Neuroanatomy Tutorial

Human Structure Lab #21
Modified from Dr. Len White – Brain and Behavior
Many images from Neurosciences, 5th edition.
For the Neuroanatomy lab and this tutorial your main goal is to locate the basic features of the brain. Dr. White will join us during our Human Structure lab to help guide you through these structures.

**GOALS and OBJECTIVES:**

- Demonstrate the four paired lobes of the cerebral cortex and identify by name and location, the boundaries of each.
- Identify structures of the brainstem and the cranial nerves.
- Identify the major vessels supplying the lobes of the brain and the spinal cord.
- Identify the dural venous sinuses formed by the folding of the dura mater.
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SURFACE FEATURES
**Basic surface features of the brain**

**Lobes:** Frontal, parietal, occipital, temporal  
**Fissures:** Longitudinal fissure (superior sagittal fissure) – separates R & L hemispheres  
Lateral (Sylvian) fissure/lateral sulcus – separates frontal & parietal from temporal  
**Sulci:** Central sulcus – between frontal & parietal lobes  
**Gyri:** Pre-central gyrus – frontal lobe, somatic motor; Post-central gyrus – parietal lobe, somatic sensory  
**Regions:** Broca’s area – production of speech  
Wernicke’s area – understanding speech  
Insula – within lateral fissure, integration of emotion & social cognition
Figure 1.5. (left) The lateral surface of the human brain. (right) Location of the insular cortex. Portions of the frontal, parietal and temporal lobes have been gently retracted apart, exposing the underlying **insula** that becomes covered by the expanding cortical mantle in brain development. (adapted from Figure A10 from Neuroscience, 5\textsuperscript{th} Ed.)
Medial surface features of the brain

Corpus callosum – white matter, conveys axons between hemispheres
Parieto-occipital sulcus – between parietal & occipital
Anterior commissure – small bundle of axons connecting hemispheres
Fornix – fiber bundle connecting hippocampus & hypothalamus
Septum pellucidum – separates lateral ventricles

**Diencephalon:** Pineal gland – attaches to posterior thalamus; Thalamus – relays most information to and from cortex; Hypothalamus – homeostasis & other physiological activities; Mammillary bodies – memory & limbic system; Pituitary gland – attached to hypothalamus via infundibulum

**Mesencephalon** (midbrain): Superior & inferior colliculi – oculomotor function, postural adjustment & audition

**Pons:** role in coordination of movement

**Medulla oblongata:** autonomic functions
Medial surface features of the brain

Figure 1.7. Illustrated views of the medial surface of a hemisected human brain. (Brainstem features will be discussed in a subsequent session.) (Figure A12 from Neuroscience, 5th Ed.)
BRAINSTEM AND CRANIAL NERVES
Medial surface of the brainstem
Cranial nerves: anterior/ventral surface of the brainstem

1. Optic chiasm
2. Anterior perforated substance
3. Tuber cinereum
4. Mammillary bodies
5. Midbrain: Cerebral crus
6. Posterior perforated substance
7. Pons: Middle cerebellar peduncle
8. Medulla oblongata: Olive
9. Pyramids
10. Decussation of pyramids
11. Ventral rootlets of C1 spinal nerve
12. Accessory nerve (CN XI)
13. Hypoglossal nerve (CN XII)
14. Olfactory tract (from CN I)
15. Optic nerve (CN II)
16. Oculomotor nerve (CN III)
17. Trochlear nerve (CN IV)
18. Trigeminal nerve (CN V)
19. Abducent nerve (CN VI)
20. Facial nerve (CN VII): Nervus intermedius
21. Vestibulocochlear nerve (CN VIII)
22. Glossopharyngeal nerve (CN IX)
23. Vagus nerve (CN X)
Cranial nerves: posterior/dorsal surface of the brainstem
Cranial nerves: superior view into cranial cavity

- Olfactory bulb and tract
- Optic nerve (CN II)
- Internal carotid artery
- Cavernous sinus
- Oculomotor nerve (CN III)
- Trochlear nerve (CN IV)
- Trigeminal nerve (CN V)
- Abducent nerve (CN VI)
- Facial nerve (CN VII)
- Vestibulocochlear nerve (CN VIII)
- Glossopharyngeal nerve (CN IX)
- Vagus nerve (CN X)
- Accessory nerve (CN XI)
- Hypoglossal nerve (CN XII)

Falc cerebri
Olfactory nerves (CN I) passing through cribriform plate
Optic nerve (CN II)
Cavernous sinus (opened)
Internal carotid artery
Oculomotor nerve (CN III)
Trochlear nerve (CN IV)
Trigeminal ganglion
Middle meningeal artery
Lesser petrosal nerve
Greater petrosal nerve
Trigeminal nerve (CN V)
Abducent nerve (CN VI)
Facial nerve (CN VII)
Vestibulocochlear nerve (CN VIII)
Glossopharyngeal nerve (CN IX)
Vagus nerve (CN X)
Accessory nerve (CN XI)
Hypoglossal nerve (CN XII)
Tentorium cerebelli (cut on right side)
# Cranial nerves: a review table

<table>
<thead>
<tr>
<th>Cranial nerve</th>
<th>Name</th>
<th>Sensory and/or motor</th>
<th>Major function</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Olfactory nerve</td>
<td>Sensory</td>
<td>Sense of smell</td>
</tr>
<tr>
<td>II</td>
<td>Optic nerve</td>
<td>Sensory</td>
<td>Vision</td>
</tr>
<tr>
<td>III</td>
<td>Oculomotor nerve</td>
<td>Motor</td>
<td>Eye movements; pupillary constriction and accommodation; muscles of eyelid</td>
</tr>
<tr>
<td>IV</td>
<td>Trochlear nerve</td>
<td>Motor</td>
<td>Eye movements</td>
</tr>
<tr>
<td>V</td>
<td>Trigeminal nerve</td>
<td>Sensory and motor</td>
<td>Somatic sensation from face, mouth, cornea; muscles of mastication</td>
</tr>
<tr>
<td>VI</td>
<td>Abducens nerve</td>
<td>Motor</td>
<td>Eye movements</td>
</tr>
<tr>
<td>VII</td>
<td>Facial nerve</td>
<td>Sensory and motor</td>
<td>Controls the muscles of facial expression; taste from anterior tongue; lacrimal and salivary glands</td>
</tr>
<tr>
<td>VIII</td>
<td>Vestibulocochlear (auditory) nerve</td>
<td>Sensory</td>
<td>Hearing; sense of balance</td>
</tr>
<tr>
<td>IX</td>
<td>Glossopharyngeal nerve</td>
<td>Sensory and motor</td>
<td>Sensation from pharynx; taste from posterior tongue; carotid baroreceptors</td>
</tr>
<tr>
<td>X</td>
<td>Vagus nerve</td>
<td>Sensory and motor</td>
<td>Autonomic functions of gut; sensation from pharynx; muscles of vocal cords; swallowing</td>
</tr>
<tr>
<td>XI</td>
<td>Spinal accessory nerve</td>
<td>Motor</td>
<td>Shoulder and neck muscles</td>
</tr>
<tr>
<td>XII</td>
<td>Hypoglossal nerve</td>
<td>Motor</td>
<td>Movements of tongue</td>
</tr>
</tbody>
</table>
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VASCULATURE
Arteries of the brain – inferior/ventral surface

Light blue = #1-5 (supplied by internal carotid and part of the anterior circulation)

Yellow/tan = #5-8 (supplied by vertebral/basilar and part of the posterior circulation)

Figure 2.1. Major arteries at the base of the brain. The top four arteries listed in the chart (previous page) arise from the carotid artery and supply most of the forebrain (match numbers in Figure to numbers in chart). The bottom four arteries arise from the vertebral and basilar arteries and supply the posterior forebrain, the brainstem and upper levels of the spinal cord. (Figure 10.3 from H. Blumenfeld, Neuroanatomy Through Clinical Cases 2nd Ed., Sinauer Assoc., Inc., 2010)
Arteries of the brain review slide – inferior view

- Anterior cerebral artery (ACA)
- Ophthalmic artery
- Internal carotid artery (ICA)
- Middle cerebral artery (MCA)
- Posterior communicating artery (PCOM)
- Anterior communicating artery (ACOM)
- Anterior choroidal artery
- Posterior cerebral artery (PCA)
- Superior cerebellar artery (SCA)
- Pontine arteries
- Labyrinthine artery
- Anterior inferior cerebellar artery (AICA)
- Posterior inferior cerebellar artery (PICA)
- Basilar artery
- Vertebral artery
- Anterior spinal artery
- Posterior spinal arteries
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DURAL VENOUS SINUSES
Dural venous sinuses

Superior sagittal sinus
Superior petrosal sinus
Inferior petrosal sinus
Inferior sagittal sinus
Great cerebral vein (cut)
(Great vein of Galen)
Straight sinus
Middle meningeal artery and vein
Posterior and anterior intercavernous sinuses
Sphenoparietal sinus
Crista galli (ghosted)
Cranial nerves:
Olfactory (CN I)
Optic (CN II)
Oculomotor (CN III)
Trochlear (CN IV)
Trigeminal (CN V)
Abducens (CN VI)
Facial (CN VII)
Vestibulocochlear (CN VIII)
Glossopharyngeal (CN IX)
Vagus (CN X)
Accessory (CN XI)
Hypoglossal (CN XII)
Dural venous sinuses