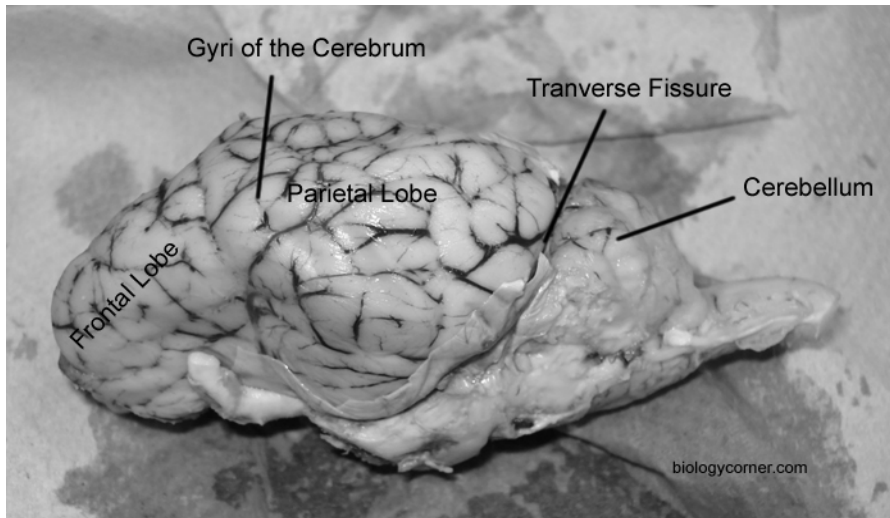
Seladi-Schulman, Jill. “Surgical Suture: Types, vs. Stitches, More.” *Healthline*, Healthline Media, 6 Apr. 2018, <https://www.healthline.com/health/sutures#technique>.

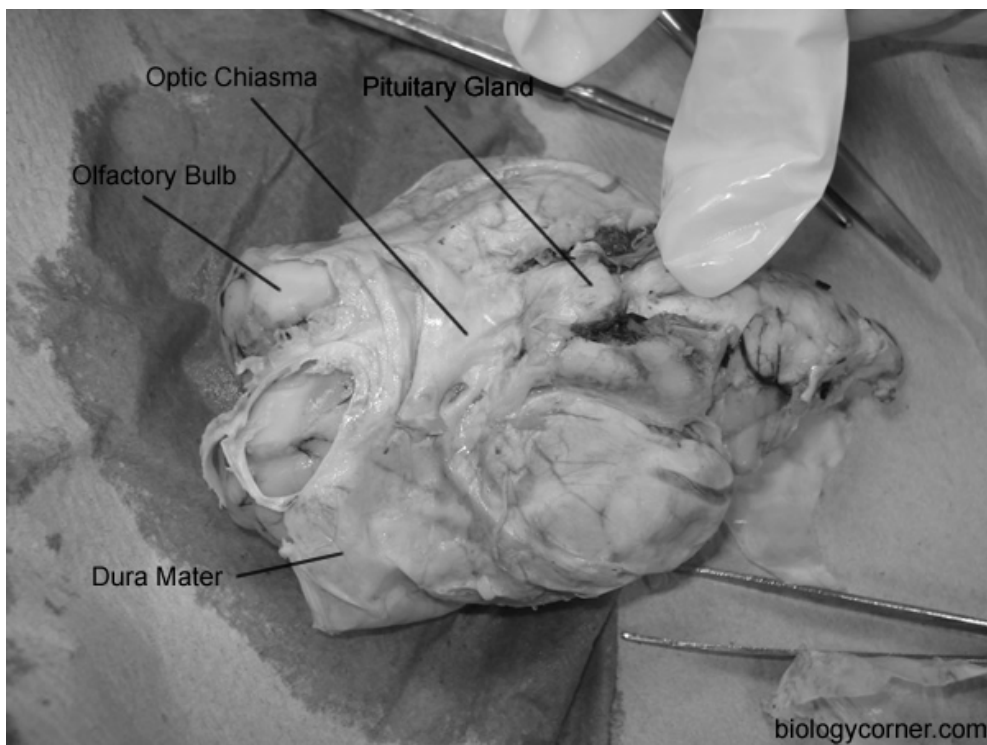
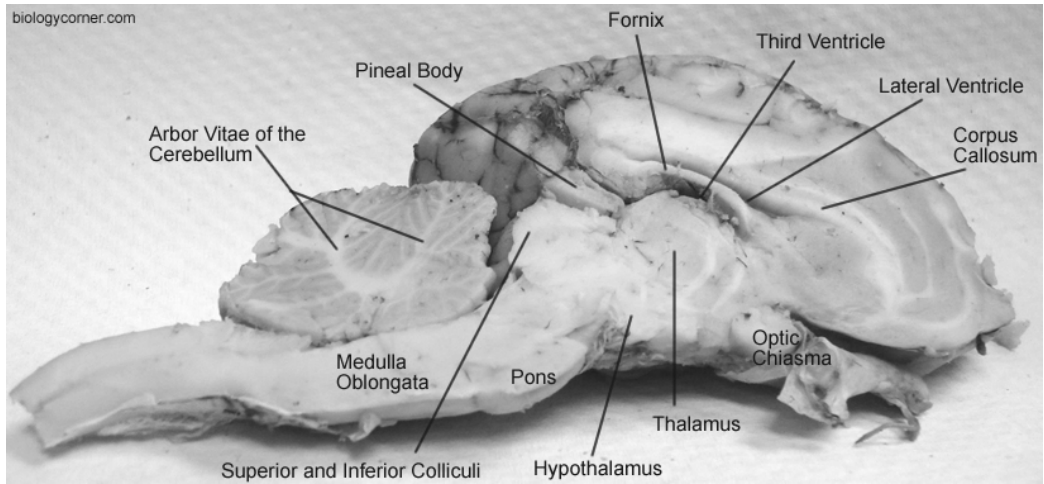
Experiment 9: Sheep Brain Dissection Lab Report

Introduction:

Welcome to the sheep brain dissection lab! In this lab, we will explore the anatomy and structure of a sheep brain, which is similar to the human brain in many ways. Sheep brain dissection is a common activity in high school biology and anatomy classes, as it provides a hands-on approach to learning about the nervous system and the brain's various regions and functions. Through this dissection, students will gain an understanding of the external and internal structures of the brain and how these structures work together to control our bodily functions, emotions, and behavior. Safety is also an essential aspect of this lab, and we will be following strict safety protocols to ensure that everyone can participate in this activity safely. So let's put on our gloves and safety goggles and get ready to explore the fascinating world of the sheep brain!

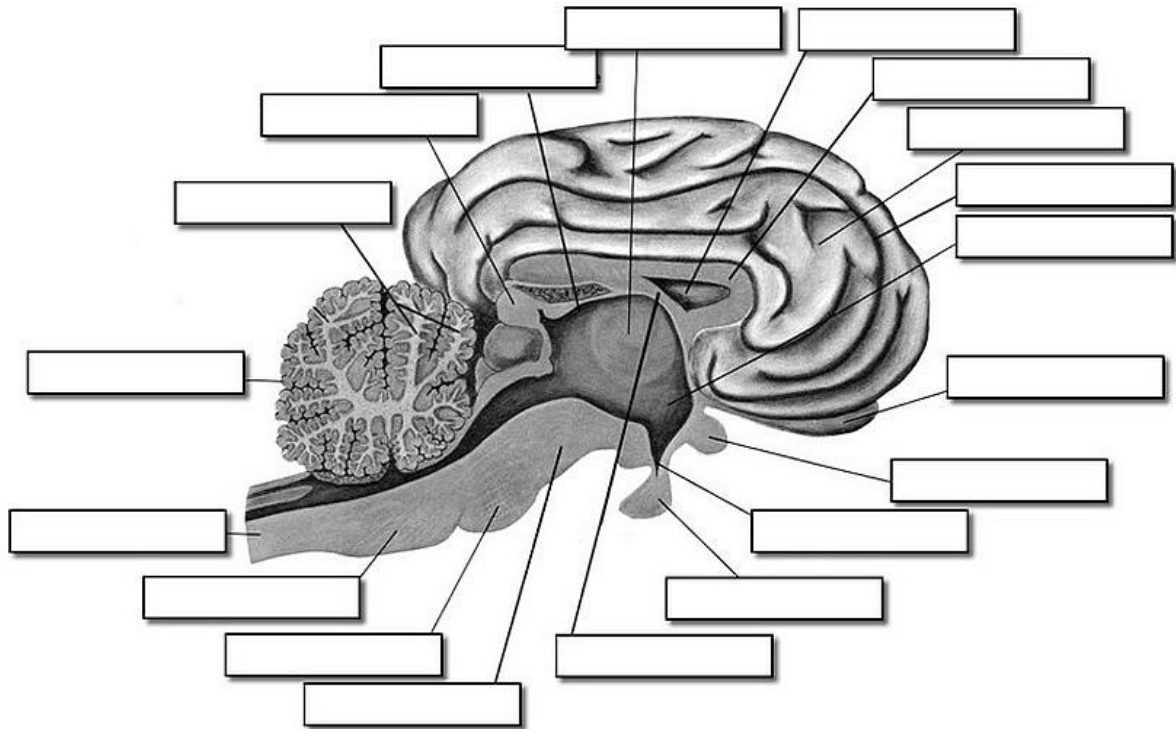






Pre-Lab Questions:

1. Write down 5 physical characteristics of your sheep brain? (for example: how the brain feels, color of the brain)
 - a.
 - b.
 - c.
 - d.
 - e.
2. Look at your sheep brain and find out whether you have the right or left hemisphere. How do you know which one you have ?
3. What part of the brain stores short-term memories ?
4. Using your knowledge of this lab, identify each part of the sheep brain



5. Damage to which lobes would interfere with parking the car?

6. Damage to which lobes would hinder your ability to learn and remember things?

7. Damage to which lobes would impact your ability to solve problems?

8. Which part of the brain controls your ability to smell ?

9. What does the gray matter in the cerebellum contain ?

10. A patient recently underwent a stroke and is worried about her recent weight gain. She exercises daily and has a very healthy diet, but still seems to gain weight. What area of the brain might be malfunctioning ?

11. Is the cerebral cortex composed of gray or white matter?

Materials:

1. Sheep brain
2. Disposable gloves
3. Scalpel or dissection scissors
4. Dissecting tray or cutting board
5. Forceps
6. Safety goggles
7. Lab coat or apron
8. Plastic bags or a biohazard waste container for disposal of remains

Procedure:

1. Safety First: Make sure you have all the necessary safety equipment, including gloves, safety goggles, and a lab coat or apron. Safety goggles are essential in protecting your eyes from splashes and dissections tools. Gloves protect your hands from any chemicals and animal tissues you might come into contact with.
2. Brain Prep: The sheep brain can be obtained from a science lab supply store or online. Before beginning the dissection, rinse the brain with cool water and pat it dry with paper towels.
3. Brain Positioning: Place the brain on the dissecting tray or cutting board ventral (underside) up. Ventral means the part of the brain that is closest to the ground or table.
4. Brain Protection: Place the brain in a dissecting tray filled with formalin, which will preserve the brain for longer. Alternatively, you can use a 10% formalin solution.
5. Skull Removal: Using a scalpel or dissection scissors, make an incision down the middle of the skull. Be careful not to cut too deep, as you do not want to damage the brain.
6. Expose the Brain: Use forceps to gently pry the skull apart and expose the brain. Be sure to remove all the pieces of bone, and handle the brain carefully so as not to damage it.
7. Identify Major Regions: Identify the major regions of the brain, including the cerebrum, cerebellum, brainstem, and spinal cord.
8. Dissecting the Brain: Use scissors or a scalpel to make incisions into the brain to expose the internal structures such as the ventricles, the hippocampus, and the thalamus.
9. Cleanup: After the dissection, dispose of any leftover tissues, chemicals, or gloves in a biohazard waste container.

Safety Precautions:

1. Always wear safety goggles, gloves, and a lab coat or apron.
2. Be careful when handling the brain as it is delicate and can be easily damaged.

3. Dispose of all waste properly to prevent the spread of disease or contamination.
4. Be sure to clean and disinfect all tools used during the dissection.

Post-Lab Questions:

In this lab, we dissected a sheep brain and located many integral parts that are necessary for a sheep to survive. Also throughout this lab, many parts of the brain were not only recognized, but detailed explanations were present showcasing the necessity of certain parts such as the frontal lobe, thalamus, medulla, etc. Using the information gained from this lab, answer the questions below. Please let one of the TA's know if you have any questions.

1. Are there limitations to using the sheep brain as a model for human brains? If so, what are they ?
2. How does the sheep brain compare to the human brain in terms of structure and function?
3. What are the major regions of the brain that were identified during the sheep brain dissection, and what are their functions?
4. What safety precautions were necessary during the sheep brain dissection, and why are they important?

References

- “12,555 Lumbar Vertebrae Images, Stock Photos & Vectors.” *Shutterstock*,
<https://www.shutterstock.com/search/lumbar-vertebrae>.
- Carretero, Rafael García, et al. “Behavioural Changes as the First Manifestation of a Silent Frontal Lobe Stroke.” *BMJ Case Reports*, BMJ Specialist Journals, 1 Jan. 2019, <https://casereports.bmj.com/content/12/1/bcr-2018-227617>.
- Carter, Rebecca. “MRI vs. CT Scan; Diagnosing Spine & Neck Injuries & Degenerative Diseases: Joseph Spine Institute.” *Joseph Spine | Advanced Spine Care*, 13 Oct. 2020,
<https://josephspine.com/mri-vs-ct-scan-diagnosing-spine-neck-injuries-degenerative-diseases/>.
- “Case Study - Spinal Cord Injury in Disasters and Conflicts.” *Physiopedia*,
https://www.physio-pedia.com/Case_Study_-_Spinal_Cord_Injury_in_Disasters_and_Conflicts.
- Chung, Dr. Andrew. “Lumbar Spine (Lower Back) Anatomy and Function.” *Health Pages Anatomy, Surgery, Pregnancy, Nutrition, Fitness*,
<https://www.healthpages.org/anatomy-function/lumbar-spine-lower-back-structure-function/>.
- Knull. “Lab Week 3: Spinal Cord and Brainstem.” *Rehab 551 Lab*,
<https://uw.pressbooks.pub/rehab551/chapter/brainstem/>.
- “Management of Spinal Cord Injuries - Case Study Part 1.” *Physiopedia*,
https://www.physio-pedia.com/Management_of_Spinal_Cord_Injuries_-_Case_Study_Part_1.
- “Neuroscience Summer Remediation Course for MD Students.” *College of Medicine*,
<https://drexel.edu/medicine/about/departments/neurobiology-anatomy/related-programs/summer-medical-neuroscience/>.
- NUEM Blog. “The Ed Guide to Neuroimaging: Part 1.” *NUEM Blog*, NUEM Blog, 16 Dec. 2019, <https://www.nuemblog.com/blog/2018/4/20/emergency-neuroimaging>.
- “Posterior Lumbar Fusion.” *YouTube*, YouTube, 10 Mar. 2021,
https://www.youtube.com/watch?v=DwxRTa6W7eI&ab_channel=ShimSpine.
- “Procedures for Using Autoclaves.” *MES*,
<https://www.mesaaustralia.com.au/blogs/news/procedures-using-autoclaves#:~:text>

=Procedures%20for%20Using%20Autoclaves%201%201.%20Operator%20Training,8%208.%20Start%20the%20Autoclave%20...%20More%20items.

SpinalCord.com. "C3, C4, & C5 Vertebrae Spinal Cord Injury." *C3, C4, & C5 Vertebrae Spinal Cord Injury* | *SpinalCord.com*, 26 Apr. 2021, <https://www.spinalcord.com/c3-c4-c5-vertebrae-spinal-cord-injury#:~:text=Symptoms%20of%20a%20spinal%20cord%20injury%20corresponding%20to,arms%20and%20For%20bend%20their%20elbows%20More%20items...%20>.

"Sterilizing Practices." *Centers for Disease Control and Prevention*, Centers for Disease Control and Prevention, 18 Sept. 2016, <https://www.cdc.gov/infectioncontrol/guidelines/disinfection/sterilization/sterilizing-practices.html>.

"What Is Anterior Lumbar Interbody Fusion? | Alif." *YouTube*, YouTube, 28 Nov. 2022, https://www.youtube.com/watch?v=dh1W1_UeguY&ab_channel=AtlanticSpineCenter.

Workbook Question Bank

Section 1 Multiple Choice Questions

1. Which surgical tools are used for cutting in brain and spine surgery?

- A. Needles and catheters
- B. Forceps and micro-dissectors
- C. Lasers and saws
- D. Microscissors and high-speed drills

2. Which safety measure is important to take when using surgical tools in brain and spine surgery?

- A. Wearing protective eyewear
- B. Disinfecting tools with alcohol wipes
- C. Keeping tools close to the edge of the surgical field
- D. Rushing through the surgery to save time

3. What is the purpose of using microscissors and micro-dissectors in brain and spine surgery?

- A. To remove tumors from deep brain structures
- B. To access restricted spaces
- C. To manipulate tissue
- D. To install shunts

4. What is the main use of neurosurgical drills in brain and spine surgery?

- A. To remove aneurysms from the cranium
- B. To make incisions into the brain and spinal cord
- C. To lift craniotomy bone flaps
- D. To correct spinal deformities

5. How are microsurgical lasers used in brain and spine surgery?

- A. To remove aneurysms from the cranium
- B. To make incisions into the brain and spinal cord
- C. To manipulate tissue
- D. To cut benign and malignant brain and spinal neoplasms

6. True or false: It is not necessary to sterilize surgical tools before using them in brain and spine surgery.

- A. True
- B. False

7. Which type of tumor can microsurgical lasers aid in removing in brain and spine surgery?

- A. Benign tumors
- B. Malignant tumors
- C. Both benign and malignant tumors
- D. Only tumors located in the spine

8. What is the purpose of using forceps in brain and spine surgery?

- A. To cut tissue
- B. To access restricted spaces
- C. To remove aneurysms from the cranium
- D. To manipulate tissue

9. True or false: Neurosurgical drills are mainly used to correct spinal deformities.

- A. True
- B. False

10. What is the advantage of using microsurgical lasers in brain and spine surgery?

- A. They are cheaper than other surgical tools
- B. They provide maximum hemostasis during surgery
- C. They are less effective than other surgical tools
- D. They are easier to use for beginners

11. What type of surgical tool is needed to correct spinal deformities in brain and spine surgery?

- A. High-speed drills
- B. Forceps
- C. Microscissors
- D. Micro-dissectors

12. How do needles and catheters contribute to brain and spine surgery?

- A. They are used for cutting
- B. They are used to manipulate tissue
- C. They are used to access restricted spaces
- D. They are used for both cutting and manipulating tissue

13. What is the main benefit of using microscissors and micro-dissectors in brain and spine surgery?

- A. They allow for faster and more aggressive procedures

- B. They reduce the risk of infection
- C. They minimize the need for extensive tissue manipulation
- D. They provide greater accuracy and control during delicate procedures

14. What are cutting surgical instruments used for?

- A. Grasping tissue or objects
- B. Retracting tissue during surgery
- C. Cutting and dissecting through skin and tissue
- D. Applying pressure to stop bleeding

15. What is the main challenge in minimally invasive surgery?

- A. Performing surgery in close proximity to delicate organs
- B. Using large, bulky instruments
- C. Minimizing the amount of anesthetic required
- D. Reducing the length of the surgical procedure

16. What is the main advantage of using micro scissors in bypass surgery?

- A. They allow for faster and more aggressive incisions
- B. They reduce the risk of infection
- C. They minimize scarring
- D. They can expose fine vessels without causing damage

17. What are forceps used for in surgery?

- A. Cutting and dissecting tissue
- B. Grasping tissue or objects
- C. Providing feedback on nerve function
- D. Removing small samples of tissue for examination

18. How many different types of forceps are there?

- A. 100
- B. 300
- C. 600
- D. 1000

19. What are Adson forceps commonly used for?

- A. Clamping, cutting, and cauterizing blood vessels
- B. Removing small pieces of tissue or sutures
- C. Manipulating delicate structures and sutures
- D. Retracting tissue during surgery

20. What are Crile forceps typically used for?

- A. Grasping tissue or objects
- B. Clamping, cutting, or cauterizing blood vessels
- C. Removing small samples of tissue for examination
- D. Providing feedback on nerve function

21. What are Malloy forceps usually used for?

- A. Cutting and dissecting tissue
- B. Grasping tissue or objects
- C. Manipulating delicate structures and sutures
- D. Removing small pieces of tissue or sutures

22. How many different types of forceps does a typical hospital have on hand?

- A. 2-3
- B. 5-8
- C. 10-15
- D. 20-25

23. What is the main benefit of using microscissors in brain and spine surgery?

- A. They allow for faster and more aggressive procedures
- B. They minimize the need for extensive tissue manipulation
- C. They provide greater accuracy and control during delicate procedures
- D. They reduce the risk of infection

24. What is Laser Ablation Brain Surgery?

- A. A highly invasive neurosurgery technique
- B. A treatment option for epilepsy only
- C. A minimally invasive treatment option for brain tumors and lesions
- D. A procedure that does not require heat from lasers

25. How does Laser Ablation Brain Surgery compare to traditional open brain surgery?

- A. It is more risky and has a longer recovery time
- B. It is less risky and has a shorter recovery time
- C. It is more painful for the patient
- D. It is only used for a limited number of conditions

26. What is the main benefit of using Laser Ablation Brain Surgery for epilepsy?

- A. Reduced risk of seizures
- B. Increased risk of seizures
- C. Greater accuracy during surgery

D. Reduced need for sutures

27. What types of sutures are available?

- A. Curved, straight, and V-shaped
- B. Absorbable, non-absorbable, and absorbable with coating
- C. Round, triangular, and V-shaped
- D. Coated, uncoated, and pre-tied

28. What is the main purpose of needles in suturing?

- A. To provide support for the tissue being sutured
- B. To pass suture through tissue
- C. To cauterize tissue
- D. To disinfect the surgical site

29. What type of needle is commonly used for skin suturing?

- A. Tapered Needle
- B. Conventional Cutting Needle
- C. Round Needle
- D. V-Shaped Needle

30. What type of needle is commonly used in softer tissues such as the intestines?

- A. Tapered Needle
- B. Conventional Cutting Needle
- C. Round Needle
- D. V-Shaped Needle

Section 1 Multiple Choice Answer Key

1. **Answer:** C. Lasers and saws

Explanation: High-speed drills, saws, and lasers are the surgical tools used for cutting in brain and spine surgery.

2. **Answer:** A. Wearing protective eyewear

Explanation: Wearing protective eyewear is an important safety measure when using surgical tools in brain and spine surgery. Additionally, all tools should be sterilized, inspected for sharp edges, and care should be taken to avoid accidental penetration of the brain or spine.

3. **Answer:** C. To manipulate tissue

Explanation: *Microscissors and micro-dissectors are used to manipulate tissue in brain and spine surgery.*

4. **Answer:** *C. To lift craniotomy bone flaps*

Explanation: *Neurosurgical drills are mainly used to lift craniotomy bone flaps in brain and spine surgery. They can also be used to remove skull base bone to expose underlying neurovascular structures and to facilitate bony decompression.*

5. **Answer:** *D. To cut benign and malignant brain and spinal neoplasms*

Explanation: *Microsurgical lasers are used to cut benign and malignant brain and spinal neoplasms in brain and spine surgery. They can be used to debulk tumor mass, ablate unwanted neoplasms without damaging adjacent neural tissue, and aid in complete tumor removal.*

6. **Answer:** *B. False*

Explanation: *False. It is necessary to sterilize surgical tools before using them in brain and spine surgery to prevent infection.*

7. **Answer:** *C. Both benign and malignant tumors*

Explanation: *Microsurgical lasers can be used to cut both benign and malignant brain and spinal neoplasms in brain and spine surgery.*

8. **Answer:** *D. To manipulate tissue*

Explanation: *Forceps are used to manipulate tissue in brain and spine surgery.*

9. **Answer:** *B. False*

Explanation: *False. Neurosurgical drills are mainly used to lift craniotomy bone flaps and remove skull base bone to expose underlying neurovascular structures in brain and spine surgery.*

10. **Answer:** *B. They provide maximum hemostasis during surgery*

Explanation: *The advantage of using microsurgical lasers in brain and spine surgery is that they provide maximum hemostasis during surgery, making it easier to perform a safe and effective excision of malignant vascular growths.*

11. **Answer:** *D. Micro-dissectors*

Explanation: *Correcting spinal deformities in brain and spine surgery requires the use of micro-dissectors to delicately manipulate tissue.*

12. **Answer:** *C. They are used to access restricted spaces*

Explanation: *Cutting surgical instruments are specifically designed to cut and dissect through skin and tissue during surgical procedures.*

13. **Answer:** *C. They provide greater accuracy and control during delicate procedures*

Explanation: *Needles and catheters are primarily used to access restricted spaces during brain and spine surgery, allowing surgeons to perform delicate procedures with greater accuracy.*

14. **Answer:** *C. Cutting and dissecting through skin and tissue*

Explanation: *Cutting surgical instruments are specifically designed to cut and dissect through skin and tissue during surgical procedures.*

15. **Answer:** *A. Performing surgery in close proximity to delicate organs*

Explanation: *Minimally invasive surgery aims to reduce patient trauma, but protecting nearby organs and avoiding functional deficiency remains a challenging task for surgeons.*

16. **Answer:** *D. They can expose fine vessels without causing damage*

Explanation: *Micro scissors are used for delicate incisions, such as exposing fine vessels during bypass surgery, without causing damage.*

17. **Answer:** *B. Grasping tissue or objects*

Explanation: *Forceps are primarily used to grasp tissue or objects during surgical procedures.*

18. **Answer:** *C. 600*

Explanation: *There are over 600 different types of forceps, each with their own unique characteristics and purposes.*

19. **Answer:** *D. Retracting tissue during surgery*

Explanation: *Adson forceps are commonly used to retract tissue during brain and spine surgeries.*

20. **Answer:** *B. Clamping, cutting, or cauterizing blood vessels*

Explanation: *Crile forceps are designed to clamp, cut, or cauterize blood vessels during surgical procedures.*

21. **Answer:** *C. Manipulating delicate structures and sutures*

Explanation: *Malloy forceps are typically used to manipulate delicate structures and sutures during brain and spine surgeries.*

22. **Answer:** *B. 5-8*

Explanation: *Hospitals usually have between five and eight different types of forceps on hand for use during surgical procedures.*

23. **Answer:** *C. They provide greater accuracy and control during delicate procedures*

Explanation: *Microscissors provide greater accuracy and control during delicate procedures in brain and spine surgery, allowing surgeons to perform intricate maneuvers with greater precision.*

24. **Answer:** *C. A minimally invasive treatment option for brain tumors and lesions*

Explanation: *Laser Ablation Brain Surgery, also known as Laser Interstitial Thermal Therapy (LITT), is a minimally invasive treatment option for brain tumors and other lesions that uses heat from precisely focused lasers to remove them.*

25. **Answer:** *B. It is less risky and has a shorter recovery time*

Explanation: *Laser Ablation Brain Surgery is less risky than traditional open brain surgery and may reduce pain and recovery time for the patient.*

26. **Answer:** *A. Reduced risk of seizures*

Explanation: *Laser Ablation Brain Surgery can reduce the number of seizures experienced by patients with epilepsy, with between 60%-70% experiencing no seizures one year after the procedure.*

27. **Answer:** *B. Absorbable, non-absorbable, and absorbable with coating*

Explanation: *Sutures are available in absorbable, non-absorbable, and absorbable with coating varieties, with each type having its own unique characteristics and uses.*

28. **Answer:** *B. To pass suture through tissue*

Explanation: *The main purpose of needles in suturing is to pass the suture through tissue, with the size, shape, and type of needle chosen based on the specific application.*

29. **Answer:** *B. Conventional Cutting Needle*

Explanation: *Conventional Cutting Needles, which are triangular with sharp edges, are commonly used for suturing tougher tissues such as skin.*

30. **Answer:** *A. Tapered Needle*

Explanation: *Tapered Needles, which are round and taper to a simple point, are commonly used in softer tissues such as the intestines.*

Section 2 Multiple Choice Questions

1. What is the largest part of the brain?

- A. Temporal Lobe
- B. Brainstem
- C. Cerebrum
- D. Cerebellum

2. What are the three main parts of a neuron?

- A. Cell wall, nucleus, and mitochondria
- B. Cell body, axon, and dendrites
- C. Chloroplast, ribosome, and endoplasmic reticulum
- D. Lysosome, centrosome, and peroxisome

- 3. True or False: Neurons are the cells responsible for receiving sensory input from the external world, for sending motor commands to our muscles, and for transforming and relaying the electrical signals at every step in between.**
- A. True
 - B. False
- 4. True or false: Information flows from the dendrites down the axon to the cell body.**
- A. True
 - B. False
- 5. Which of the following processes does the occipital lobe NOT perform?**
- A. Spatial processing
 - B. Color processing
 - C. Sound processing
 - D. Object and face recognition
- 6. Which of the following is NOT a function of distance and depth perception?**
- A. Calculating the size of objects
 - B. Judging the distance between objects
 - C. Determining the location of objects
 - D. Recognizing faces
- 7. True or False: The occipital lobe is responsible for processing auditory signals.**
- A. True
 - B. False
- 8. What is the primary function of the cerebellum?**
- A. Processing visual information
 - B. Regulating body temperature
 - C. Coordinating muscle movements
 - D. Producing hormones
- 9. True or False: The cerebellum takes up about 50% of brain matter in the human body.**
- A. True
 - B. False
- 10. Which lobe of the brain is responsible for processing visual information from the eyes?**
- A. Frontal lobe
 - B. Parietal lobe
 - C. Occipital lobe

D. Temporal lobe

11. Which area of the brain is responsible for speech ability, including speaking and writing?

- A. Frontal lobe
- B. Parietal lobe
- C. Occipital lobe
- D. Broca's area

12. Which part of the nervous system is made up of the brain and spinal cord?

- A. Central nervous system
- B. Peripheral nervous system
- C. Autonomic nervous system
- D. Sympathetic nervous system

13. True or False: The frontal lobe is responsible for processing visual information from the eyes.

- A. True
- B. False

14. True or False: The parietal lobe is responsible for sensory perception and interpreting the world around us.

- A. True
- B. False

15. Which of the following illustrations is commonly used in a poster presentation?

- A. Cartoons
- B. Paintings
- C. Charts
- D. Sculptures

16. Which of the following is NOT a source of medical research opportunities?

- A. Pharmaceutical companies
- B. Universities
- C. Non-profit organizations
- D. Athletic clubs

17. Networking is the best way to find research opportunities in the field of medical research.

- A. True

B. False

18. Which of the following is a type of research opportunity that allows undergraduate students to conduct their own research project?

- A. Volunteer research assistant
- B. Paid research assistant
- C. Independent research project
- D. Internship

19. Volunteer research assistant positions require specific qualifications or experience.

- A. True
- B. False

20. Paid research assistant positions are typically easier to obtain than volunteer positions.

- A. True
- B. False

21. Which part of the brainstem is responsible for regulating breathing and the sleep-wake cycle?

- A. Pons
- B. Medulla oblongata
- C. Cerebellum
- D. Midbrain

22. Which of the following basic functions of the autonomic nervous system is regulated by the medulla?

- A. Vision
- B. Taste
- C. Respiration
- D. Hearing

23. Which area of the brain is associated with auditory and visual processing, motor movement, and contains the substantia nigra that is rich in dopamine neurons and affected by Parkinson's disease?

- A. Cerebral cortex
- B. Basal ganglia
- C. Thalamus
- D. Midbrain

24. True or False: The midbrain is primarily responsible for regulating basic bodily functions like breathing and heart rate.

- A. True
- B. False

25. True or False: The brainstem is responsible for regulating basic bodily functions like breathing and heart rate, but it does not play a role in controlling arousal, consciousness, or attention.

- A. True
- B. False

26. Which of the following senses is mainly processed by the parietal lobe?

- A. Vision
- B. Hearing
- C. Touch
- D. Smell

27. Which of the following cognitive processes is NOT associated with the parietal lobe?

- A. Attention
- B. Working memory
- C. Decision-making
- D. Emotion regulation

28. True or False: Damage to the parietal lobe can result in sensory dysfunction.

- A. True
- B. False

29. True or False: The parietal lobe is not involved in spatial orientation and navigation.

- A. True
- B. False

30. Which of the following abilities is not primarily managed by the temporal lobe?

- A. Language
- B. Memory
- C. Motor skills
- D. Sensory processing

31. Which region of the temporal lobe is key to recognizing familiar faces and known objects?

- A. Hippocampus

- B. Amygdala
- C. Superior temporal gyrus
- D. Inferior temporal gyrus

32. True or False: The hippocampus is essential for memory-related processes and abilities.

- A. True
- B. False

33. True or False: The amygdala plays no role in how we experience and process emotions.

- A. True
- B. False

34. Grey matter in the brain is primarily responsible for:

- A. Conducting nerve signals through the brain
- B. Supporting and protecting the brain's overall structure
- C. Processing information and generating new signals through axon signaling
- D. Enabling voluntary muscle movements throughout the body

35. Which of the following statements accurately describes white matter in the brain?

- A. Composed of bundles of dendrites
- B. The tissue which generates new nerve signals in the brain
- C. Functions to conduct, process, and send nerve signals up and down the spinal cord
- D. Gets its white color from a high concentration of myelin

36. Grey matter is primarily responsible for conducting nerve signals throughout the brain.

- A. True
- B. False

37. White matter in the brain functions to conduct, process, and send nerve signals up and down the spinal cord.

- A. True
- B. False

38. Which of the following functions is primarily associated with the frontal lobe of the brain?

- A. Processing visual information
- B. Controlling voluntary muscle movements
- C. Regulating emotional responses

D. Facilitating thinking, reasoning, and problem-solving

39. Which of the following is a function associated with Broca's area in the brain?

- A. Processing visual information
- B. Controlling voluntary muscle movements
- C. Facilitating speech ability (speaking and writing)
- D. Regulating emotional responses

40. The frontal lobe is the smallest lobe of the brain.

- A. True
- B. False

41. The functions associated with the frontal lobe include memory, learning, reward, and attention.

- A. True
- B. False

42. Which part of the neuron is responsible for receiving sensory input from the external world?

- A. Axon
- B. Dendrites
- C. Cell body
- D. Nucleus

Section 2 Multiple Choice Answers

1. **Answer:** C. Cerebrum

Explanation: It is composed of large left and right hemispheres and has 4 lobes within each hemisphere.

2. **Answer:** B. Cell body, axon, and dendrites.

Explanation: As mentioned in the information, the three main parts of a neuron are the cell body, axon, and dendrites.

3. **Answer:** A. True

Explanation: As mentioned in the information, neurons are responsible for all these functions.

4. **Answer:** B. False

Explanation: Information flows from the cell body down the axon to the dendrites.

5. **Answer:** C. Sound processing.

Explanation: The occipital lobe processes visual signals, not auditory signals. Sound processing is primarily performed by the temporal lobe.

6. **Answer:** D. Recognizing faces.

Explanation: Distance and depth perception primarily involve judging the size and distance of objects, as well as their locations relative to the viewer. Object and face recognition are separate functions performed by the occipital lobe.

7. **Answer:** B. False.

Explanation: The occipital lobe processes visual signals, not auditory signals.

8. **Answer:** C. Coordinating muscle movements.

Explanation: The cerebellum is responsible for the coordination and fine-tuning of movements in the body, including maintaining balance and timing of movements.

9. **Answer:** B. False.

Explanation: While the cerebellum contains over 50% of the neurons found in the human body, it only takes up about 10% of the brain's total volume.

10. **Answer:** C. Occipital lobe

Explanation: The occipital lobe is located at the back of the brain and is responsible for processing visual information from the eyes.

11. **Answer:** D. Broca's area

Explanation: Broca's area is a specific area within the frontal lobe that is responsible for speech ability, including speaking and writing.

12. **Answer:** A. Central nervous system

Explanation: The central nervous system (CNS) consists of the brain and spinal cord.

13. **Answer:** A. False

Explanation: The frontal lobe, which makes up about 25%-40% of the cerebral cortex, is mainly responsible for thinking, reasoning, learning, recalling, and voluntary muscle movement. It is not responsible for processing visual information from the eyes.

14. **Answer:** A. True

Explanation: The parietal lobe, located between the frontal and occipital lobes, is responsible for sensory perception and interpreting the world around us.

15. **Answer:** C. Charts

Explanation: As stated in the information provided, a poster presentation is designed to visually convey scientific research and often includes illustrations such as charts, graphs, and photographs of the research. While cartoons, paintings, and sculptures may be used in some poster presentations, they are not as commonly used as charts and graphs.

16. **Answer:** D. Athletic clubs

Explanation: As stated in the information provided, medical research opportunities can be found through a variety of sources, including universities, hospitals, research institutes, and government agencies. While pharmaceutical companies and non-profit organizations may also offer research opportunities, athletic clubs are not typically associated with medical research.

17. **Answer:** A. True

Explanation: As stated in the information provided, the best way to find research opportunities in the field of medical research is to network with other students, faculty members, and professionals in the field.

18. **Answer:** C. Independent research project

Explanation: As stated in the information provided, some universities offer undergraduate students the opportunity to conduct their own research projects under the supervision of a faculty member.

19. **Answer:** B. False

Explanation: As stated in the information provided, volunteer research assistant positions usually do not require any specific qualifications or experience.

20. **Answer:** B. False

Explanation: As stated in the information provided, paid research assistant positions may require more qualifications or experience than volunteer positions, independent research projects, or internships. Therefore, they may be more difficult to obtain than volunteer positions

21. **Answer:** A. Pons

Explanation: The brainstem is the lower part of the brain that connects the spinal cord to the brain. It includes the medulla oblongata, pons, and midbrain. The pons is

responsible for regulating various automatic and unconscious processes such as breathing and the sleep-wake cycle.

22. Answer: C. Respiration

Explanation: *The medulla oblongata is a vital part of the brainstem that controls several basic functions of the autonomic nervous system. It regulates the respiratory rate and depth, cardiac function, and blood pressure by controlling the activity of the heart rate and the blood vessels' smooth muscles. In addition, the medulla is responsible for reflexes like vomiting, coughing, sneezing, and swallowing.*

23. Answer: D. Midbrain

Explanation: *The midbrain is associated with a variety of functions, including auditory and visual processing, motor movement, and sleep/wake and arousal regulation. The midbrain acts as a sort of relay station for auditory and visual information, allowing signals to be transmitted between the brainstem and higher cortical regions. It is also associated with motor movement, particularly movements of the eye, and contains substantia nigra, an area rich in dopamine neurons that are affected by Parkinson's disease. The substantia nigra plays a critical role in the regulation of movement, and the loss of dopamine neurons in this region is a hallmark feature of Parkinson's disease.*

24. Answer: B. False

Explanation: *While the brainstem as a whole is responsible for regulating basic bodily functions like breathing, heart rate, and blood pressure, the midbrain is primarily associated with motor movement, particularly movements of the eye, and auditory and visual processing. It's also associated with sleep/wake cycles, arousal (alertness), and temperature regulation. Additionally, the midbrain contains the substantia nigra, an area that is rich in dopamine neurons and is associated with movement regulation. Damage or injury to the midbrain can result in a range of neurological symptoms, including problems with eye movement, visual and auditory processing, and regulation of sleep and temperature.*

25. Answer: B. False

Explanation: *The brainstem is responsible for regulating basic bodily functions like breathing and heart rate, but it also plays a role in controlling arousal, consciousness, and attention. In addition, the brainstem is responsible for connecting the brain to the spinal cord and is divided into three parts: the midbrain, pons, and medulla oblongata, each with distinct structures and functions. Damage or injury to the brain stem can result in a range of neurological symptoms, including paralysis, sensory loss, and problems with speech or swallowing.*

26. **Answer:** C. Touch

Explanation: The parietal lobe primarily receives sensory information related to touch, taste, and temperature.

27. **Answer:** D. Emotion regulation

Explanation: The amygdala, a structure in your temporal lobe, is involved in how you feel and process different emotions.

28. **Answer:** A. True.

Explanation: The parietal lobe plays a critical role in sensory perception and integration, and damage to this area of the brain can lead to dysfunction in the senses.

29. **Answer:** B. False.

Explanation: The parietal lobe is involved in directing the body, interpreting spatial orientation, and navigation, and can play a role in tasks such as mental rotation and map reading.

30. **Answer:** C. Motor skills

Explanation: The temporal lobe is not primarily responsible for managing motor skills. Instead, motor skills are managed by the cerebellum and motor cortex, which are located in other parts of the brain.

31. **Answer:** D. Inferior temporal gyrus

Explanation: The inferior temporal gyrus is a region of the temporal lobe that is responsible for visual processing and object recognition. It plays a key role in recognizing familiar faces and known objects.

32. **Answer:** B. True

Explanation: The hippocampus is a region of the temporal lobe that is essential for several memory-related processes and abilities, including the formation of new memories and the retrieval of old ones.

33. **Answer:** B. False

Explanation: The amygdala is a region of the temporal lobe that plays a key role in how we experience and process certain emotions, such as fear and aggression. It is also involved in the formation of emotional memories.

34. **Answer:** C. Processing information and generating new signals through axon signaling

Explanation: Grey matter gets its gray tone from a high concentration of neuronal cell bodies and is primarily responsible for processing information and generating new signals through axon signaling.

35. **Answer:** D. Gets its white color from a high concentration of myelin

Explanation: White matter is composed of bundles of axons and gets its white color from a high concentration of myelin. The function of white matter is to conduct, process, and send nerve signals throughout the brain.

36. **Answer:** B. False

Explanation: Grey matter is primarily responsible for processing information and generating new signals through axon signaling.

37. **Answer:** B. False

Explanation: White matter functions to conduct, process, and send nerve signals throughout the brain, not just up and down the spinal cord.

38. **Answer:** D. Facilitating thinking, reasoning, and problem-solving

Explanation: The frontal lobe is mainly responsible for thinking, reasoning, learning, recalling, and voluntary muscle movement, making it an important part of the brain for problem-solving and executive functioning.

39. **Answer:** C. Facilitating speech ability (speaking and writing)

Explanation: Broca's area is located in the frontal lobe and is responsible for speech ability, specifically speaking and writing.

40. **Answer:** B. False

Explanation: The frontal lobe is actually the largest lobe of the brain, making up about 25% - 40% of the cerebral cortex.

41. **Answer:** A. True

Explanation: The frontal lobe plays a role in a variety of functions, including memory, learning, reward, attention, and executive functioning, which includes planning, problem-solving, motivation, judgment, decision-making, impulse control, social behavior, and personality.

42. **Answer:** *B. Dendrites.*

Explanation: *As mentioned in the information, dendrites are responsible for receiving sensory input from the external world.*

Section 3 Multiple Choice Questions

1. What are the three main functions of the spine?

- A. Maintaining a healthy immune system, storing minerals, and producing red blood cells
- B. Protecting the brain, connecting the arms and legs to the body, and regulating body temperature
- C. Protecting the spinal cord, providing structural support and balance, and enabling flexible motion
- D. Controlling breathing, digesting food, and regulating heart rate

2. What is the function of facet joints in the spine?

- A. To support the intervertebral discs
- B. To form a passageway for nerve roots
- C. To provide structural support and balance
- D. To help the spine bend, twist, and extend in different directions

3. The spine is not involved in flexible motion.

- A. True
- B. False

4. What is the function of the spinal nerves in the cervical spine?

- A. To provide structural support and balance
- B. To create a continuous, hollow longitudinal cavity
- C. To protect the spinal cord
- D. To provide movement and feeling to the muscles, skin, and tissue they serve

5. What is found within the cavities of cancellous bone in a vertebra?

- A. Cartilage
- B. Nerves
- C. Bone marrow
- D. Synovial fluid

6. What is the function of the intervertebral foramen?

- A. To support the intervertebral discs
- B. To form a passageway for nerve roots
- C. To provide structural support and balance

D. To help the spine bend, twist, and extend in different directions

7. Which of the following is NOT true about the nerves in the thoracic spine?

- A. There are twelve vertebrae in the thoracic spine
- B. The nerves in the T-1 to T-5 section affect muscles in the upper chest
- C. The nerves in the T-1 to T-5 section affect mid-back muscles
- D. The nerves in the T-1 to T-5 section affect leg muscles

8. The thoracic spine is made up of twelve vertebrae.

- A. True
- B. False

9. In regards to the body, where is the sacrum located?

- A. In the neck
- B. In the lower back
- C. In the chest
- D. In the hip

10. Which of the following is NOT true about the sacrum?

- A. It is a large, flat triangular-shaped bone
- B. The S1 - S5 bones are fused together to form the sacrum
- C. The sacrum is located in the lower back
- D. The weight-bearing joints of the sacrum do not support this part of the spinal column

11. How many vertebral segments is the coccyx composed of?

- A. 1-2
- B. 2-4
- C. 3-5
- D. 5-7

12. The coccyx supports your weight while you are sitting.

- A. True
- B. False

13. What typically causes spinal cord injuries?

- A. Genetic disorders
- B. Bacterial infections
- C. Traumatic injury from the vertebrae
- D. Cancer

14. What is the difference between complete and incomplete spinal cord injuries?

- A. Complete injuries result in quadriplegia, while incomplete injuries result in paraplegia
- B. Complete injuries result in paraplegia, while incomplete injuries result in quadriplegia
- C. Complete injuries do not result in paralysis, while incomplete injuries do
- D. Complete injuries result in temporary paralysis, while incomplete injuries result in permanent paralysis

15. What is the ASIA classification for a patient who has full loss of motor function but some preserved sensory sensation?

- A. ASIA E
- B. ASIA D
- C. ASIA C
- D. ASIA B

16. A patient classified as ASIA A has full loss of both motor function and sensory sensation.

- A. True
- B. False

17. Which of the following circuits is not included in the pattern-generating circuits of the spinal locomotor networks?

- A. Circuits that control bilateral muscle activity
- B. Circuits that control flexor muscles in limbed animals
- C. Circuits that control extensor muscles in limbed animals
- D. All of the above are included in the pattern-generating circuits

18. The spinal locomotor circuit drives groups of motor neurons in such a way that their concerted activity leads to appropriate motor output.

- A. True
- B. False

19. What is the difference between spinal cord injury (SCI) and spinal cord syndrome?

- A. SCI is caused by a disease, while spinal cord syndrome is caused by trauma
- B. SCI is a specific type of injury that results in a specific set of symptoms, while spinal cord syndrome can have varying symptoms depending on the area of the spinal cord affected
- C. SCI and spinal cord syndrome are the same thing
- D. SCI is a temporary condition, while spinal cord syndrome is permanent

20. What is the purpose of a bladder catheter in the treatment of a spinal cord injury?

- A. To provide extra nutrition and calories
- B. To stabilize fractured backbones
- C. To help decrease the swelling in the spinal cord
- D. To drain urine into a collection bag

21. Mechanical ventilators are used to drain urine from the bladder.

- A. True
- B. False

22. Which of the following treatments involves exposing the person to high levels of oxygen in a pressurized chamber?

- A. Epidural stimulation
- B. Stem cell therapy
- C. Hyperbaric oxygen therapy (HBOT)
- D. Rehabilitation therapy

23. Which of the following conditions are fusion surgeries typically recommended for?

- A. Migraines
- B. Arthritis
- C. Spinal stenosis
- D. Asthma

24. Fusion surgeries involve joining two or more vertebrae together to form a flexible, movable link.

- A. True
- B. False

25. What is one way a doctor may diagnose a potential spinal cord injury in a patient?

- A. By performing an X-ray
- B. By asking the patient about their medical history
- C. By ruling out any injury through physical examination
- D. By testing blood pressure

26. Which diagnostic test uses strong magnetic fields and radio waves to produce computer-generated images of the spinal cord?

- A. X-ray
- B. CT scan
- C. MRI
- D. PET scan

Section 3 Multiple Choice Answers

1. **Answer:** C. False

Explanation: The three main functions of the spine are protecting the spinal cord, providing structural support and balance, and enabling flexible motion.

2. **Answer:** D. To help the spine bend, twist, and extend in different directions

Explanation: Facet joints in the spine help the spine to bend, twist, and extend in different directions.

3. **Answer:** B. False

Explanation: The spine is involved in enabling flexible motion, as one of its three main functions.

4. **Answer:** D. To provide movement and feeling to the muscles, skin, and tissue they serve

Explanation: The spinal nerves in the cervical spine provide movement and feeling to the muscles, skin, and tissue they serve.

5. **Answer:** C. Bone marrow

Explanation: Bone marrow, which forms red blood cells and some types of white blood cells, is found within the cavities of cancellous bone in a vertebra.

6. **Answer:** B. To form a passageway for nerve roots

Explanation: The intervertebral foramen forms a passageway between vertebrae, allowing a place for nerve roots to branch out from the spinal canal.

7. **Answer:** D. The nerves in the T-1 to T-5 section affect leg muscles

Explanation: The nerves in the T-1 to T-5 section affect leg muscles. The T-1 through T-5 nerves affect muscles in the upper chest, mid-back, and abdominal muscles.

8. **Answer:** A. True

Explanation: There are twelve vertebrae in the thoracic spine.

9. **Answer:** *B. In the lower back*

Explanation: *The sacrum is located under the final lumbar vertebra (L5) and sits between the hip bones.*

10. **Answer:** *D. The weight-bearing joints of the sacrum do not support this part of the spinal column*

Explanation: *The weight-bearing joints of the sacrum support this part of the spinal column.*

11. **Answer:** *C. 3-5*

Explanation: *The coccyx is composed of 3-5 vertebral segments.*

12. **Answer:** *A. True*

Explanation: *The coccyx supports your weight while you are sitting.*

13. **Answer:** *C. Traumatic injury from the vertebrae*

Explanation: *Spinal cord injuries typically arise from traumatic injury from the vertebrae.*

14. **Answer:** *B. Complete injuries result in paraplegia, while incomplete injuries result in quadriplegia*

Explanation: *Complete injuries can result in paralysis below where the injury has occurred, which can lead to quadriplegia or paraplegia.*

15. **Answer:** *D. ASIA B*

Explanation: *ASIA B is the classification for full loss of motor function but some preserved sensory sensation.*

16. **Answer:** *A. True*

Explanation: *ASIA A is the classification for full loss of both motor function and sensory sensation.*

17. **Answer:** *B. Circuits that control flexor muscles in limbed animals*

Explanation: *The pattern-generating circuits in the spinal locomotor networks include circuits that control bilateral muscle activity and circuits that control flexor-extensor muscles in limbed animals.*

18. **Answer:** *A. True*

Explanation: *The spinal locomotor circuit is charged with the task of driving groups of motor neurons rhythmically in such a way that their concerted activity leads to appropriate motor output.*

19. **Answer:** *B. SCI is a specific type of injury that results in a specific set of symptoms, while spinal cord syndrome can have varying symptoms depending on the area of the spinal cord affected*

Explanation: *The SCI is a general term for any damage to the spinal cord, while spinal cord syndrome refers to a specific set of symptoms that occur as a result of damage to a specific area of the spinal cord. Additionally, depending on the area of the spinal cord affected, symptoms of spinal cord syndrome can vary.*

20. **Answer:** *D. To drain urine into a collection bag*

Explanation: *A bladder catheter is a tube that is placed into the bladder to help drain urine into a collection bag in patients with spinal cord injuries who may have difficulty with bladder function.*

21. **Answer:** *B. False*

Explanation: *The passage explains that mechanical ventilators, or breathing machines, are used to assist with breathing in patients with spinal cord injuries, while bladder catheters are used to help drain urine from the bladder.*

22. **Answer:** C. Hyperbaric oxygen therapy (HBOT)

Explanation: *Hyperbaric oxygen therapy (HBOT) involves exposing the person to high levels of oxygen in a pressurized chamber, which can help to reduce inflammation and promote healing in the damaged spinal cord.*

23. **Answer:** C. Spinal stenosis

Explanation: *Fusion surgeries are typically recommended for patients suffering from spinal stenosis, degenerative disc disease, and herniated discs. Migraines and asthma are not conditions that are typically treated with fusion surgeries, and while arthritis may affect the spine, it is not always an indication for fusion surgery.*

24. **Answer:** B. False

Explanation: *Fusion surgeries involve joining two or more vertebrae together to form a solid, immovable link. This is done by inserting screws and rods into the vertebrae, then fusing them with a graft of either bone or artificial material.*

25. **Answer:** C. By ruling out any injury through physical examination

Explanation: *The doctor may first attempt to rule out any spinal cord injury through physical examination before moving on to further testing.*

26. **Answer:** C. MRI

Explanation: *MRI, or magnetic resonance imaging, uses a strong magnetic field and radio waves to produce detailed computer-generated images of the spinal cord and surrounding structures. It is helpful for identifying herniated disks, blood clots, or other masses that might compress the spinal cord.*

Section 4 Multiple Choice Questions

1. What is epilepsy?

- A. A chronic disease that causes repeated seizures due to abnormal electrical signals produced by damaged brain cells.
- B. A bacterial infection that affects the brain.
- C. A type of headache that causes severe pain and discomfort.

D. A genetic disorder that affects muscle control.

2. True or False: Genetics is the only known cause of epilepsy.

- A. True
- B. False

3. What is the main difference between a focal onset aware seizure and a focal onset impaired awareness seizure?

- A. The body movements are more severe during a focal onset impaired awareness seizure.
- B. The person is more likely to lose consciousness during a focal onset aware seizure.
- C. Focal onset aware seizures involve changes in senses, emotions, or muscle jerking, while focal onset impaired awareness seizures involve a blank stare or repetitive movements.
- D. Focal onset impaired awareness seizures are easier to treat with medication than focal onset aware seizures.

4. True or False: Tonic-clonic seizures involve a combination of muscle stiffness and repeated, rhythmic muscle jerking.

- A. True
- B. False

5. Which location in the brain is associated with Medulloblastoma?

- A. Meninges
- B. Pituitary Glands
- C. Cerebellum or Brainstem
- D. Skull Base

6. True or False: A stroke can occur when a blood vessel in the brain bursts.

- A. True
- B. False

7. True or False: Tremors are always caused by a known underlying condition.

- A. True
- B. False

8. True or False: Neuroradiology focuses on treating nervous system problems through medication.

- A. True
- B. False

9. True or False: Atonic seizures involve greatly increased muscle tone.

- A. True
- B. False

10. What is stereotactic radiosurgery?

- A. A type of physical therapy for spinal cord injuries
- B. A form of surgery that requires opening the skull
- C. A treatment that uses high-powered x-rays on a small area of the body
- D. A medication given through a drug pump

11. What is an electroencephalogram (EEG)?

- A. A machine that detects electrical activity in the heart
- B. A procedure that involves placing metal discs on the chest to detect electrical activity in the brain
- C. A procedure that involves placing metal discs on the scalp to detect electrical activity in the brain
- D. A procedure that involves injecting a dye into the bloodstream to visualize the brain

12. What are the basic brain waves that can be recorded on an EEG?

- A. Gamma, delta, alpha, beta
- B. Alpha, beta, theta, delta
- C. Theta, delta, epsilon, kappa
- D. Gamma, beta, delta, theta

13. What can be determined from the frequency, amplitude, and duration of brain waves recorded on an EEG?

- A. The age of the patient
- B. The state of the brain
- C. The patient's blood pressure
- D. The type of medication the patient is taking

14. What does CT stand for?

- A. Computerized technology
- B. Computerized tomography
- C. Cross-sectional technology
- D. Cross-sectional tomography

15. What does the acronym "BCBVB" stand for when it comes to reading a head CT scan?

- A. Brain, Cerebellum, Vessels, Bones, Blood

- B. Blood, Cisterns, Brain, Ventricles, Bones
- C. Blood, Cerebellum, Brain, Ventricles, Bones
- D. Brain, Cisterns, Ventricles, Blood, Bones

16. Multiple-choice question: What is the purpose of using contrast material in a CT scan?

- A. To make the body part being scanned more comfortable
- B. To allow the machine to take photographs at multiple angles
- C. To insert contrast material into the bloodstream for diagnosis
- D. To make organs and vessels easier to see in the images

17. What does blood appear as in a CT scan of the brain?

- A. Black
- B. Gray
- C. White
- D. Red

18. What are ventricles in the brain?

- A. Pockets of cerebral spinal fluid
- B. Cavities that contain blood
- C. Enlarged spaces in the brain
- D. None of the above

19. Which of the following best describes how a PET scan works?

- A. It uses X-ray radiation to create cross-sectional images of the body
- B. It detects the radiation emitted from a radioactive tracer that travels to parts of the body using glucose as energy
- C. It uses a magnetic field and radio waves to create images of the body
- D. It measures electrical activity in the brain using electrodes

20. What does the color red indicate in a PET scan?

- A. Low activity levels
- B. Medium activity levels
- C. High activity levels
- D. No activity levels

21. What other imaging test can be combined with PET scans to provide a more comprehensive view of the tumor?

- A. CT Scan
- B. X-Rays

- C. Ultrasounds
- D. Mammography

22. True or False: The darker areas of a PET scan show where there are low cases of the radio tracker.

- A. True
- B. False

23. Which one of these are not a sign of Alzheimer's?

- A. Loss of memory
- B. Seizures
- C. Severe changes in personality
- D. Loss of motion related skills

24. True or False: ALS causes motor neurons to degenerate and die?

- A. True
- B. False

25. What contrast material is injected for an MRI scan ?

- A. Gadolinium
- B. Iodophors
- C. Peracetic
- D. Glutaraldehyde

26. True or False: You should compare the fat sensitive images with the water sensitive images in an MRI scan?

- A. True
- B. False

27. What does ACL stand for?

- A. Alter Cruciate Ligament
- B. Anterior Cruciate Ligaments
- C. Anterior Cruciate Ligament
- D. None of the above

28. Why should you order an MRI for the brain?

- A. Migraine or chronic headaches
- B. Seizures
- C. Extreme fatigue/weakness
- D. All of the above

Section 4 Multiple Choice Answers

1. **Answer:** *A. A chronic disease that causes repeated seizures due to abnormal electrical signals produced by damaged brain cells*

Explanation: *Epilepsy is a chronic disease that causes repeated seizures due to abnormal electrical signals produced by damaged brain cells. The other options are not accurate descriptions of epilepsy.*

2. **Answer:** *B. False.*

Explanation: While genetics can play a role in the development of epilepsy, it is not the only known cause. Other known causes of epilepsy include mesial temporal sclerosis, head injuries, brain infections, and immune disorders. In fact, the cause of seizures is unknown in up to 70% of cases.

3. **Answer:** *C. Focal onset aware seizures involve changes in senses, emotions, or muscle jerking, while focal onset impaired awareness seizures involve a blank stare or repetitive movements*

Explanation: *Focal onset aware seizures involve changes in senses, emotions, or muscle jerking while the person is awake and aware. Focal onset impaired awareness seizures involve a blank stare or repetitive movements and may cause the person to be confused or lose awareness or consciousness. The main difference between the two types of seizures is the presence or absence of awareness during the seizure.*

4. **Answer:** *A. True*

Explanation: *Tonic-clonic seizures are a combination of muscle stiffness (tonic) and repeated, rhythmic muscle jerking (clonic).*

5. **Answer:** *C. Cerebellum or Brainstem*

Explanation: *Medulloblastoma is a type of brain tumor that is typically located in the cerebellum or brainstem.*

6. **Answer:** *A. True*

Explanation: *A stroke can occur due to two main reasons - either when something blocks blood supply to part of the brain (ischemic stroke) or when a blood vessel in the brain bursts (hemorrhagic stroke).*

7. **Answer:** *B. False*

Explanation: *While some tremors can be associated with specific conditions, the majority of tremors have no known cause.*

8. **Answer:** *B. False*

Explanation: *Neuroradiology focuses on diagnosing and treating nervous system problems using imaging techniques and minimally invasive procedures such as interventional neuroradiology.*

9. **Answer:** *B. False*

Explanation: *Atonic seizures involve a loss of muscle control or weak muscles during the seizure, causing parts of the body to droop or drop. This seizure type is sometimes called a "drop seizure" or "drop attack."*

10. **Answer:** *C. A treatment that uses high-powered x-rays on a small area of the body*

Explanation: *Stereotactic radiosurgery is a form of radiation therapy that uses high-powered x-rays to target a specific area of the body, in this case, the nervous system. It is used for certain types of nervous system disorders and helps to avoid damage to surrounding brain tissue.*

11. **Answer:** *C. A procedure that involves placing metal discs on the scalp to detect electrical activity in the brain*

Explanation: *An electroencephalogram (EEG) is a procedure that involves placing tiny metal discs, or electrodes, on the scalp to detect electrical activity in the brain. The recordings from an EEG can help diagnose various neurological disorders.*

12. **Answer:** *B. Alpha, beta, theta, delta*

Explanation: *The basic brain waves that can be recorded on an EEG are alpha, beta, theta, and delta waves. While there are other more complex waves, these are the primary types of brain waves.*

13. **Answer:** *B. The State of the Brain*

Explanation: *The frequency, amplitude, and duration of brain waves recorded on an EEG can be used to determine the state of the brain, such as whether the patient is awake or asleep.*

14. **Answer:** *B. Computerized tomography*

Explanation: *CT stands for computerized tomography, which is a diagnostic imaging test that combines multiple X-ray images to produce cross-sectional images of the body.*

15. **Answer:** *B. Blood, Cisterns, Brain, Ventricles, Bones*

Explanation: "BCBVB" stands for "Blood Can Be Very Bad" and represents the five main components to look for when reading a head CT scan.

16. **Answer:** D. To make organs and vessels easier to see in the images

Explanation: Contrast material is used in CT scans to enhance the visibility of organs and vessels in the images.

17. **Answer:** B. Computerized tomography.

Explanation: CT stands for computerized tomography, which is a diagnostic imaging test that combines multiple X-ray images to produce cross-sectional images of the body.

18. **Answer:** A. Pockets of cerebral spinal fluid

Explanation: Ventricles are cavities in the brain that contain cerebrospinal fluid, which is a clear liquid that surrounds and protects the brain and spinal cord.

19. **Answer:** B. It detects the radiation emitted from a radioactive tracer that travels to parts of the body using glucose as energy.

Explanation: PET scan uses a radioactive tracer that is made up of natural chemicals, such as glucose, and a machine detects the radiation emitted as the tracer travels to the parts of the body that use the glucose as energy. This creates images that show areas of the body with high metabolic activity, as seen in hot spots.

20. **Answer:** C. High activity levels

Explanation: In a PET scan, the color red indicates areas with high activity levels, which may be caused by conditions such as inflammation, infection or cancer.

21. **Answer:** A. CT Scan

Explanation: CT scans are often combined with PET scans to provide a more comprehensive view of the tumor. The CT scan helps to create a detailed image of the body's internal structures, which can help to identify the location and size of the tumor.

22. **Answer:** B. False

Explanation: The brighter areas of a PET scan show where there are high cases of the radio tracker, while the darker areas show where there are low cases of the radio tracker.

23. **Answer:** B. Seizures

Explanation: Seizures are not a sign of Alzheimer's. Common signs of Alzheimer's include loss of memory, severe changes in personality, and loss of motion-related skills.

24. **Answer:** *A. True*

Explanation: *ALS, or amyotrophic lateral sclerosis, causes motor neurons to degenerate and die, which leads to muscle weakness and eventually paralysis.*

25. **Answer:** *A. Gadolinium*

Explanation: *Gadolinium is the contrast material that is injected for an MRI scan. It helps to improve the visibility of certain tissues and structures within the body.*

26. **Answer:** *A. True*

Explanation: *It is recommended to compare the fat-sensitive images with the water-sensitive images in an MRI scan to help differentiate between different types of tissues and identify abnormalities.*

27. **Answer:** *C. Anterior Cruciate Ligament*

Explanation: *ACL stands for Anterior Cruciate Ligament, which is a ligament in the knee that connects the thigh bone to the shinbone.*

28. **Answer:** *D. All of the above.*

Explanation: *All of the answer choices align with symptoms of neurological disorders that would need an MRI.*

Section 5 Multiple Choice Questions

1. What is the surgical procedure commonly used for movement disorders such as parkinson disease?

- A. Neuroendoscopy
- B. Vertebroplasty
- C. Spinal Laminectomy
- D. Deep brain stimulation

2. Which surgical procedure is performed to remove a part of the skull in order to gain access to the brain?

- A. Spinal Fusion
- B. Thrombectomy
- C. Foraminotomy
- D. Craniotomy

3. True or false: Neuroendoscopy is a minimally invasive technique that involves threading a thin tube called an endoscope through a large incision in the skull to access or remove brain tissue.

- A. True
- B. False

4. True or false: Spinal fusion involves the removal of spinal disk between two or more vertebrae, followed by the fusion of the adjacent vertebrae using bone grafts or metal devices secured by screws.

- A. True
- B. False

5. What does the suffix -RRHAPHY indicate in a medical term??

- A. Surgical puncture
- B. Surgical removal
- C. Suturing
- D. Surgical Repair

6. True or false: Dialysis is a medical procedure that involves the surgical removal of certain elements from the blood or lymph by passing them through a semipermeable membrane.

- A. True
- B. False

7. What is the main goal of a cervical laminectomy???

- A. To remove the entire cervical vertebrae
- B. To fuse the cervical vertebrae together
- C. To release pressure from the back of the neck on the spinal cord and nerves
- D. To treat degenerative diseases in the cervical spine

8. What is the purpose of a lumbar discectomy?

- A. To remove a portion of the spinal cord
- B. To remove a portion of a damaged disc in the lower back
- C. To remove a portion of a vertebrae in the lower back
- D. To remove a portion of a muscle in the lower back

9. True or False: A lumbar discectomy involves a surgeon making a large incision on the back

- A. True
- B. False

10. What is the Retro-Sigmoid “Keyhole” Craniotomy used for?

- A. Removing brain tumors

- B. Treating aneurysms
- C. Relieving intracranial pressure
- D. Repairing skull fractures

11. Which of the following is NOT a procedure that can be performed using craniotomy?

- A. Aneurysm clipping
- B. Treating epilepsy
- C. Knee replacement
- D. Tumor removals

12. True or False: The instruments used in craniotomy include drills, lasers, and ultrasonic aspirators.

- A. True
- B. False

13. What types of tumors can be treated with an orbitozygomatic craniotomy?

- A. Lung cancer
- B. Breast cancer
- C. Meningiomas, pituitary tumors, and craniopharyngiomas
- D. Leukemia

14. What is the primary benefit of an awake craniotomy?

- A. The patient is kept comfortable during the procedure
- B. The patient can communicate with the surgical team during the procedure
- C. The procedure is less invasive than other types of craniotomies
- D. The procedure is faster than other types of craniotomies

15. What is the primary goal of aneurysm clipping?

- A. To increase blood flow to the brain
- B. To decrease blood pressure in the brain
- C. To block blood flow to the aneurysm
- D. To remove the aneurysm from the brain

16. How is access to the aneurysm obtained during endovascular coiling?

- A. Through a small incision in the skull
- B. Through a small incision in the neck
- C. Through a small incision in the abdomen
- D. Through a small incision in the groin

17. True or False: Patients are typically under general anesthesia during deep brain stimulation surgery.

- A. True
- B. False

18. What tool is used to visualize the pituitary gland during a transsphenoidal surgery?

- A. A microscope
- B. A scalpel
- C. An endoscope
- D. A stereotactic head frame

19. True/False: The patient is positioned face up for interspinous process decompression.

- A. True
- B. False

20. True or False: Spinal fusion surgery involves connecting two or more bones in any part of the spine to prevent movement and reduce pain.

- A. True
- B. False

21. True or False: Cervical fusion is always done using metal plates or rods.

- A. True
- B. False

22. True or False: The main goal of lumbar spinal fusion surgery is to increase flexibility in the spine.

- A. True
- B. False

23. Which of the following surgeries is done to relieve pressure on the spinal cord?

- A. Laminoplasty
- B. Sacroiliac Joint Fusion
- C. Cervical Fusion
- D. Lumbar Spinal Fusion

24. Which federal law requires the creation of national standards to protect sensitive patient health information from being disclosed without the patient's consent or knowledge?

- A. Medicare
- B. Medicaid

- C. HIPAA
- D. ACA

25. What is the goal of Sacroiliac Joint Fusion surgery?

- A. To eliminate pain caused by instability in the joint
- B. To correct the curvature of the spine in people with scoliosis
- C. To relieve pressure on the spinal cord
- D. To place screws, rods and cages to steady the spine

26. What is scoliosis?

- A. A condition that causes the spine to curve to one side
- B. A condition that causes the spine to twist
- C. A condition that causes the spine to become shorter
- D. A condition that causes the spine to become longer

27. Which healthcare providers are required to ensure the privacy and confidentiality of patients under HIPAA?

- A. Only physicians and hospitals
- B. Only health plans and pharmacies
- C. Only public health authorities and insurance companies
- D. All healthcare providers, including physicians, hospitals, health plans, pharmacies, public

28. True or False: Cervical Fusion is a surgery done to correct the curvature of the spine in people with scoliosis.

- A. True
- B. False

29. True or False: HIPAA only applies to healthcare providers, not family members, friends or coworkers.

- A. True
- B. False

30. True or False: Patients have the right to see and obtain copies of their medical records, but they cannot request corrections if they detect errors.

- A. True
- B. False

31. True or False: The goal of Laminoplasty surgery is to relieve pressure on the spinal cord caused by spinal stenosis.

- A. True
- B. False

Section 5 Multiple Choice Answers

1. **Answer:** D) Deep brain stimulation

Explanation: Deep brain stimulation is a surgical procedure that involves the implantation of an electronic device called an implantable pulse generator to deliver electrical stimulation to specific areas in the brain. It is most commonly used for the treatment of movement disorders such as Parkinson's disease.

2. **Answer:** D) Craniotomy

Explanation: Craniotomy is a surgical procedure that involves the removal of a part of the skull to access the brain. It is commonly used to treat brain tumors, skull fractures, aneurysms, hematomas, infections, and address swelling in the brain.

3. **Answer:** False

Explanation: Neuroendoscopy is a minimally invasive technique that involves threading a thin tube called an endoscope through the mouth, nose, or small incisions in the skull to access or remove brain tissue.

4. **Answer:** True

Explanation: Spinal fusion is a surgical procedure that involves the removal of a spinal disk between two or more vertebrae, followed by the fusion of the adjacent vertebrae using bone grafts or metal devices secured by screws. It is performed to alleviate pain and other symptoms caused by damaged disks.

5. **Answer:** C) Suturing

Explanation: The suffix -RRHAPHY in a medical term indicates suturing, which is the act of using a needle and thread to repair a wound or join tissues together. An example is nephrorrhaphy, which is the surgical suturing of the kidney.

6. **Answer:** *True*

Explanation: *Dialysis is a medical procedure that involves the removal or detachment of certain elements from the blood or lymph by passing them through a semipermeable membrane. It is commonly used to treat kidney failure.*

7. **Answer:** *C)*

Explanation: *To release pressure from the back of the neck on the spinal cord and nerves. This is the primary goal of a cervical laminectomy, as it involves removing the spinal canal lumbar and any soft tissue that may be compressing the spinal column to relieve pressure and restore nerve function.*

8. **Answer:** *B) To remove a portion of a damaged disc in the lower back*

Explanation: *A lumbar discectomy is an operation to repair a vertebral disc in the lower back. It involves a surgeon removing a portion of the injured disc, relieving pressure on the spinal cord.*

9. **Answer:** *False*

Explanation: *A lumbar discectomy involves a tiny incision on the back, and the correct placement is confirmed using an X-ray machine. A series of tubes are then used to access the damaged disc, and the instruments are inserted through these tubes to remove the herniated portion of the disc.*

10. **Answer:** *A) Removing brain tumors*

Explanation: *The Retro-Sigmoid “Keyhole” Craniotomy is a minimally invasive surgical method used to remove brain tumors, particularly for meningiomas, acoustic neuromas, and skull base tumors.*

11. **Answer:** *C) Knee replacement*

Explanation: *Craniotomy is a surgical procedure used to gain access to the brain and can be used for procedures such as aneurysm clipping, epilepsy treatment, and tumor*

removals. Knee replacement is a completely different surgical procedure that involves replacing a damaged knee joint with an artificial one.

12. **Answer:** True

Explanation: True. In addition to the three-pin Mayfield skull clamp, long-handled scissors, and dissectors, drills, lasers, and ultrasonic aspirators are also used in craniotomy procedures.

13. **Answer:** C) Meningiomas, pituitary tumors, and craniopharyngiomas.

Explanation: An orbitozygomatic craniotomy is a traditional skull base technique used to target challenging tumors and aneurysms, including meningiomas, pituitary tumors, and craniopharyngiomas.

14. **Answer:** B) The patient can communicate with the surgical team during the procedure.

Explanation: The primary benefit of an awake craniotomy is that the patient is kept conscious and alert during the operation, which allows the surgical team to evaluate the patient's neurological function and monitor their responses. Additionally, the patient's ability to communicate with the surgical team during the procedure can be valuable in ensuring the best possible outcome.

15. **Answer:** C) To block blood flow to the aneurysm.

Explanation: Aneurysm clipping is a surgical procedure to treat a cerebral aneurysm by blocking the blood flow to the aneurysm, preventing it from rupturing and reducing the risk of stroke.

16. **Answer:** D) Through a small incision in the groin.

Explanation: Access to the aneurysm during endovascular coiling is obtained through a small incision in the groin, allowing a catheter to be inserted and guided to the aneurysm.

17. **Answer:** False.

Explanation: *Patients are usually awake with local anesthesia during deep brain stimulation surgery to ensure proper testing of the stimulation.*

18. **Answer:** *C) An endoscope.*

Explanation: *An endoscope is used to visualize the pituitary gland during a transsphenoidal surgery. The endoscope is composed of a thin, wire-like structure with a light and camera.*

19. **Answer:** *False.*

Explanation: *The patient is positioned face down on their stomach for this procedure.*

20. **Answer:** *True.*

Explanation: *Spinal fusion surgery aims to connect two or more bones in the spine to make it more stable, correct a problem or reduce pain by preventing movement between them.*

21. **Answer:** *False.*

Explanation: *While metal plates or rods might be used in some cervical fusion surgeries, the use of bone grafts or cages filled with bone graft material is also a possibility.*

22. **Answer:** *False.*

Explanation: *The main goal of lumbar spinal fusion surgery is to stabilize the spine, not increase its flexibility. The procedure involves fusing two or more vertebrae together to prevent movement and reduce pain.*

23. **Answer:** *A0 Laminoplasty*

Explanation: *Laminoplasty is a surgery done to relieve pressure on the spinal cord, usually caused by spinal stenosis, a condition that narrows the spinal canal.*

24. **Answer:** *C) HIPAA*

Explanation: *HIPAA is a federal law that requires the creation of national standards to protect sensitive patient health information from being disclosed without the patient's consent or knowledge.*

25. **Answer:** *A) To eliminate pain caused by instability in the joint*

Explanation: *The goal of Sacroiliac Joint Fusion surgery is to eliminate pain caused by instability in the joint.*

26. **Answer:** *A) A condition that causes the spine to curve to one side*

Explanation: *Scoliosis is a condition that causes the spine to curve to one side.*

27. **Answer:** *D) All healthcare providers, including physicians, hospitals, health plans, pharmacies, public health authorities, insurance companies, billing agencies, information systems sales and service providers, and others.*

Explanation: *HIPAA requires all healthcare providers to ensure the privacy and confidentiality of patients.*

28. **Answer:** *False*

Explanation: *Cervical Fusion is not a surgery done to correct the curvature of the spine in people with scoliosis. It is a surgery done in the neck area to fuse spinal bones together.*

29. **Answer:** *False*

Explanation: *HIPAA applies to everyone, including those closest to the patient - their spouse, family members, friends, coworkers, etc.*

30. **Answer:** *False*

Explanation: *Patients are able to see and obtain copies of their medical records, generally within 30 days of their request, and to request corrections if they detect errors.*

31. **Answer:** *True*

Explanation: *The goal of Laminoplasty surgery is to relieve pressure on the spinal cord, usually caused by spinal stenosis, a condition that narrows the spinal canal.*

Section 6 Multiple Choice Questions

1. True or False: The spinal cord is responsible for delivering information from the brain to the rest of the body.

- A. True
- B. False

2. What is the purpose of awake craniotomy surgery?

- A. To remove tumors from the spine
- B. To remove brain tissue while preserving cognitive and motor function
- C. To transplant a new brain into the patient
- D. To treat psychiatric disorders

3. True or false: The term dorsal refers to the bottom side of the body.

- A. True
- B. False

4. What does neuroanatomy study?

- A. The relationship between structure and function in the nervous system
- B. The relationship between structure and function in the respiratory system
- C. The relationship between structure and function in the digestive system
- D. The relationship between structure and function in the immune system

5. True or false: The limbic system is responsible for regulating temperature control, hormones, and emotions.

- A. True
- B. False

6. Which lobe of the brain is responsible for processing sensory information and determining spatial awareness?

- A. Frontal lobe
- B. Parietal lobe
- C. Temporal lobe
- D. Occipital lobe

7. True or false: The cerebral cortex is a smooth, flat layer that covers the entire surface of the brain.

- A. True
- B. False

8. Which part of the brain regulates the "fight or flight" response, as well as non-emergency vital processes such as feeding and reproduction?

- A. Cerebral cortex
- B. Amygdala
- C. Hippocampus
- D. Hypothalamus

9. True or false: The primary potential risks of undergoing brain and spine surgery, discussed in lecture, are: infection, bleeding, neurological deficits.

- A. True
- B. False

10. What are some benefits of surgical intervention for brain or spine-related conditions?

- A. Improved digestion and immunity
- B. Improved vision and hearing
- C. Improved mobility and function, reduced pain
- D. Improved sleep and memory

11. How many cranial nerves does the human brain have?

- A. 10
- B. 11
- C. 12
- D. 13

12. Which lobe of the brain processes olfactory information?

- A. Temporal lobe
- B. Parietal lobe
- C. Occipital lobe
- D. Frontal lobe

13. True or False: Olfactory impulses are sent from the nasal cavity to the optic nerve.

- A. True
- B. False

14. What does the oculomotor nerve control in the eye?

- A. Lens shape
- B. Retinal sensitivity

- C. Muscle movements
- D. Tear production

15. Which part of the face does the maxillary region of the trigeminal nerve provide sensation to?

- A. Upper third
- B. Middle third
- C. Lower third
- D. Entire face

16. True or False: The facial nerve extends from the brainstem, through the optic nerve, and then enters the face.

- A. True
- B. False

17. What does the vestibulocochlear nerve allow for?

- A. Sense of taste
- B. Sense of balance and hearing
- C. Vision and hearing
- D. Sense of smell and taste

18. True or False: The Glossopharyngeal Nerve is responsible for controlling the respiratory system.

- A. True
- B. False

19. What is the function of the vestibular nucleus?

- A. To control the heartbeat
- B. To integrate sensory information and send motor signals to the muscles and joints
- C. To regulate breathing
- D. To secrete hormones

20. What is a symptom of vestibular nucleus disorders?

- A. Rash
- B. Fever
- C. Nausea
- D. Unsteadiness

- 21. True or False: The vestibular nucleus plays a role in adjusting our eye movements to keep our visual field stable as we move.**
- A. True
 - B. False
- 22. True or False: Vestibular nucleus disorders can only be caused by inner ear disorders.**
- A. True
 - B. False
- 23. Which cranial nerve is responsible for the sense of smell?**
- A. 1st cranial nerve
 - B. 2nd cranial nerve
 - C. 8th cranial nerve
 - D. 12th cranial nerve
- 24. Which part of the spine is responsible for controlling the body's balance?**
- A. Cervical
 - B. Thoracic
 - C. Lumbar
 - D. Sacral
- 25. True or False: The 12th cranial nerve is responsible for hearing.**
- A. True
 - B. False
- 26. True or False: Paralysis caused by a spinal cord injury can affect some parts of the body and not others.**
- A. True
 - B. False

Section 6 Multiple Choice Answer Key

1. **Answer:** *A. True.*

Explanation: *The spinal cord is the bundle of nerves that carries signals from the brain to the rest of the body and sends sensory information back to the brain.*

2. **Answer:** *B. To remove brain tissue while preserving cognitive and motor function.*
Explanation: *The purpose of awake craniotomy surgery is to remove brain tissue while preserving cognitive and motor function.*
3. **Answer:** *B. False.*
Explanation: *The term dorsal refers to the top side (from Latin dorsum, back).*
4. **Answer:** *A. The relationship between structure and function in the nervous system.*
Explanation: *Neuroanatomy studies the relationship between structure and function in the nervous system.*
5. **Answer:** *A. True.*
Explanation: *The limbic system, which is located in the midbrain, regulates several functions, including temperature control, hormone regulation, and emotions.*
6. **Answer:** *B. Parietal lobe.*
Explanation: *The parietal lobe is responsible for processing sensory information and determining spatial awareness, as well as processing information related to taste, temperature, and touch.*
7. **Answer:** *B. False.*
Explanation: *The cerebral cortex has a folded, wrinkled surface with sulci (folds) and gyri (bumps) which increase its surface area.*
8. **Answer:** *D. Hypothalamus.*
Explanation: *The hypothalamus is responsible for regulating emergency responses such as the "fight or flight" response, as well as non-emergency vital processes such as feeding and reproduction.*
9. **Answer:** *A. True.*
Explanation: *Patients who undergo brain and spine surgery have a risk of complications like infections, bleeding, and neurological deficits.*
10. **Answer:** *C. Improved mobility and function, reduced pain.*
Explanation: *The statement describes some benefits of surgical intervention for brain or spine-related conditions, which include improved quality of life, reduced pain, and improved mobility or function. Surgery to remove a brain tumor can alleviate symptoms such as headaches and seizures, while spine surgery can alleviate back pain and improve movement.*

11. **Answer:** C. 12

Explanation: *The human brain has 12 cranial nerves including the: olfactory, optic, oculomotor, trochlear, trigeminal, abducens, facial, vestibulocochlear, glossopharyngeal, vagus, spinal accessory, hypoglossal nerves.*

12. **Answer:** D. Frontal lobe.

Explanation: *The olfactory tract travels to the frontal lobe where the brain processes olfactory information.*

13. **Answer:** B. False.

Explanation: *Olfactory impulses are sent from the nasal cavity to the olfactory bulb through olfactory receptors*

14. **Answer:** C. Muscle movements.

Explanation: *The oculomotor nerve provides movement to the majority of the muscles that move the eyeball and upper eyelid.*

15. **Answer:** B. Middle Third

Explanation: *The maxillary region of the trigeminal nerve provides feeling to the middle third of the face, the side of the nose, the upper teeth, and the lower eyelid.*

16. **Answer:** B. False.

Explanation: *The facial nerve extends from the brainstem, through the vestibulocochlear nerve, and then enters the face.*

17. **Answer:** B. Sense of balance and hearing.

Explanation: *The vestibulocochlear nerve allows for hearing and sense of balance, including static equilibrium and dynamic equilibrium.*

18. **Answer:** B. False.

Explanation: *The Glossopharyngeal Nerve does not control the respiratory system.*

19. **Answer:** B. To integrate sensory information and send motor signals to the muscles and joints.

Explanation: *The vestibular nucleus plays a crucial role in maintaining balance by integrating sensory information and sending motor signals to the muscles and joints to correct any imbalances.*

20. **Answer:** D. Unsteadiness.

Explanation: Disorders of the vestibular nucleus can result in balance problems, such as vertigo and dizziness. Other symptoms can include unsteadiness, difficulty walking, and nystagmus (involuntary eye movements).

21. **Answer:** A. True.

Explanation: The vestibular nucleus also helps to adjust our eye movements to keep our visual field stable as we move.

22. **Answer:** B. False.

Explanation: Vestibular nucleus disorders can be caused by various factors, including inner ear disorders, brainstem injuries, and certain medications.

23. **Answer:** A. 1st cranial nerve.

Explanation: The 1st cranial nerve is responsible for the sense of smell, and it is evaluated by asking the patient to identify odors presented to each nostril while the other nostril is occluded.

24. **Answer:** D. Sacral.

Explanation: The sacral nerves are responsible for controlling the body's balance. There are 31 symmetrical pairs of nerves in the spine that function to assist the body.

25. **Answer:** B. False.

Explanation: The 8th cranial nerve carries auditory and vestibular input, which is responsible for hearing. The 12th cranial nerve is responsible for tongue movement and is evaluated by asking the patient to extend the tongue and inspecting it for atrophy, twitches, and weakness.

26. **Answer:** A. True.

Explanation: Because the spinal nerves are responsible for each body part's function, paralysis may affect certain parts of the body but not others when the spine is injured.

Section 7 Multiple Choice Questions

1. What is the purpose of clamping and occluding instruments in surgery?

- A. To control bleeding and manipulate tissue
- B. To close incisions and wounds
- C. Remove tumors
- D. To provide exposure to the surgical site

2. True or False: Suturing instruments are used to remove tissue during surgery.

- A. True
- B. False

3. True or false: Electrocautery devices are used to control bleeding in surgery.

- A. True
- B. False

4. Which statement is true about special purpose surgical instruments?

- A. They are only used in emergency surgeries
- B. They are not subject to quality or safety standards
- C. They are designed for specific tasks within surgery
- D. They are all disposable after one use

5. What is a scalpel used for in surgery?

- A. To grip and retract tissue
- B. To stabilize tissue
- C. To cut tissue and make the initial incision
- D. To suture wounds

6. Why are the tips of forceps serrated?

- A. To grip and retract tissue
- B. To maintain sterilization during surgery
- C. To cut tissue and make the initial incision
- D. To remove the tumors without lesions

7. What is the purpose of a retractor in surgery?

- A. To cut tissue
- B. To grip and stabilize tissue
- C. To keep an incision open and hold back tissue
- D. To view the surgical site through tiny incisions

8. True or False: Staplers and clips are used for cleaning up the surgical site during the operation

- A. True
- B. False

9. True or False: The Yankauer suction tube is used for surface suction only.

- A. True
- B. False

10. True or False: Electrosurgery is a technique that uses electric current to cut through tissue.

- A. True
- B. False

11. Which of the following best describes the difference between sterilization and disinfection?

- A. Sterilization eliminates all harmful microorganisms, while disinfection only reduces their numbers.
- B. Sterilization reduces harmful microorganisms, while disinfection eliminates them completely.
- C. Sterilization only eliminates bacterial spores, while disinfection eliminates all other microorganisms.
- D. Sterilization and disinfection are the same process.

12. True or False: Medical facilities should practice disinfection instead of sterilization.

- A. True
- B. False

13. What cleaning solution should be used to clean medical instruments before sterilization?

- A. Alcohol
- B. Water
- C. Enzymatic cleaning solution
- D. Vinegar

14. True or False: Overloading sterilizer trays can cause inadequate sterilization and drying.

- A. True
- B. False

15. Which of the following is NOT one of the three most frequently used techniques for sterilization?

- A. Steam sterilization
- B. Ethylene oxide sterilization
- C. Dry heat sterilization
- D. Ultraviolet (UV) sterilization

16. True or False: Steam sterilization is the most commonly used and quickest sterilization procedure.

- A. True
- B. False

17. What is ethylene oxide?

- A. A colorless gas
- B. A type of steam used in sterilization
- C. A type of heat used in sterilization
- D. A type of radiation used in sterilization

18. True or False: Dry heat sterilization is faster than steam sterilization.

- A. True
- B. False

19. What are the 4 parts that the sterilization process in the healthcare industry is conventionally broken into?

- A) Pre-Surgery, Surgery, Post-Surgery, Follow-Up
- B) Decontamination, Assembly and Packaging, Sterile Storage, Distribution
- C) Cleaning, Disinfecting, Packaging, Shipping
- D) Examination, Diagnosis, Treatment, Recovery

20. True/False: Ultrasonic washers are used for assembling and packaging medical devices.

- A. True
- B. False

21. What type of surgical wound involves operating on an internal organ with a spilling of contents from the organ into the wound?

- a. Clean wounds
- b. Clean-contaminated wounds
- c. Contaminated wounds
- d. Dirty wounds

22. What is a prion?

- a. A type of bacteria
- b. A type of virus
- c. A type of misfolded protein
- d. A type of fungi

23. What is the purpose of drapes during surgery?

- a. To create barriers between the surgical field and other parts of the body to prevent infection
- b. To hold surgical instruments
- c. To keep the patient warm
- d. To provide a clean surface for the surgical team to work on

24. How are drapes sterilized before usage?

- a. Through radiation
- b. Through steam
- c. Both a and b
- d. None of the above

25. What is the most common procedure for patient preparation before surgery?

- a. Inserting an IV to administer fluids, antibiotics, anesthetics, and more
- b. Performing a CT scan
- c. Administering pain medication
- d. None of the above

26. True or False: Sterile storage facilities must have porous surfaces.

- A. True
- B. False

27. True or False: Storage containers used for transportation do not need to be kept clean.

- A. True
- B. False

28. True or False: Prions can transmit their misfolded shape onto normal versions of the same protein.

- A. True
- B. False

29. True or False: Drapes may be repositioned during surgery if necessary.

- A. True

B. False

30. True or False: Drapes should be placed on areas of the patient that would need open access during the surgery.

A. True

B. False

Section 7 Multiple Choice Answer Key

1. **1. What is the purpose of clamping and occluding instruments in surgery?**

Answer: *A) To control bleeding*

Explanation: *Clamping and occluding instruments, such as forceps and clamps, are used to control bleeding and assist in the manipulation of tissue.*

2. **Answer:** *False*

Explanation: *Suturing instruments, such as needles and suture needles, are used to close incisions and wounds.*

3. **Answer:** *False*

Explanation: *Electrocautery devices are cutting and dissecting instruments used to make incisions and remove tissue, not to control bleeding.*

4. **Answer:** *C) They are designed for specific tasks within surgery*

Explanation: *As mentioned in the information, special purpose surgical instruments are designed for specific tasks within surgery and may only be used in specific procedures.*

5. **Answer:** *C) To cut tissue and make the initial incision*

Explanation: *The scalpel is a cutting instrument used to make incisions in tissue.*

6. **Answer:** *A) To grip and retract tissue*

Explanation: *The serrated tips of forceps allow them to grip and hold tissue without slipping.*

7. **Answer:** *C) To keep an incision open and hold back tissue*

Explanation: *Retractors are used to keep an incision open and hold back tissues or other items to keep the operating area clear.*

8. **Answer:** *False*

Explanation: *Staplers and clips are used for cleaning up the surgical site during the operation*

9. **Answer:** *False*

Explanation: *The Yankauer suction tube is mainly used for intra-abdominal suction and surface suction.*

10. **Answer:** *True*

Explanation: *Electrosurgery uses an alternating electrical current to cauterize or cut tissue.*

11. **Answer:** *A) Sterilization eliminates all harmful microorganisms, while disinfection only reduces their numbers.*

Explanation: *Sterilization is the process of killing and eliminating all forms of microbial life, including bacterial spores, while disinfection is the process of eliminating or reducing harmful microorganisms from inanimate objects and surfaces. Sterilization eliminates all microorganisms, while disinfection only reduces their numbers, meaning that some germs may still be present.*

12. **Answer:** *B) False*

Explanation: *Disinfection only reduces the number of microorganisms, while sterilization eliminates all microorganisms. Medical facilities must practice sterilization to ensure the safety of their patients.*

13. **Answer:** *C) Enzymatic cleaning solution*

Explanation: *Enzymatic cleaning solutions are designed to break down and remove organic matter, such as blood and tissue, from medical instruments. This is an important step in the sterilization process to ensure that the instruments are properly cleaned and ready for use.*

14. **Answer:** *A) True*

Explanation: *Overloading sterilizer trays can cause inadequate sterilization and drying. Allowing proper distance between trays or cassettes is important for effective sterilization and to prevent damage to the instruments*

15. **Answer:** *D) Ultraviolet (UV) sterilization*

Explanation: *Ultraviolet (UV) sterilization is not one of the three most frequently used techniques for sterilization. While UV light can be used to disinfect surfaces, it is not typically used for sterilizing surgical instruments.*

16. **Answer:** *A) True*

Explanation: *Steam sterilization is often the most commonly used and quickest sterilization procedure. It is effective at killing microorganisms and can be done relatively quickly and inexpensively.*

17. **Answer:** *A) A colorless gas*

Explanation: *Ethylene oxide is a colorless and highly flammable gas used in sterilization.*

18. **Answer:** *B) False*

Explanation: *Dry heat sterilization takes more time than steam sterilization, as instruments are typically heated for 1-2 hours at high temperatures, compared to the relatively quick process of steam sterilization.*

19. **Answer:** *B) Decontamination, Assembly and Packaging, Sterile Storage, Distribution*

Explanation: *The sterilization process in the healthcare industry is conventionally broken into 4 parts: Decontamination, Assembly and Packaging, Sterile Storage, and Distribution.*

20. **Answer:** *B) False*

Explanation: *Ultrasonic washers, tunnel washers, and cart washers are used for the decontamination process, not for assembly and packaging.*

21. **Answer:** *C) Contaminated wounds*

Explanation: *Contaminated wounds involve operating on an internal organ with a spilling of contents from the organ into the wound.*

22. **Answer:** *C) A type of misfolded protein*

Explanation: *A prion is a misfolded protein.*

23. **Answer:** *A) To create barriers between the surgical field and other parts of the body to prevent infection*

Explanation: *Drapes are used to create barriers between the surgical field and other parts of the body to prevent infection.*

24. **Answer:** *C) Both a and b*

Explanation: *Drapes can be sterilized through radiation, steam, and more.*

25. **Answer:** *A) Inserting an IV to administer fluids, antibiotics, anesthetics, and more*

Explanation: *The most common procedure for patient preparation before surgery is to insert an IV to administer fluids, antibiotics, anesthetics, and more.*

26. **Answer:** *False*

Explanation: *Surfaces of storage facilities such as the ceiling, walls, and floors must be non-porous, smooth, non-shedding, and easily cleanable.*

27. **Answer:** *False*

Explanation: *Storage containers used for transportation are to be kept clean and free of visible dust / soil.*

28. **Answer:** *True*

Explanation: *Prions can transmit their misfolded shape onto normal versions of the same protein, leading to neurodegenerative diseases in humans and other animals such as “Mad Cows Disease”.*

29. **Answer:** *False*

Explanation: *Once a drape has been placed, surgical team members cannot touch any surface underneath the drape and may not reposition any part of the drape.*

30. **Answer:** *False*

Explanation: *Drapes should be placed on areas of the patient that would not need open access during the surgery.*

Section 8 Multiple Choice Questions

1. What is the main cause of tremors?

- A. Aging
- B. Muscle strain
- C. Inner parts of the brain that control movements
- D. Poor posture

2. True or false: Epilepsy can be caused by excessive physical activity.

- A. True
- B. False

3. Who is at risk of developing epilepsy?

- A. Only those with a family history of epilepsy
- B. Only children
- C. Only adults over the age of 65
- D. Anyone can develop epilepsy

4. True or false: The hippocampus plays a role in memory processing, emotions, spatial navigation, and learning.

- A. True
- B. False

5. Which area of the brain is most commonly associated with seizures in cases of intractable epilepsy?

- A. Hippocampus
- B. Temporal lobe
- C. Frontal cortex
- D. Thalamus

6. True or false: Huntington's disease is a non-inherited neurological condition.

- A. True
- B. False

7. Which movement disorder is associated with uncoordinated or clumsy balance, speech, or limb movements?

- A. Huntington's disease
- B. Tourette syndrome
- C. Ataxia
- D. Parkinson's disease

8. Which movement disorder is associated with repetitive movements and vocal sounds?

- A. Huntington's disease
- B. Tourette syndrome
- C. Ataxia
- D. Parkinson's disease

9. Which of the following is NOT a condition that can be treated with deep brain stimulation?

- A. Dystonia
- B. Parkinson's disease
- C. Alzheimer's disease
- D. Obsessive-Compulsive Disorder (OCD)

10. Where is the electronic device for deep brain stimulation typically positioned?

- A. Inside the brain
- B. In the upper chest, beneath the skin
- C. In the neck, beneath the skin

D. In the abdomen, beneath the skin

11. True or False: Brain plasticity is the ability of neurons to form new or stronger connections.

- A. True
- B. False

12. What is the difference between functional and anatomic hemispherectomy?

- A. Functional hemispherectomy removes the entire hemisphere, while anatomic hemispherectomy only removes a smaller region.
- B. Anatomic hemispherectomy disconnects the side of the brain, while functional hemispherectomy removes the parietal, temporal, and occipital lobes.
- C. Anatomic hemispherectomy is a less invasive surgery than functional hemispherectomy.
- D. Functional hemispherectomy is usually only done if anatomic hemispherectomy fails.

13. What is the success rate of hemispherectomy in reducing seizures?

- A. 25%
- B. 50%
- C. 67%
- D. 100%

14. What type of cells are involved in the development of a low-grade glioma?

- A. Neurons
- B. Glial cells
- C. Blood cells
- D. Muscle cells

15. True or False: Low-grade gliomas are fast-growing tumors.

- A. True
- B. False

16. What is the best surgical option for a low-grade glioma?

- A. Craniotomy
- B. Chemotherapy
- C. Radiation therapy
- D. Immunotherapy

17. What are the potential risks associated with surgery for a low-grade glioma.

- A. loss of hearing
- B. loss of sight

- C. loss of speech and motor functions
- D. loss of smell

18. How is deep brain stimulation (DBS) achieved?

- A. By administering medication
- B. By using lasers to remove brain tissue
- C. By inserting electrodes in specific brain regions
- D. By performing surgery to replace damaged brain cells

19. What is Parkinson's disease?

- A. A disease characterized by involuntary muscle contractions
- B. A movement disorder caused by a deficiency of dopamine
- C. A disease that affects the spinal cord
- D. A disease caused by a bacterial infection

20. What is selective denervation surgery used for in the treatment of dystonia?

- A. To raise the amount of dopamine in the brain
- B. To cut the nerves that control muscle spasms
- C. To delay the body's processing of levodopa
- D. To lessen the intensity of muscle spasms

21. True or False: Parkinson's disease is a disorder that affects a specific area of the brain called the basal ganglia.

- A. True
- B. False

22. True or False: Dystonia is a movement disorder characterized by involuntary muscle contractions that can affect just one part of the body or the entire body.

- A. True
- B. False

23. What are obsessions in OCD?

- A. Recurrent actions that an OCD sufferer feels driven to carry out in reaction to an intrusive thought.
- B. Aversion to contamination or germs.
- C. Excessive cleaning.
- D. Arranging objects in a specific manner.

24. Which of the following is a treatment option for OCD?

- A. Corticosteroids
- B. Selective serotonin reuptake inhibitors (SSRIs)

- C. Insulin
- D. Blood thinners

25. True/False: Compulsions in OCD are actions that the sufferer feels compelled to repeat.

- A. True
- B. False

26. True/False: OCD is a mental illness that is characterized by uncontrollable, recurrent thoughts and/or behaviors.

- A. True
- B. False

Section 8 Multiple Choice Answer Key

1. **Answer:** *C) Inner parts of the brain that control movements*

Explanation: *The main cause of tremors is a problem in the inner parts of the brain that control movements.*

2. **Answer:** *B) False*

Explanation: *Epilepsy is caused by sudden surges of abnormal and excessive electrical activity in your brain and can affect how you appear or act. Excessive physical activity is not a known cause of epilepsy.*

3. **Answer:** *D) Anyone can develop epilepsy*

Explanation: *Epilepsy can occur at any age, and those with a family history of epilepsy may be at a higher risk, but anyone can develop epilepsy.*

4. **Answer:** *A) True*

Explanation: *Seizures have been known to cause hippocampal sclerosis, which is shrinkage and loss of cells in the hippocampus, an area of the brain that plays a role in memory processing, emotions, spatial navigation, and learning.*

5. **Answer:** *B) Temporal Lobe*

Explanation: *In 2/3 cases of intractable epilepsy managed surgically, seizures tend to occur in the temporal lobe.*

6. **Answer:** *B) False*

Explanation: *Huntington's disease is an inherited, progressive disease that is associated with uncontrolled movements, cognitive problems, and psychiatric conditions.*

7. **Answer:** *C) Ataxia*

Explanation: *Ataxia refers to a neurological condition that affects the part of the brain that controls coordinated movement. It may cause uncoordinated or clumsy balance, speech, or limb movements, and other symptoms.*

8. **Answer:** *B) Tourette Syndrome*

Explanation: *Tourette syndrome is associated with repetitive movements and vocal sounds. It typically starts between childhood and teenage years.*

9. **Answer:** *C) Alzheimer's disease*

Explanation: *Deep brain stimulation is not currently an established treatment for Alzheimer's disease. However, research is ongoing to investigate its potential effectiveness for this condition.*

10. **Answer:** *B) In the upper chest, beneath the skin*

Explanation: *The electronic device for deep brain stimulation is typically positioned beneath the skin of the upper chest, and is connected to the electrodes in the brain by a wire that passes beneath the skin.*

11. **Answer:** *A) True*

Explanation: *Brain plasticity refers to the brain's ability to reorganize itself by forming new neural connections.*

12. **Answer:** *A) Functional hemispherectomy removes a smaller region of the brain, while anatomic hemispherectomy removes the parietal, temporal, and occipital lobes.*

Explanation: *The information provided states that functional hemispherectomy involves removing a smaller region of the brain rather than a whole hemisphere and disconnecting the side of the brain, while anatomic hemispherectomy involves removing the parietal, temporal, and occipital lobes of the brain to resolve seizures.*

13. **Answer:** *C) 67%*

Explanation: *About 2/3 (or 67%) of patients who undergo hemispherectomy are seizure-free and live a relatively normal life.*

14. **Answer:** *B) Glial cells*

Explanation: *A low-grade glioma is a brain tumor that originates from glial cells, which are non-neuronal cells that support and protect neurons in the brain.*

15. **Answer:** *B) False*

Explanation: *Low-grade gliomas are slow-growing brain tumors.*

16. **Answer:** *A) Craniotomy*

Explanation: *A craniotomy is the best surgical option for a low-grade glioma.*

17. **Answer:** *C) loss of speech and motor functions*

Explanation: *There are possible complications such as aphasia that may cause a decline in speech and fine motor skills.*

18. **Answer:** *C) By inserting electrodes in specific brain regions*

Explanation: *Deep brain stimulation involves the insertion of electrodes in specific regions of the brain. These electrodes generate electrical impulses that control aberrant impulses and can impact certain brain chemicals and cells. An electronic device, similar to a pacemaker, is implanted beneath the skin of the upper chest and regulates the intensity of the stimulation. The device is connected to the electrodes in the brain by a wire that passes beneath the skin.*

19. **Answer:** *B) A movement disorder caused by a deficiency of dopamine*

Explanation: *Parkinson's disease is a disorder that affects a specific area of the brain called the basal ganglia, leading to a deficiency of the neurotransmitter dopamine. This*

deficiency causes symptoms like delayed movement and tremors, and can also have other effects on mental health, thinking capacity, and more.

20. **Answer:** *B) To cut the nerves that control muscle spasms*

Explanation: *Selective denervation surgery is a treatment for dystonia that involves cutting the nerves that control muscle spasms. This can help to lessen the intensity of the spasms and improve the patient's quality of life.*

21. **Answer:** *A) True*

Explanation: *Parkinson's disease is a disorder that deteriorates a specific area of the brain called the basal ganglia, leading to a deficiency of the neurotransmitter dopamine and causing symptoms like delayed movement and tremors.*

22. **Answer:** *A) True*

Explanation: *Dystonia is a movement disorder characterized by involuntary muscle contractions that can affect just one part of the body (focal dystonia), two or more neighboring parts (segmental dystonia), or the entire body (general dystonia). The severity of the muscle spasms can vary, and they can make it difficult for the patient to carry out everyday activities.*

23. **Answer:** *B) Aversion to contamination or germs.*

Explanation: *Obsessions are anxious-inducing, recurrent thoughts, desires, or mental images that are present in people with OCD. Some examples of obsessions include aversion to contamination or germs, having everything in perfect symmetry or order, or fear of harming oneself or others.*

24. **Answer:** *B) Selective serotonin reuptake inhibitors (SSRIs)*

Explanation: *OCD symptoms might be lessened with the aid of selective serotonin reuptake inhibitors (SSRIs), a kind of serotonin reuptake inhibitors (SRIs). Other treatment options for OCD include cognitive-behavioral therapy (CBT) and exposure and response prevention (ERP).*

25. **Answer:** *A) True*

Explanation: *Compulsions are recurrent actions that an OCD sufferer feels driven to carry out in reaction to an intrusive thought. These actions may provide temporary relief from anxiety but can become time-consuming and interfere with daily life.*

26. **Answer:** A) True

Explanation: *OCD is a frequent, persistent, and long-lasting mental illness characterized by uncontrollable, recurrent thoughts and/or behaviors that the sufferer feels compelled to repeat. These thoughts and behaviors can cause significant distress and may interfere with daily life.*

Section 9 Multiple Choice Questions

1. What is a fellowship?

- A. A training period for doctors
- B. A program for enrolling into a medical school
- C. An optional study of a specific field of medicine
- D. None of the above

2. What is the primary difference between neurosurgery and orthopedic spinal surgery?

- A. Neurosurgery focuses on bone and joint disorders while orthopedic spinal surgery focuses on conditions that affect the nervous system.
- B. Neurosurgery focuses on conditions that affect the nervous system while orthopedic spinal surgery focuses on bone and joint disorders in relation to the spine.
- C. Neurosurgery focuses on conditions that affect the digestive system while orthopedic spinal surgery focuses on conditions that affect the respiratory system.
- D. Neurosurgery and orthopedic spinal surgery are the same thing.

3. What test do students need to take to get into medical school?

- A. LSAT
- B. GMAT
- C. MCAT
- D. GRE

4. Which of the following is NOT a condition that a neurosurgeon may treat?

- A. Brain tumors
- B. Cerebrovascular disease

- C. Muscular dystrophy
- D. Hydrocephalus

5. What is the use of GPS-like tracking systems in robotic spine surgery?

- A. To help the surgeon in precise placement of screws and other hardware when repairing a damaged or deformed spine
- B. To help the surgeon see inside the patient's body
- C. To help the patient recover faster
- D. To help the patient feel less pain after surgery

6. True or False: Robotic spine surgery is a type of surgery that does not involve any incisions.

- A. True
- B. False

7. What is embolization?

- A. A technique used in interventional neuroradiology to treat head, neck and spinal tumors
- B. A type of medical imaging test
- C. A surgical procedure to remove brain aneurysms
- D. A medication to treat heart disease

8. What techniques are used in interventional neuroradiology to guide catheters and other instruments around the arteries and veins in the head, neck or spine?

- A. Physical palpation
- B. Blood tests
- C. Medical imaging tests
- D. Hearing tests

9. True or False: Interventional neuroradiology is a subspecialty of clinical radiology.

- A. True
- B. False

10. What type of technology is used to guide minimally invasive spine procedures?

- A. Microscopes
- B. Stethoscopes
- C. Imaging technology
- D. Ultrasound technology

11. True or False: The purpose of image-guided therapeutic pain management services is to help patients prepare for surgery.

- A. True
- B. False

12. True or False: Nurse practitioners working in neurosurgery are not involved in coordinating with other healthcare providers.

- A. True
- B. False

13. True or False: MD/PhDs in neurosurgery are trained to perform non-surgical treatments and research only.

- A. True
- B. False

14. True or False: MD/PhDs in neurosurgery are not required to adhere to ethical and legal standards in their practice.

- A. True
- B. False

15. Interventional radiologists primarily use surgical techniques to treat conditions such as tumors and vascular disease.

- A. True
- B. False

16. Out of the following fields, which fields should Neurosurgery MD have a very strong foundation in?

- A. Anatomy
- B. Anthropology
- C. Pharmacology
- D. Both A and C

17. True Or False: You should spend your undergraduate years participating in internships and volunteer work.

- A. True
- B. False

18. Which strand closes a wound with multiple suture strands?

- A. Continuous
- B. Steady
- C. Disrupted
- D. Interrupted

- 19. True or False: The internal organs are positioned above the layer of tissue.**
A. True
B. False
- 20. Where is the subcutaneous suture positioned?**
A. Dermis
B. Mucosa
C. Mesoderm
D. Hypodermis
- 21. True or False: When a knot is tied, should it be as small as possible?**
A. True
B. False
- 22. When doing a one-handed knot should you pick up the short end or long end first?**
A. Short end
B. Long end
C. Medium
D. None of the above
- 23. True or False: When doing a two-handed knot, the suture ends should not be crossed.**
A. True
B. False
- 24. Which knot is normally formed inside the incision and is mainly used for large sutures in deep areas of the body?**
A. Instrument Tie
B. Buried Knot
C. Surgeons Knot
D. Two-Handed Knot
- 25. Which instrument is used to cut through skin and tissues?**
A. Sapphire Blade
B. Scalpels
C. Dissecting Scissors
D. Retractors
- 26. Which one of these is not a part of the brain?**
A. Cerebrum

- B. Cerebellum
- C. Mesothelium
- D. Medulla

27. Which part of the brain is responsible for controlling conscious thought and movement?

- A. Thalamus
- B. Brain stem
- C. Medulla
- D. Cerebrum

28. True or False: Hypothalamus is located above the Thalamus.

- A. True
- B. False

Section 9 Multiple Choice Answer Key

1. **Answer:** C. *An optional study of a specific field of medicine*

Explanation: *Fellowships are not required in a surgeon's career path; however, certain individuals receive the chance to spend 1 to 3 years studying a specific field of medicine more in depth.*

2. **Answer:** B. *Neurosurgery focuses on conditions that affect the nervous system while orthopedic spinal surgery focuses on bone and joint disorders in relation to the spine.*

Explanation: *The primary difference between neurosurgery and orthopedic spinal surgery is the focus of their practice. Neurosurgeons are specialized in conditions that affect the nervous system such as the brain, spinal cord, and nerves. They primarily deal with conditions such as brain tumors, spinal cord injuries, and nerve disorders. On the other hand, orthopedic spinal surgeons are specialized in spinal conditions and focus more on bone and joint disorders in relation to the spine. They primarily deal with conditions such as spinal stenosis, herniated discs, and fractures of the spine.*

3. **Answer:** C. *MCAT*

Explanation: *Students who want to enroll in medical school need to take the MCAT (Medical College Admission Test).*

4. **Answer:** *C. Muscular dystrophy*

Explanation: *Neurosurgeons primarily treat conditions that affect the nervous system such as brain tumors, cerebrovascular disease, hydrocephalus, etc. Muscular dystrophy is a group of diseases that cause progressive weakness and loss of muscle mass.*

5. **Answer:** *A. To help the surgeon in precise placement of screws and other hardware when repairing a damaged or deformed spine.*

Explanation: *Robotic spine surgery procedures can use GPS-like tracking systems to assist the spine surgeon in precise placement of screws and other hardware when repairing a damaged or deformed spine.*

6. **Answer:** *False*

Explanation: *Robotic spine surgery involves making small incisions through which the robotic arms and instruments are inserted.*

7. **Answer:** *A. A technique used in interventional neuroradiology to treat head, neck and spinal tumors.*

Explanation: *Embolization involves injecting medical grade ‘glue’, special tiny coils or sand-like particles into the blood vessels of a tumor to block blood flow to the tumor and cause it to shrink or die.*

8. **Answer:** *C. Medical imaging tests.*

Explanation: *Interventional neuroradiologists use cutting-edge imaging and guidance techniques to guide catheters and other tiny instruments around the arteries and veins in the head, neck or spine, such as X-rays and CT scans.*

9. **Answer:** *True*

Explanation: *Interventional neuroradiology involves the use of medical imaging tests in diagnosing and treating diseases of the central nervous system, head, neck and spine.*

10. **Answer:** *C. Imaging technology*

Explanation: *Imaging technology precisely guides minimally invasive procedures with needles, catheters and other devices. It allows for the surgeons to know the precise location of where the instruments need to be for optimal surgery. Some imaging technology includes CT scans, MRI scans, PET scans, and more.*

11. **Answer:** *False*

Explanation: *The purpose of image-guided therapeutic pain management services is to manage pain without surgery and in some cases avoid surgery altogether.*

12. **Answer:** *False*

Explanation: *One of the general duties of nurse practitioners working in neurosurgery is to coordinate with other healthcare providers, especially for follow-up care. In addition, nurse practitioners working in neurosurgery are to manage pain and other symptoms of patients post-surgery, along with monitoring them for complications.*

13. **Answer:** *False*

Explanation: *MD/PhDs in neurosurgery may perform both surgical and non-surgical treatments, depending on the patient's needs.*

14. **Answer:** *False*

Explanation: *MD/PhDs in neurosurgery must adhere to ethical and legal standards in their practice, such as informed consent and patient privacy, to ensure the safety and well-being of their patients.*

15. **Answer:** *False*

Explanation: *Interventional radiologists primarily use minimally invasive techniques, such as needles, catheters, and other small instruments, to treat conditions. They may use surgical techniques in some cases, but the goal is to minimize the invasiveness of the procedure.*

16. **Answer:** *D*

Explanation: *Neurosurgery MD focuses heavily on the human anatomy and structure, and the effect of certain medications and drugs within the human brain.*

17. **Answer:** *True*

Explanation: *Spending your time gaining experience in the medical field, whether it be research or an internship, will look favorable on your resume.*

18. **Answer:** *D*

Explanation: *Interrupted sutures include closing the wound with multiple suture strands. This material is cut and knotted off when a stitch is made.*

19. **Answer:** *False*

Explanation: *The internal organs are positioned beneath the layer of tissue.*

20. **Answer:** *A*

Explanation: *Subcutaneous sutures are positioned in your dermis. Short stitches are positioned parallel to the incision in a line.*

21. **Answer:** *True*

Explanation: *Each knot should be as small as possible, as to reduce any foreign.*

22. **Answer:** *Short End*

Explanation: *The reason why you should pick up the short end first when tying a one-handed knot is that the short end is the end of the rope or cord that you will be manipulating to create the knot. The long end is typically used as a passive anchor to create tension or to secure the knot in place once it's tied. By starting with the short end, you can create the loop and guide the long end around it to create the knot with greater control and precision.*

23. **Answer:** *False*

Explanation: *When tying a two-handed knot, it is common practice to cross the suture ends to create a secure knot. This technique allows for the knot to be tightened firmly and reduces the likelihood of the knot slipping or coming undone. To tie a two-handed knot, start by grasping both ends of the suture with both hands, and then cross one end*

over the other to create a loop. Then, pass one end through the loop and tighten the knot by pulling on both ends of the suture.

24. Answer: B

Explanation: *Buried knots are usually formed inside the incision and are mainly used for large sutures in deep areas of the body.*

25. Answer: C

Explanation: *Dissecting scissors are primarily used to cut through skin and tissues.*

26. Answer: C

Explanation: *The mesothelium is the layer of tissues that surrounds the organs of the chest. It is not part of the brain.*

27. Answer: D

Explanation: *The cerebrum is the largest part of the brain and is responsible for controlling conscious thought, movement, and sensation.*

28. Answer: False

Explanation: *The hypothalamus is located below the thalamus.*

Section 10 Multiple Choice Questions

1. What are the ridges and grooves on the outer layers of the cerebrum called?

- A. Fissures and bumps
- B. Convulsions and depressions
- C. Gyri and sulci
- D. Arteries and veins

2. True or False: Sheep brains are larger than human brains.

- A. True
- B. False

3. What is the layer of protective tissue covering the brain made of?

- A. Bone
- B. Cartilage
- C. Meninges
- D. Muscle

4. What are the three layers of meninges that protect the brain?

- A. Pons, midbrain, and cerebellum
- B. Dura mater, arachnoid mater, and pia mater
- C. Olfactory bulbs, optic nerves, and spinal cord
- D. Amygdala, hippocampus, and thalamus

5. True or False: the olfactory bulbs are located in the cerebellum.

- A. True
- B. False

6. True or False: to preserve the brain, it should be laid down on its spinal cord side.

- A. True
- B. False

7. What is the purpose of making a vertical section to separate the two hemispheres of the brain?

- A. To identify the hypothalamus
- B. To expose the endocrine glands
- C. To see the internal structure of the brain
- D. To separate the cerebrum from the cerebellum

8. True or False: the use of a teasing needle is not recommended during brain dissection.

- A. True
- B. False

9. Which structure is responsible for connecting the two hemispheres of the brain?

- A. Pons
- B. Thalamus
- C. Corpus callosum
- D. Medulla

10. Which region is made up of the thalamus, hypothalamus, and third ventricle?

- A. Cerebellum
- B. Occipital lobe
- C. Diencephalon
- D. Frontal lobe

11. True or False: the pituitary gland is located between the medulla and the occipital lobe.

- A. True
- B. False

12. True or False: the occipital lobe is responsible for processing visual information.

- A. True
- B. False

13. Which tissue is white matter in the cerebellum?

- A. Nerve cell bodies
- B. A collection of nerve fibers
- C. Dark matter
- D. A branching tree of tissue

14. What is the dark tissue surrounding the white matter in the cerebellum?

- A. Nerve axons
- B. A collection of nerve fibers
- C. Gray matter
- D. A branching tree of tissue

15. True or False: The gyrus and sulci can be observed on a transverse section of the brain.

- A. True

B. False

16. True or False: The sacrum and coccyx are part of the spine.

- A. True
- B. False

17. What are the flexible joints that link the vertebrae together called?

- A. Cartilage
- B. Ligaments
- C. Facets
- D. Tendons

18. What is the purpose of a brain simulation software?

- A. To treat neurological disorders
- B. To study the brain without using live samples
- C. To perform brain surgeries
- D. To diagnose brain injuries

19. True or False: Both orthopedic surgeons and neurological surgeons can perform spine surgery.

- A. True
- B. False

20. True or False: CT scans can only be done without contrast.

- A. True
- B. False

21. What does a PET scan reveal?

- A. Detailed images of organs, blood vessels, bones, and muscles
- B. Abnormalities, rhythms, and background activity in brain wave patterns
- C. Parts of the body that require more energy and show "hot spots" or "cold spots"
- D. Areas in the brain that require electrical stimulation

22. What is the purpose of the Health Insurance Portability and Accountability Act (HIPAA)?

- A. To protect sensitive patient health information from being disclosed without the patient's consent or knowledge
- B. To create national standards for medical imaging tests
- C. To provide insurance coverage for all Americans
- D. To regulate medical device implants

Section 10 Multiple Choice Answer Key

1. **Answer:** *C. Gyri and sulci*

Explanation: *The information provided states that the folds on the outer layers of the cerebrum are called gyri (ridges) and sulci (grooves).*

2. **Answer:** *B. False*

Explanation: *The information provided states that sheep brains are much smaller than human brains and are roughly the size of a human fist.*

3. **Answer:** *C. Meninges*

Explanation: *The information provided states that the layer of protective tissue covering the brain is made of meninges, including the dura mater, arachnoid mater, and pia mater.*

4. **Answer:** *B. Dura mater, arachnoid mater, and pia mater*

Explanation: *The information provided states that the layer of protective tissue covering the brain is made of three layers of meninges: dura mater, arachnoid mater, and pia mater.*

5. **Answer:** *B. False*

Explanation: *The information provided states to turn the brain over and identify the olfactory bulbs, which are located in the front part of the brain and are part of the olfactory system responsible for sense of smell. The cerebellum is located at the back of the brain and is responsible for motor control.*

6. **Answer:** *B. False*

Explanation: *The information provided states to preserve the brain by laying it down on its flat side with the spinal cord facing out the sides.*

7. **Answer:** *C. To see the internal structure of the brain*

Explanation: *The information provided states that making a vertical section separates the two hemispheres of the brain and allows for a view of the internal structure of the brain.*

8. **Answer:** *False*

Explanation: *The information provided suggests using a teasing needle to gently probe the parts of the brain to get a better view. However, it is important to be careful not to damage the delicate structures of the brain.*

9. **Answer:** *C. Corpus callosum*

Explanation: *The corpus callosum is a bundle of white fibers that connects the two hemispheres of the brain, as stated in the information provided*

10. **Answer:** *C Diencephalon*

Explanation: *The information provided states that the diencephalon is a region made up of the thalamus, hypothalamus, and third ventricle.*

11. **Answer:** *B. False*

Explanation: *The information provided states that the pituitary gland is located between the pons and the optic chiasm. It is not located between the medulla and occipital lobe.*

12. **Answer:** *A. True*

Explanation: *The occipital lobe is responsible for processing visual information, as stated in the information provided.*

13. **Answer:** *B. A collection of nerve fibers.*

Explanation: *The white matter in the cerebellum is made up of nerve axons, which are a collection of nerve fibers.*

14. **Answer:** *C. Gray matter.*

Explanation: *The dark tissue surrounding the white matter in the cerebellum is made up of a collection of nerve cell bodies, which is called gray matter.*

15. **Answer:** *A. True*

Explanation: *The gyrus and sulci are the folds and grooves on the surface of the cerebral hemisphere, and they can be observed on a transverse section of the brain.*

16. **Answer:** *A. True*

Explanation: *The sacrum and coccyx are part of the spine. The sacrum is a large triangular bone at the base of the spine, while the coccyx is a small bone at the very end of the spine.*

17. **Answer:** *C. Facets.*

Explanation: *The vertebrae link together through flexible joints called facets, which allow for movement and flexibility in the spine.*

18. **Answer:** *B. To study the brain without using live samples.*

Explanation: *A brain simulation software allows scientists to research and study the brain without necessarily having to use live samples.*

19. **Answer:** *A. True.*

Explanation: *Both orthopedic surgeons and neurological surgeons are qualified to perform spine surgery, although they may have different specialties and areas of expertise.*

20. **Answer:** *B. False*

Explanation: *CT scans can be done with or without contrast. When done with contrast, contrast material is inserted via IV or orally to provide a clearer picture of the organs and vessels.*

21. **Answer:** *C. Parts of the body that require more energy and show "hot spots" or "cold spots"*

Explanation: *PET scans reveal areas of the body that require more energy, such as cancer cells, and show up as "hot spots" or "cold spots" on the scan.*

22. **Answer:** *A. To protect sensitive patient health information from being disclosed without the patient's consent or knowledge*

Explanation: *The purpose of HIPAA is to protect sensitive patient health information from being disclosed without the patient's consent or knowledge.*

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