Anatomy 14
Nervous System Lab
Dr. J. Lim

Neuron Anatomy
Utilizing the lecture notes and book diagrams:

- **Draw** a typical multipolar motor neuron. **Label and describe** the primary function of the three parts listed.
  - Cell body
  - Dendrites
  - Axon

  - Next add myelination to your drawing.
    - would tissue with many myelinated axons be gray or white? _________
    - would tissue with many nerve cell bodies be gray or white? _________

- **Compose** a paragraph describing how a nerve impulse is transmitted from one neuron to another. Be sure to include the following terms:
  - Action potential
  - Synaptic knob
  - Neurotransmitter
  - Synaptic cleft
  - Receiving (postsynaptic) membrane

Neuron Classification
Utilizing your lecture notes and textbook:

- **Name and describe** the three classes of neurons based upon their function.

The Human Brain
Utilizing a brain model, textbook and your notes:

- Discuss the externally visible regions of the cerebral hemispheres, diencephalons, brain stem and cerebellum.

- Locate on a model, then **draw and describe** the regions of the cerebral hemisphere that controls each of the following functions:
  - Motor movement
  - Sensory perception
  - Sight
  - Reasoning
  - Hearing
  - Smell
• SHEEP BRAIN DISSECTION
  o Obtain sheep brain, gloves, dissecting tray and instruments
  o Lateral view: View your sheep brain from the lateral aspect (from the side)
    • Compare relative sizes of the cerebrum, brain stem and cerebellum of the sheep brain to the human brain

  • which of these structures are most prominent in humans?
  • Locate the frontal, parietal, occipital and temporal lobes
  • Locate the central sulcus. Which two lobes does it separate?
    o Dorsal view: Place the sheep brain on the tray inferior surface down
      • Observe the pia mater (innermost meninge) extending down into the sulci/fissures on the superior and lateral surfaces of the brain
      • Cut through this meningeal tissue along the longitudinal fissure. Gently force the cerebral hemispheres apart laterally to expose the corpus callosum, the large fiber tract deep to the longitudinal fissure
      • Carefully dissect open some sulci. Note their depth compared to the longitudinal fissure.
      • Examine the cerebellum. Note that in contrast to humans, it is not divided longitudinally.
Olfactory bulbs: Note the club-like olfactory bulbs on the inferior surface of the frontal lobes of the cerebral hemispheres.

How does the size of these olfactory bulbs compare with those in humans?

Can you surmise as to whether the sense of smell more important for food acquisition/protection in sheep or humans?

- Optic Chiasm: Note the X-shaped structure. Locate the
  - optic nerve - carries sensory impulses from the retina
  - optic chiasm – site where fibers from each optic nerve cross over to the opposite side
  - optic tracts - nerve posterior to the chiasm

- Pituitary: Stalk of the pituitary gland is posterior to the chiasm
  - this structure may or may not be present

- Brain Stem: Locate the midbrain, pons and medulla oblongata posterior to the chiasm
• **Internal structures:** With the brain ventral side down, obtain the large knife and make a mid-sagittal cut along the longitudinal fissure and midline of the cerebellum creating equal left and right halves. Share half of the brain with a group without a specimen as needed.

• Diencephalon: Identify the thalamus and hypothalamus
• Brain Stem: Locate the midbrain, pons and medulla oblongata
• Cerebellum: Notice the treelike arrangement of its white matter
• Dispose of your brain specimen as directed and wash/dry/return the dissection instruments.
• Wash your desktop with Simple Green and your hands with soap and water.

**Spinal Cord**

Describe the composition of the following parts of the spinal cord:

- Gray matter
- Dorsal root
- Dorsal root ganglion
- Ventral root
- Spinal nerves

**The Reflex Arc**

Label and describe the function of each element of the reflex arc:

- Receptor
- Sensory neuron
- Interneuron (add it in)
- Motor neuron
- Effector
Neural Tissue - Microscope

View the following slides.

- Indicate the presence (+) or absence (-) of nerve cell bodies or axons in the table
- In all cases, begin viewing at 40X before increasing mag
- Next sketch as instructed at the magnifications indicated.

<table>
<thead>
<tr>
<th>Slide Description</th>
<th>Nerve Cell bodies</th>
<th>Axons</th>
<th>Sketch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spinal Cord Is &amp; cs</td>
<td></td>
<td></td>
<td>Is and cs at 40X</td>
</tr>
<tr>
<td><em>Note the difference between gray/white matter at 400X</em></td>
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<tr>
<td>Spinal Cord and ganglion cs</td>
<td></td>
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<td>dorsal root ganglion at 100X</td>
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<tr>
<td><em>After viewing the spinal cord at 40X, zoom in on the ganglion at 100X</em></td>
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<tr>
<td>Nerve cells smear</td>
<td></td>
<td></td>
<td>Draw the recognizable parts of one or two neurons at 400X</td>
</tr>
<tr>
<td><em>Look for neuron parts (dendrites, nerve cell bodies &amp; axons)</em></td>
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<td></td>
<td></td>
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<tr>
<td>Cerebellum</td>
<td></td>
<td>40X</td>
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<tr>
<td><em>Note the presence of gray/white matter and sulci/gyri at 40X</em></td>
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<tr>
<td>Sciatic Nerve Is</td>
<td></td>
<td>100X</td>
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<tr>
<td><em>Note the long axons at 100X</em></td>
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</tbody>
</table>
Peripheral Nerves

Note the many axons in transverse section at 400X

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<th>400X</th>
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**Spinal Reflexes – Reflex Hammer**

- **Reflexes** are rapid, predictable and involuntary one-way responses to a stimulus
- **Spinal reflexes** are rapid, predictable and involuntary one-way responses to a stimulus mediated through the center of the spinal cord without brain involvement
- **Somatic Reflexes** are rapid, predictable and involuntary one-way contractions of skeletal muscle in response to a stimulus mediated through the center of the spinal cord without brain involvement

- **Patellar (knee-jerk) reflex**

  o Seat the subject on the lab bench with legs hanging free (or the knees crossed)
  o Tap the patellar ligament sharply with the reflex hammer just below the knee to elicit response
    - Note: knee-jerk reflex assess the L2-L4 level of the spinal cord
  o Test both knees and record your observations.

  o Which muscle contracted?
• **Achilles (ankle-jerk) reflex**

  - Remove your shoe
  - Have your partner use one hand to dorsiflex your foot to increase tension on the Achilles tendon and gastrocnemius (calf) muscle
  - Sharply tap the Achilles tendon with a reflex hammer
    - Note: ankle-jerk reflex assesses the first two sacral segments of the spinal cord
  - Describe the result?
  - Name the muscle contracted:

• **Babinski (plantar) Reflex**

  - Babinski's reflex occurs when the big toe moves toward the top surface of the foot and the other toes fan out after the sole of the foot has been firmly stroked.
  - Babinski's reflex is one of the reflexes that occurs in infants. It is normal in children up to 2 years old, but it disappears as the child gets older and the nervous system becomes more developed. It may disappear as early as 12 months.

  The presence of a Babinski's reflex after age 2 is a sign of damage to the nerve tracts connecting the spinal cord and the brain (the corticospinal tract). This tract runs down both sides of the spinal cord. A Babinski’s reflex can occur on one side or on both sides of the body.

  - Firmly stroke the sole of the subject's foot from heel to the ball of the foot near the big toe using the end of the reflex hammer handle
  - Describe the plantar response elicited:
  - The presence of a Babinski reflex could mean a problem in
• Romberg Test

The cerebellum receives input from the vestibular system (inner ear) the visual system and the peripheral nervous system (proprioception) to help maintain balance and equilibrium.

The Romberg Test consists of testing balance before and after one of the three systems (vision) is inactivated. If the other two systems that help maintain balance are functioning, the patient will be able to maintain balance.

A normal patient may experience subtle swaying with their eyes closed, but should not lose balance.

The field sobriety test for driving under the influence contains variations of the Romberg test.

A positive Romberg's sign (inability to maintain steady balance with eyes closed) indicates one or more of the following problems:

• Vestibular ataxia (vertigo) - problems with the inner ear or sensory feedback

• Cerebellar ataxia - problems with cerebellum or neural pathways supplying it

• Proprioceptive dysfunction - damaged proprioceptive sensors in the muscles and/or joints resulting in faulty feedback positional data to the cerebellum; thereby causing cerebellar ataxia.

Procedure:

• check steadiness of balance with feet together and eyes OPEN

• with eyes now closed, examiner nudges SLIGHTLY the subject at the right and then the left shoulders to check for ability to compensate and regain posture

  o IMPORTANT: examiner should stand close be prepared to rescue the subject if sway is excessive at any time

Describe your results:

A positive Romberg's sign could mean a problem in which structures/regions of the nervous system?