Objectives
After completing this laboratory, the student will be able to:

1. provide the name, number, and functions of the twelve pairs of cranial nerves.
2. perform and recall one or more functional tests for each cranial nerve pair.
3. identify major components of the brain.
Cranial Nerve Pair I: Olfactory Nerves (CN I)

The olfactory nerve pair carries the sensory information for the special sense of smell.

To test the function of the olfactory nerves, ask the subject to close his or her eyes, waft a series of substances under his or her nose, and ask him or her to identify the odor.

On the brain model at this station and on the illustrations below, identify the following:

- **olfactory tracts and bulbs** (light structures with bulbous ends on inferior surface of the frontal lobes of the cerebrum on the large brain model)
- **the primary olfactory cortex (i.e. primary receptive area for the special sense of smell)** located in the inferomedial surface of the temporal lobe of the cerebrum. (This region, colored orange on the large brain models in the lab, is called the uncus.)
Cranial Nerve Pair II: Optic Nerves (CN II)

The optic nerve pair transmits **sensory** visual information from the retina to the brain for the special sense of sight.

To test the functionality of the optic nerves, perform the following tasks:

- Read the time off the clock with both eyes. Then do the same with each eye individually.
- Close your eyes and gently press on the side of your eye. *What do you see?*
- Perform the blind spot test. To do this, hold the index card with the dot and the “x” on it at arm’s length away from your nose. Close your left eye and focus on the dot (not on the “x”). Slowly move the card toward your nose until the “x” disappears. You have found your blind spot. *Explain why you have a blind spot, and why you don’t notice it?*
- Perform the test for colorblindness by reading the numbers on the color test plates at this station.

*On the brain model at this station and on the illustrations below, identify the following:*

- **the optic nerves, optic chiasm, and optic tracts** on the inferior surface of the brain.
- **the primary visual cortex (i.e. the primary receptive area for the special sense of sight) located in the occipital lobe** (colored green on the large brain model) of the cerebrum.
Cranial Nerve Pair III: Oculomotor Nerves (CN III)

The oculomotor nerve pair has many motor functions including the following:

- conducts motor information to four of the six extraocular eye muscles that control movement of the eyeball. See page 6 for list of muscles controlled by CN III.
- conducts motor information to the intraocular eye muscles that control the size of pupil.
  - What is the purpose of this?
- conducts motor information to the intraocular eye muscles that control the shape of the lens.
  - What is the purpose of this?

To test the motor functionality of the oculomotor nerve pair, perform the following tasks:

- Instruct the subject to follow your finger with his or her eyes as you move it up and down, side to side, and diagonally. CN III is usually tested in conjunction with CN IV and CN VI while looking for fluid eye movements.
- Shine a penlight into the subject’s right eye and observe constriction of the pupil in that same eye (direct light reflex).
- Shine a penlight into the subject’s right eye and observe constriction of the pupil in the opposite eye (consensual light reflex).
- Test the subject’s ability to focus (accommodation reflex) by having him or her stare at the “Magic Eye” pictures until the 3-D objects appear.
Cranial Nerve Pairs IV and VI: Trochlear Nerves and Abducens Nerves, Respectively (CN IV and CN VI)

CN IV, VI, and III are usually examined together. CN IV and CN VI conduct motor information to two of the six extraocular eye muscles that move the eyeballs. More specifically, CN IV (trochlear) innervates the superior oblique muscle while CN VI (abducens) innervates the lateral rectus muscle in each eye. CN III (oculomotor) innervates all the other extraocular eye muscles: superior rectus, inferior rectus, medial rectus, and inferior oblique.

To examine the motor functionality of these cranial nerve pairs, perform the following test: Holding your index finger approximately one foot in front of the subject’s face. Instruct the subject to follow your finger as you move your finger up and down, side to side, and diagonally.

On the brain model at this station, identify the nerve roots of CN IV, CN VI, and CN III. To do this, observe the anterolateral surfaces of the brainstem and the diagram on page 2.
Cranial Nerve Pair V: Trigeminal Nerves (CN V)

The trigeminal nerve pair is considered a mixed nerve pair, because it has both sensory and motor functions. First, CN V conducts general sensory information from the scalp, forehead, nose, cheeks, lower jaw, gums, and teeth. Second, CN V conducts motor information to skeletal muscles involved in mastication (i.e. chewing). The muscles innervated by CN V include but are not limited to the masseter and temporalis.

To test the sensory function of the trigeminal nerve pair, instruct the subject to close his/her eyes while poking the skin of his or her forehead with your finger. Have the subject indicate when he or she felt the sensation by saying, “now”. Repeat the procedure for the cheek and the mandible.

To test the motor function of the trigeminal nerve pair, instruct the subject to elevate and depress his or her mandible and to move his or her mandible from side to side.

*On the brain model at this station and on the illustration on the right below, identify the primary somatosensory cortex in the postcentral gyrus of the parietal lobe (dark blue in color on the brain model).*
Cranial Nerve Pair VII: Facial Nerves (CN VII)

The facial nerve pair is considered a **mixed** nerve pair because it has both sensory and motor functions. First, CN V conducts **sensory** taste information from the **anterior two-thirds** of the tongue for the special sense of taste. Second, CN V conducts **motor** information to the muscles responsible for facial expressions. The muscles innervated by CN V include but are not limited to the zygomaticus major and orbicularis oris.

To test the **sensory** function of the facial nerve pair, ask the subject to take the Pepsi v. Coke Taste Test. To perform this functional test, ask the subject to close his or her eyes and give him or her a small sample of either Pepsi or Coke. Then wait one minute and give him or her a small sample of the other soft drink. Then ask the subject to open his or her eyes and indicate which sample was the Pepsi and which sample was the Coke.

To test the **motor** function of the facial nerve pair, instruct the subject to perform the following actions: pucker the lips, wink the eye, puff the cheeks, and smile.

*On the brain model at this station, identify the **gustatory cortex** (i.e. **primary receptive area for the special sense of taste**) located in the **insula** (a small lobe deep to the lateral sulcus).*
Cranial Nerve Pair VIII: Vestibulocochlear Nerves (CN VIII)

The vestibulocochlear nerve pair conducts sensory signals to the brain regarding equilibrium (balance) and audition (hearing).

To test the vestibular (i.e. equilibrium/balance) function of this nerve pair, spin the subject in a chair for about ten to fifteen seconds. Stop the chair and immediately observe the oscillations of the subject’s eyeball. This eye movement occurring for a few moments after rotation of the head is referred to as nystagmus. Nystagmus should end fairly quickly after spinning in the chair has stopped.

To test the cochlear (i.e. audition/hearing) function of this nerve pair, stand behind the seated subject holding a tuning fork. Ask the subject to close his or her eyes. Strike the tuning fork on the sole of your shoe and hold the tuning fork behind one of the subject’s ears. Ask the subject to identify the location of the sound.

*On the ear model at this station and on the illustration at the left below, identify the vestibular portion and the cochlear portion of the vestibulocochlear nerve.*

*On the brain model at this station and on the illustration to the right below, identify the primary auditory cortex (i.e. primary receptive area for the special sense of hearing) located on the superior temporal gyrus (colored orange in the large brain model) of the temporal lobe of the cerebrum.*
**Cranial Nerve Pair IX: Glossopharyngeal Nerves (CN IX)**

The glossopharyngeal nerve pair is considered a *mixed* nerve pair because it has both sensory and motor functions. First, CN IX conducts *sensory* taste information from the **posterior one-third** of the tongue. Second CN IX conducts *sensory* information from the pharyngeal walls to the brain. Third, CN IX conducts *motor* information to the stylopharyngeus muscle of the throat to allow for the elevation of the pharynx during swallowing.

To test the sensory and motor functions of the glossopharyngeal nerve pair as it relates to pharyngeal wall sensation and the motor operation of the stylopharyngeus muscle, test for the gag reflex as follows:

- **Warning!** Don’t stand directly in front of your patient! While depressing the subject’s tongue with a tongue depressor, lightly touch the side walls of the subject’s pharynx (throat) with a cotton tipped applicator.
- Observe the movement of the uvula and pharynx.

Next time you get a sore throat, appreciate the existence of this nerve.
Cranial Nerve Pair X: Vagus Nerves (CN X)

The vagus nerve pair is considered a **mixed** nerve because it has both sensory and motor functions. First, CN X conducts **visceral sensory** information from the heart, lungs and most abdominal organs. Second, CN X also conducts **general sensory** information from the laryngopharynx and pharynx. Third, CN X conducts **somatic motor** information to skeletal muscles in the pharynx and larynx. Fourth, CN X conducts **visceral motor** information to smooth muscle in the organs of the thoracic and abdominal cavities.

Usually, cranial nerves IX (glossopharyngeal) and X (vagus) are tested simultaneously.

To test the **somatic motor** portion of CN X, hold your hand over your throat and swallow, palpating the structures that make up the pharynx and larynx as you do so.

Signs of injury to either the right or left vagus nerves can include the following: hoarseness in the voice, difficulty in swallowing, and deviation of the uvula to one side of the pharynx.
Cranial Nerve Pair XI: Spinal Accessory Nerves (CN XI)

The spinal accessory nerve conducts motor information to muscles of the neck that move the head, specifically the sternocleidomastoid and trapezius muscles.

To test the motor function of the spinal accessory nerve as it relates to the sternocleidomastoid, perform the following:

1. Using your hand, apply pressure to the side of the subject’s head and instruct him or her to resist the pressure from your hand.
2. Repeat step 1 on the opposite side of the head.
3. Using your hand, apply pressure to the subject’s forehead and instruct him or her to resist the pressure from your hand.

To test the motor function of the spinal accessory nerve as it relates to the trapezius, apply pressure to the subject’s shoulders while he or she is seated and ask him or her to shrug the shoulders.
Cranial Nerve Pair XII: Hypoglossal Nerves (CN XII)

The hypoglossal nerve pair conducts motor information to the intrinsic and extrinsic muscles of the tongue.

To test the motor function of the hypoglossal nerve pair, perform the following:

- Instruct the subject to stick the tongue straight out.
- Observe the movement of the tongue and check for any deviations to the left or right.
- Instruct the subject to move the tongue to the left and then to the right.
- Observe the movement of the tongue.
- Instruct the subject to retract the tongue and close the mouth.
In the chart below, write the names of the cranial nerve pairs and provide their specific functions.

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<thead>
<tr>
<th>Name of Cranial Nerve</th>
<th>Function of Cranial Nerve</th>
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<tbody>
<tr>
<td>I</td>
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<tr>
<td>II</td>
<td>sensory:</td>
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<td>III</td>
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<td>XI</td>
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<td>XII</td>
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Basic Brain Anatomy

Identify on the brain models in the lab and label on the lateral illustration below the following components of the brain:

- cerebrum
- cerebellum
- frontal lobe
- parietal lobe
- temporal lobe
- occipital lobe
- gyrus (gyri – plural)
- sulcus (sulci – plural)
- superior temporal gyrus
- central sulcus
- lateral sulcus
Identify on the brain models in the lab and label on the midsagittal illustration below the following components of the brain:

- cerebrum
- cingulate gyrus
- corpus callosum
- thalamus
- hypothalamus
- pituitary gland
- midbrain (mesencephalon)
- pons
- medulla oblongata
- cerebellum
Cranial Meninges

Label the following features on the illustration below.

- skull
- dura mater
- arachnoid mater
- pia mater
- gray matter
- white matter