

NEUROANATOMY

Lab Manual

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Neuroanatomy

Lab 1: Gross Anatomy of the Brain I. Meninges, Blood Supply, CSF

If the brain feels no pain, where is the source of migraine?

Goals: Review the meninges including the large venous sinuses and the septa. Learn the CSF circulation and the major arteries, including the circle of Willis

Text Pages: Atlas: Haines, Chapter 2 and p. 47; Text: Blumenfeld, pp. 44–46, 122–135

Meninges: The meninges are divided into a dura, an arachnoid, and a pia mater.

The **dura mater** is divided into an outer periosteal layer and an inner meningeal layer. In places these layers separate to form large dural venous sinuses, in other places they come together to form septa.

Checklist:

Sinuses:

- Superior sagittal sinus
- Inferior sagittal sinus
- Transverse sinus
- Occipital sinus
- Sigmoid sinus
- Straight sinus
- Jugular bulb

Septa:

- Falx cerebri
- Tentorium cerebelli
- Falx cerebelli
- Diaphragma sellae

Clinical note: Be able to distinguish epidural from subdural hematomas.

The supratentorial dura is innervated by branches of the trigeminal nerve, the infratentorial dura is innervated by branches of the upper cervical spinal nerves and the vagus nerve.

The major blood supply to the dura is provided by the middle meningeal artery, a branch of the maxillary artery that enters the skull through the foramen spinosum. The ophthalmic artery gives rise to anterior meningeal branches. Occipital and vertebral arteries provide posterior meningeal branches.

The **arachnoid mater** is a delicate nonvascular membrane that passes over the cortical sulci without following their contours. The subarachnoid space contains cerebrospinal fluid (CSF). The extent of the subarachnoid space varies. Over the cerebral hemispheres this space is narrow, except over the sulci. At the base of the brain and around the brainstem the pia and the arachnoid often are widely separated, forming subarachnoid cisterna. The largest cistern is found between the medulla and the cerebellum and is called the cerebellomedullary cistern. Cerebrospinal fluid from the fourth ventricle passes into this cistern via the median foramen of Magendie and the two lateral foramina of Luschka. Arachnoid granulations, present in the lateral recesses off of the superior sagittal sinus, take up CSF.

Checklist:

- Arachnoid mater
- Arachnoid granulations (villi)
- Cisterns:
 - Cerebellomedullary
 - Pontine
 - Interpeduncular
 - Chiasmatic
 - Superior (cisterna ambiens)

The **pia mater** is divided into two layers, the intima pia and the epipial layer. The intima pia is adherent to the nervous tissue and follows its contours. The intima pia encloses blood vessels entering and leaving the CNS. The epipial layer is formed by a meshwork of collagenous fibers continuous with the arachnoid trabeculae. Over the convex surface of the cerebral cortex the epipial layer is absent. On the spinal cord, blood vessels lie within the epipial layer. On the cortex, blood vessels lie on the surface of the intima pia, anchored by arachnoid trabeculae.

Checklist:

- Pia Mater
- Cortical Blood Vessels
- Denticulate Ligaments
- Filum Terminale

Circle of Willis:

Confluence of the internal carotid and vertebral arteries.

Checklist of arteries:

- | | |
|------------------------|--------------------------------|
| Vertebral | Basilar |
| Internal Carotid | Ant./Post. Inferior Cerebellar |
| Superior Cerebellar | Labyrinthine |
| Posterior Cerebral | Posterior Communicating |
| Middle Cerebral | Anterior Cerebral |
| Anterior Communicating | Anterior Spinal |
| Posterior Spinal (x 2) | |

Note not only the positions of these arteries on the ventral brainstem, but also their distributions along the cerebral cortex.

CSF Circulation:

Checklist:

- Choroid Plexus, IV Ventricle
- Foramen of Luschka (position)
- Foramen of Magendie (position)
- Arachnoid Granulations
- Subarachnoid Space

Meninges will be removed at the beginning of the next laboratory, giving you time to review. If time permits, examine the **Lateral Ventricles**, **Third Ventricle**, and **Cerebral Aqueduct** in a sagittally split brain.

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Lab 2: Gross Anatomy of the Brain II. Brainstem and Non-Cortical Structures

Goals: To become conversant with the gross structures of the brainstem and ventral medial area.

Procedure: Using Haines (e.g., pp. 22–27) find and identify all of the cranial nerves. Taking care not to tear the cranial nerve roots, remove the arteries and meninges from the entire brain. Identify the major divisions of the brain. Review the blood supply.

A Note on Terminology: You will remember that in the peripheral nervous system, axons are grouped into **nerves**, and cell bodies are localized in **ganglia**. (Ganglia may contain synapses [sympathetic and parasympathetic] or may not [dorsal root, trigeminal, geniculate]). In the CNS, axons are grouped into **tracts** and cell bodies are grouped into **nuclei**. If only life were this simple. There are several synonyms for "tract" including **fasciculus**, **brachium**, **striae**, and **peduncle**. Likewise "nucleus" may also be termed **colliculus**, **body**, and **trigone**. In the brain "**ganglion**" refers to a specific collection of nuclei in the deep cerebral cortex. In anatomy, historical precedence, and large egos (manifested in the form of eponyms) often work against the simplification and standardization of terminology.

On the **ventral** surface of your brain, and using your plastic models and Haines pp. 22, 24 as guides, identify the major features of the brainstem and medial area.

Checklist:

Telencephalon

Olfactory Bulb
Olfactory Tract

Medial Olfactory Stria
Lateral Olfactory Stria

Diencephalon

Infundibulum

Mammillary Bodies

Diencephalon/Mesencephalon Junction

Optic Nerve, Chiasm, Tract
Crus Cerebri (Cerebral Peduncles)

Mesencephalon

CN III (Oculomotor Nerve)
CN IV (Trochlear Nerve—may be ripped off)

Metencephalon (Pons)

Basilar Pons
CN V (Trigeminal)

Middle Cerebellar Peduncles

Metencephalon/Myelencephalon Junction

CN VI (Abducens Nerve)

Myelencephalon (Medulla)

CN VII (Facial Nerve)

CN VIII (Vestibulocochlear Nerve)

CN IX (Glossopharyngeal Nerve)

CN X (Vagus Nerve)

CN XI (Spinal and Cranial Accessory Nerve)

CN XII (Hypoglossal Nerve)

Pyramidal Tracts Pyramidal Decussation

Olivary Nucleus

Ventral Median Sulcus (Anterior Median Fissure)

Ventral Lateral Sulcus (Anterior Lateral Sulcus)

Using your brain and a prosected specimen identify the major features of the **dorsal** brainstem; use your brainstem model and Haines p. 34 as guides.

Checklist:

Spinal Cord/Myelencephalon (Medulla):

Dorsal Median Sulcus (Posterior Median Fissure)

Dorsal Intermediate Sulcus (Post. Int. Sulcus)

Dorsal Lateral Sulcus (Post. Lat. Sulc.)

Cuneate Fasciculus (Tract)

Cuneate Tubercle (Nucleus)

Gracile Fasciculus

Gracile Tubercle

Cerebellum

Fourth Ventricle:

Obex

Vagal Trigone

Hypoglossal Trigone

Stria Medullares of the Fourth Ventricle

Sulcus Limitans

Facial Colliculus

Metencephalon (Pons):

Superior, Middle, Inferior Cerebellar Peduncles

Mesencephalon (Midbrain):

Superior Colliculus

Inferior Colliculus

CN IV (Trochlear Nerve)

Mesencephalon (Midbrain)/Diencephalon:

Superior Colliculus, Brachium
Inferior Colliculus, Brachium

Diencephalon:

Lateral Geniculate Body of the Thalamus
Medial Geniculate Body of the Thalamus
Dorsal Thalamus
Pineal Body
Habenula
Stria Medullaris of the Thalamus (Note difference in spelling
between this S. M. and the S. M. in the Fourth Ventricle)
Stria Terminalis

Using prosected specimens and Haines pp. 30, 31, identify the major features of the brainstem in midsagittal section.

Checklist:

Myelencephalon (Medulla):

Pyramidal tracts:

Fourth Ventricle

Cerebellum

Metencephalon (Pons):

Basilar Pons

Tegmentum of Pons

Mesencephalon (Midbrain):

Tectum

Superior Colliculus

Inferior Colliculus

Cerebral Aqueduct

Tegmentum

Diencephalon:

Posterior Commissure

Pineal Body

Habenula

Stria Medullaris of the Thalamus

Massa Intermedia

Supraoptic Recess

Optic Chiasm

Hypothalamus

Hypothalamic Sulcus

Mammillary Body

Telencephalon:

Corpus Callosum

Rostrum

Genu

Body

Splenium

Anterior Commissure

Septum Pellucidum
Fornix,
 Body
 Column

Review all structures using MRI images presented in Haines.

Basal Vein
Great Cerebral Vein

Ventral Surface (Haines pp. 20, 21, 22, 23, 24, 25)

Frontal, Temporal, Occipital, Limbic Lobes
Olfactory Bulb, Tract, Lateral, Medial Olfactory Striae
Gyrus Rectus Olfactory Sulcus
Orbital Gyri Uncus
Parahippocampal Gyrus Collateral Sulcus
Occipitotemporal Gyri Occipital Gyri
Occipitotemporal Sulcus Lingual Gyrus
Anterior Cerebral Artery: Orbital Branches
Posterior Cerebral Artery: Anterior and Posterior, Temporal,
Parietooccipital, and Calcarine Branches

Cortical Fiber Types (Haines pp. 56, 57, 58, 59, 60, 61)

Commissural Fibers—Course between right and left halves of the Cerebral Cortex.

Association Fibers—Long fibers coursing within a hemisphere or short fibers coursing between adjacent gyri.

Projection Fibers—Course from the Brainstem (i.e., Thalamus) to the Cortical Gyri, or the reverse.

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Lab 4: Gross Anatomy and Histology of the Spinal Cord

Goal: To understand the Anatomical Organization of the Spinal Cord

Gross Anatomy: Using prosected spinal cords and Haines pp. 10, 11, 12 to identify the following:

- Cervical and Lumbar Enlargements
- Dorsal and Ventral Root Filaments
- Dorsal Root Ganglia
- Spinal Nerves
- Caudal Equina
- Conus Medullaris
- Gray Matter—Dorsal and Ventral Horns
- White Matter
- Fasciculus Gracilis and Cuneatus
- Review Fissures and Sulci

Using the morphology of the gray and white matter as a guide, locate cross sections of the spinal cord to their approximate spinal levels.

Review the blood supply of the spinal cord including: the single anterior and paired posterior spinal arteries, the radicular arteries, the anterior and posterior spinal veins, and the internal venous plexus.

Histology: Using projection slides, observe in cross section the differences between the sacral, lumbar, thoracic, and cervical levels of the spinal cord. In particular note:

Sacral Level: Haines pp. 84–85. Small diameter, circular, relatively small white matter. Identify:

- Substantia gelatinosa
- Nucleus proprius
- Intermediate zone
- Lateral and medial motor nuclei
- Fasciculus gracilis
- Lateral white matter
- Anterior white matter

Lumbar Level: Haines pp. 86–87. Small diameter, circular, more white matter, expanded ventral horns. Identify the same structures as at the sacral level and compare their sizes.

Thoracic Level: Haines pp. 88–89. Larger diameter, still circular, large areas of white matter, relatively small gray matter. In addition to the structures you've already noted, identify:

Dorsal Nucleus of Clarke
Intermediolateral cell column (Cell Bodies to Preganglionic
Sympathetic Fibers to the Gut)
Fasciculus Cuneatus
Dorsal Intermediate Sulcus
Dorsolateral Sulcus

Cervical Levels: Haines pp. 90–93. Oval in cross section. Lower cervical levels have an expanded ventral horn to accommodate motor neuron cell bodies to the arms. In addition to the structures you've already noted, identify:

Spinal Accessory Nucleus
Spinal Trigeminal Nucleus
Spinal Trigeminal Tract

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Lab 5: Blood Supply

Goal: The goal of today's lab is to locate the branches and twigs of the Cerebral Arteries, Circle of Willis, Basilar Artery, and Vertebral Arteries to specific areas in the spinal cord, brainstem, and cerebral cortex. Use Haines, pp. 11, 17, 19, 21, 23, 25, 27, 29, 35, 37, 95, 110, 111, 124, 125, 136, 137, 158, 159, 240–252.

Checklist:

Vertebral Arteries
Basilar Artery.
Anterior, Middle, and Posterior Cerebral Arteries.

Branches of the Anterior Cerebral Artery and the regions they supply

<u>Branches</u>	<u>Regions</u>
Orbital Branches	Paraolfactory Gyrus
Pericallosal Branch	Cingulate Gyrus
Frontopolar Branches	Superior Frontal Gyrus
Callosomarginal Branch	Cingulate Gyrus
Internal Frontal Branch	Superior Cortex, Medial Surface
Paracentral Branches	Medial Portions Pre- and Postcentral Gyri
Internal Parietal Branches	Precuneus

Branches of the Posterior Cerebral Artery and the regions they supply

<u>Branches</u>	<u>Regions</u>
Anterior Temporal Branch	Parahippocampal Gyrus, Inferior Temporal Gyrus, Uncus
Posterior Temporal Branch	Occipital Temporal Gyrus
Parietooccipital Branch	Posterior, Medial Parietal Region Anterior, Medial Occip. Reg.
Calcarine Branch	Cuneus, Lingual Gyrus

Branches of the Middle Cerebral Artery and the regions they supply

<u>Branches</u>	<u>Regions</u>
Rolandic Branches	Precentral and Postcentral Gyri
Pre-Rolandic Branches	Precentral Gyrus, Middle Frontal Gyrus, Superior Frontal Gyrus
Orbitofrontal Branches	Middle, Inferior, Frontal Gyrus
Anterior Parietal Branches	Supramarginal Gyrus, Parietal Region
Posterior Parietal Branches	Supramarginal Gyrus, Parietal Region

Angular Branches
Anterior Temporal Branches
Middle Temporal Branches
Posterior Temporal Branches

Angular Gyrus
Superior, Middle Temporal Gyrus
Superior, Middle Temporal Gyrus
Temporal/Parietal Interface

Superior and Inferior Cerebellar Arteries

Quadrigeminal Artery

Review the blood supply to the spinal cord.

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Lab 6: Gross Anatomy and Histology of the Medulla

Goal: To understand the nuclear groups and tracts of the Medulla and coordinate them with medullary surface anatomy.

Procedure: Using the projection slide set and Haines pp. 98–109 as your guide, identify the following structures. You will want to compare levels with a prosected brainstem for perspective.

Spinal Cord Fiber Tracts

- Anterolateral System (composed of Spinoreticular and Spinothalamic Tracts)
- Dorsal Columns (Fasciculus Gracilis and Fasciculus Cuneatus)
- Lateral Vestibulospinal Tract
- Lateral, Anterior Corticospinal Tracts
- Medial Longitudinal Fasciculus
- Medullary and Pontine Reticulospinal Tracts
- Rubrospinal Tract
- Tectospinal Tract
- Dorsal Longitudinal Fasciculus (Lissauer's Tract)

Checklist:

- Accessory (Lateral) Cuneate Nucleus
- Anterior (Ventral), Posterior (Dorsal) Spinocerebellar Tracts
- Anterior Corticospinal Tract
- Anterolateral System
- Area Postrema
- Central Gray
- Central Tegmental Tract
- CNs XII, XI, X, IX, VIII, VII
- Cuneate Fasciculus and Nucleus
- Dorsal and Ventral Cochlear Nuclei
- Dorsal Longitudinal Fasciculus
- Dorsal Motor Nucleus of Vagus
- Fourth Ventricle
- Gracilis Fasciculus and Nucleus
- Hypoglossal Nucleus
- Inferior Olivary Nucleus
- Inferior, Middle, Superior Cerebellar Peduncles
- Internal Arcuate Fibers
- Medial Accessory, and Dorsal Accessory Olivary Nuclei
- Medial Lemniscus
- Medial Longitudinal Fasciculus
- Medial, Inferior (Spinal), Lateral, Superior Vestibular Nuclei
- Nucleus Ambiguus
- Nucleus Prepositus

Pyramidal Decussation, Tract
Raphe Nuclei
Reticular Formation
Reticulospinal Tract
Rubrospinal Tract
Solitary Fasciculus and Nucleus

Spinal Accessory Nucleus (CN XI)
Spinal Trigeminal Tract and Nucleus
Stria Medullares
Sulcus Limitans
Tectospinal Tract
Vestibulospinal Tract

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Lab 7: Gross Anatomy and Histology of the Pons

Goal: To be able to recognize the major nuclei and tracts of the Pons and correlate them with its surface features.

Procedure: Using the various projection slides and Haines pp. 116–123, identify the following metencephalon nuclei and tracts. You will also want to compare levels with a projected brainstem for perspective.

Checklist:

Abducens Nerve	Abducens Nucleus
Anterolateral System	Central Tegmental Tract
Chief Sensory Nucleus, Trigeminal Nerve CN IV	
Corticospinal Fibers (Pyramidal Tract)	
Dorsal Longitudinal Fasciculus	
Facial Nerve	
Facial Nucleus	
Inferior Cerebellar Peduncle	
Lateral Lemniscus	
Lateral Vestibular Nucleus	
Locus Ceruleus	
Medial Lemniscus	
Medial Longitudinal Fasciculus	
Medial Vestibular Nucleus	
Mesencephalic Nucleus, V	
Middle Cerebellar Peduncle	
Pontine Nuclei	
Raphe Nucleus	
Reticular Formation	
Rubrospinal Tract	
Solitary Nucleus	
Solitary Tract	
Spinal Trigeminal Nucleus	
Spinal Trigeminal Tract	
Superior Cerebellar Peduncle	
Superior Olive	
Superior Salivatory Nucleus	
Superior Vestibular Nucleus	
Trapezoid Body	
Trigeminal Motor Nucleus	
Trigeminal Nerve	
Trochlear Nerve	
Ventral Spinocerebellar Tract	

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Lab 8: Gross Anatomy and Histology of the Midbrain

Goal: To be able to recognize the major nuclei and tracts of the Midbrain and correlate them with its surface features.

Procedure: Using the various projection slides and Haines pp. 126–135, identify the following mesencephalon nuclei and tracts. You will also want to compare levels with a projected brainstem for perspective.

Checklist:

- Anterolateral System
- Central Grey
- Central Tegmental Tract
- Cerebellorubral Fibers
- Cerebellothalamic Fibers
- Cerebral Aqueduct
- CNs III, IV
- Corticobulbar Fibers
- Corticonigral Fibers
- Corticospinal Fibers
- Crus Cerebri
- Dorsal Longitudinal Fasciculus
- Dorsal Tegmental Decussation
- Edinger-Westphal Nucleus
- Fornix
- Frontopontine Fibers
- Habenulopeduncular Tract
- Hypothalamus
- Inferior Colliculus
- Inferior Colliculus Brachium
- Lateral Geniculate Body
- Lateral Lemniscus
- Mammillothalamic Tract
- Medial Geniculate Body
- Medial Lemniscus
- Medial Longitudinal Fasciculus
- Mesencephalic Nucleus
- Nigrostriatal Fibers
- Nucleus of Darkschewitsch
- Nucleus of Cajal
- Occipitopontine Fibers
- Oculomotor Nerve
- Oculomotor Nucleus
- Optic Nerve
- Optic Tract
- Parietopontine Fibers

Pineal Gland
Pontocerebellar Fibers
Posterior Commissure
Pretectal Nucleus
Pulvinar Nuclear Complex
Red Nucleus
Reticular Formation
Rubrospinal Tract
Spinotectal Tract
Spinothalamic Tract
Substantia Nigra
Subthalamic Nucleus
Superior Cerebellar Peduncle
Superior Colliculus
Superior Colliculus Brachium
Supraoptic Nucleus
Temporopontine Fibers
Third Ventricle
Trochlear Nerve
Trochlear Nucleus
Ventral Tegmental Decussation

Neuroanatomy

Lab 9: Gross Anatomy and Histology of the Cerebellum

Goal: To understand the organization of the cerebellum, including its distinct histological structure, foliation patterns, and nuclei.

Procedure: Examine the projection slides, Haines pp. 32, 33, 112–115 and prosected specimens to view the following important structures, and to understand the internal circuitry of this nucleus responsible for motor learning and coordination.

Checklist:

Histology:

- Molecular, Purkinje Cell, and Granular Cell Laminae
- Purkinje cells
- Granular cells

Foliation:

- Flocculus
- Hemisphere
- Lobules I–X
- Nodulus
- Primary Fissure
- Tonsil
- Vermis

Peduncles: Superior, Middle, Inferior

Nuclei: Fastigial, Globose, Emboliform, Dentate

Internal Circuitry

Neuroanatomy

Lab 10: Gross Anatomy and Histology of the Cerebral Cortex

Goal: To understand the histological organization of the Forebrain.

Procedure: Two groups will cut the cortex in transverse (coronal) sections (Haines pp. 64–72); two groups will cut horizontal (axial) sections (Haines, pp. 74–81). Once you have recognized the features of your sliced brain, switch brains to get one with orthogonal cuts. No matter how you slice it, you'll learn the cortex. Histological sections of the same material are covered in Haines pp. 138–157.

Checklist:

- Amygdaloid Nuclear Complex
- Anterior Commissure
- Anterior, Posterior Horns, Internal Capsule
- Association, Projection, Commissural Fibers
- Caudate Nucleus (Head, Body, Tail)
- Cerebral Aqueduct
- Cerebral Peduncles
- Choroid Plexus
- Clastrum
- Corpus Callosum (Splenum, Genu, Body)
- Fornix (Body, Column, Crus)
- Frontal, Occipital Poles
- Frontal, Parietal, Occipital, Limbic, Temporal Lobes
- Globus Pallidus
- Habenula
- Hippocampus (Fimbria, Formation, Commissure)
- Hypothalamus
- IIIrd Ventricle
- Insula
- Internal, External, Extreme Capsules
- Interpeduncular Fossa
- Interventricular Foramen
- Lamina Terminalis
- Lateral Sulcus
- Lateral Ventricles (Anterior, Posterior, Inferior Horns, Body)
- Lateral, Medial Geniculate Bodies
- Lenticular Nucleus
- Longitudinal Fissure
- Mammillary Body
- Mammillothalamic Tract
- Massa Intermedia
- Olfactory, Optic Tracts
- Parietooccipital Sulcus
- Pineal Gland
- Pituitary Gland

Posterior Commissure
Pulvinar
Putamen
Red Nucleus
Septum Pellucidum
Stria Medullaris of Thalamus
Stria Terminalis
Substantia Nigra
Subthalamic Nucleus
Thalamic Nuclei: Anterior, Dorsal Medial, Ventral Anterior, Ventral Lateral, (Internal Medullary Lamina, External Medullary Lamina), Central Median, Ventral Posterolateral, Ventroposteromedial,
Third Ventricle, Infundibular and Supraoptic Recesses

Supplement

Some Definitions in Neurology

- Agnosia** - lack of sensory-perceptual ability to recognize objects
- Alexia** - word or text blindness
- Alzheimer's disease** - slowly progressive dementia, most common degenerative disease of the CNS
- Amnesia** - disturbance of long-term memory
- Aneurysm** - dilation of an artery
- Angiography** - radiography of vessels after injection of a radiopaque material
- Angiopathy** - any disease of blood vessels or lymphatics
- Aphasia** - impaired or absent communication by speech, writing, or signs, due to dysfunction of brain centers in the dominant hemisphere
- Aphemia** - inability to combine sounds to produce recognizable speech
- Aphonia** - loss of voice due to disease or injury
- Aphronia** - deficit in thinking
- Apraxia** - inability to execute purposeful movements
- Apoplexy** - obsolete term for a stroke
- Ataxia** - inability to coordinate muscles in the execution of voluntary movements
- Babinski sign** - extension of the big toe and fanning of the other toes that indicates corticospinal damage
- Bell's palsy** - hemiparalysis of the facial muscles due to CN VII damage
- Brown-Sequard syndrome** - paralysis due to hemisection of the spinal cord
- Catalepsy** - a morbid condition characterized by limb rigidity; subject pale, unresponsive to stimuli, pulse, respiration slow
- Central scotoma** - blindspots involving central vision
- Cerebellar disease** - indicated by intention tremors
- Chorea** - irregular, spasmodic, involuntary movements of the limbs or facial muscles
- Coma** - profound unconsciousness from which one cannot be aroused
- Computed tomography** - the use of x-ray absorption to define density of tissues in the nervous system
- Conduction aphasia** - language problem caused by an interruption in the arcuate fasciculus connecting Wernicke's area with Broca's area resulting in pronounced impairment of repetition
- Confabulation** - making up stories to produce a fluent answer
- Contre-coup injury** - injury at a point opposite to the area where the blow was received (as in the skull)
- Cortical blindness** - blindness resulting from bilateral occipital lobe injuries
- Craniotomy** - opening of the skull

Delirium tremens - acute insanity caused by alcohol withdrawal marked by sweating, tremor, atonic dyspepsia, restlessness, anxiety, mental confusion, hallucinations

Dementia - a general mental deterioration

Demyelination - destruction or loss of myelin from the sheath of Schwann cells (PNS) or oligodendroglia (CNS)

Depression - a sinking of spirits so as to constitute a clinically discernible condition

Diadochokinesis - the normal power of bringing a limb into the opposite position

Diplopia - double vision

Dysarthria - disturbance of speech articulation due to emotional stress or to paralysis, uncoordination, or spasticity of the laryngeal muscles used for speaking

Dysautonomia - abnormal functioning of the autonomic nervous system

Dysergia - a lack of harmonious action between the muscles concerned with executing a particular voluntary movement

Dysesthesia -- impairment of sensation short of anesthesia

Dyskinesia - difficulty in performing voluntary movements

Dyslexia - incomplete alexia, a level of reading far below the individual's level of skill or intelligence

Dysmetria - a form of dysergia in which the subject is unable to arrest a muscular movement at a particular point

Echolalia - echophrasia, echo reaction, repetition of speech

Electroencephalograph - a recording of electrical activity of the brain taken from electrodes attached to the scalp

Embolism - obstruction or occlusion of a blood vessel caused by a clot or foreign substance

Encephalopathy - any disease of the brain

Epilepsy - convulsive state caused by excessive, uncoordinated neuronal discharge

Essential tremor - tremor present at rest that continues during movement, usually limited to the hands and arms

Expressive aphasia - aphasia due to damage in Broca's area, located in the third frontal convolution of the speech-dominant hemisphere

Focal brain damage - localized brain damage, esp. associated with wounds that penetrate the skull, or with head injuries resulting from automobile accidents

Generalized seizures - one of two types of seizures (the other being partial) caused by simultaneous activity in several cortical areas, the person loses consciousness and postural tone

Habit spasms - tics

Hallucinations - the apparent, often strong, subjective perception of an object or event where none exists

Hemianopia - (hemianopsia) loss of vision for one half of the visual field in one or both eyes

Hemiparesis - slight paralysis affecting one side only

Herpes zoster - eruption of groups of vesicles associated with the course of a nerve due to inflammation of ganglia and dorsal nerve roots resulting from an activation of the varicella-zoster virus, which may have laid dormant for many years

Huntington disease - autosomal, dominant, inherited degenerative brain disease (Woody Guthrie had it, Arlo does not), especially affecting the caudate nucleus, produces chorea

Hyperphagia - over eating

Hypersomnia - over sleeping

Hypotonia - reduced tension, eg. in muscles

Infarction - an area of necrosis due to sudden loss of blood supply

Kuru - a lethal neurodegenerative disorder that appears to be transmitted primarily through direct contact with infected nervous tissue (this is why you wear gloves in neurolab)

Lead-pipe rigidity - continuous rigidity associated with Parkinson's disease

Locked-in syndrome - a condition caused by a lesion in the pons where the patient is alert but unable to respond to the environment due to loss of voluntary muscle control below the level of the oculomotor nuclei

Magnetic resonance imaging - the use of a high intensity magnetic field to align protons, a transient electromagnetic pulse to disrupt the alignment and a radiowave detector to measure local energy changes

Mask - any of a variety of diseases producing alteration or discoloration of the skin of the face

Meningeal carcinomatosis - carcinoma that spreads through the meninges without producing a discrete mass

Meningeal lymphomatosis - associated with the HIV-1 virus, the lymphoma originates outside the nervous system and forms sheets of cells in the arachnoid space

Meningitis - inflammation of the meninges

Meningoencephalitis - meningitis caused by a bacterial, viral, fungal, or protozoan infection

Motor neuron disease - a broad category of potentially fatal diseases causing muscle weakness and wasting

Multiple sclerosis - motor neuron disease caused by demyelination of the corticospinal tracts

Myasthenia gravis - muscle weakness that develops due to autoimmune damage to the acetylcholine receptors of noncardiac striated muscle

Narcolepsy - sudden onset of sleep

Neuropathy - any disorder affecting any part of the nervous system

Ophthalmoplegia - paralysis of one or more of the motor nerves to the eye

Optokinetic nystagmus - movement of the eye when gaze is fixed

Paraphasia - the loss of ability to speak correctly, including word substitutions, jumbling of words and sentences

Paresthesias - an abnormal sensation

Parkinson disease - deterioration of the dopamine producing cells in the substantia nigra, decreased mobility, in particular an inability to start motions or to finish motions once started

Phantom limb pain - pain that seems to arise in an amputated limb

Pinealomas - rare neoplasm derived from the pineal gland

Postencephalic Parkinsonism - the "sleepy sickness" of Awakenings

Postictal confusion - transient thought disorders following seizures

Pseudocoma - coma-like condition that can develop after structural brain injuries, encephalitis, metabolic encephalopathy, psychiatric disturbances and poisoning

Pseudoseizures - cover a range of seizure-like phenomena that may or may not be associated with real seizures

Psychic blindness - no loss of vision but patient cannot recognize what they see

Psychosis - a mental disorder causing gross distortion or disorganization of a person's mental capacity, affective response, and capacity to recognize reality, communicate and relate to others to the degree of interfering with their capacity to cope with the ordinary demands of everyday life

Receptive aphasia - impaired language comprehension, also called Wernicke's aphasia

Reflex - an involuntary reaction in response to a stimulus applied to the periphery and transmitted to the nervous centers of the brain and spinal cord

Rigidity - stiffness or inflexibility

Rinne test - test for distinguishing between hearing loss due to acoustic nerve injury and to conductive hearing loss

Schizophrenia - parergasia, the most common type of psychosis, characterized by a disorder in the thinking process, such as delusions and hallucinations and extensive withdrawal from the outside world

Schwannoma - neurofibroma, neurolemoma, usually develop on CN VIII, but also on CNs V, IX, X, or VII

Scotoma - an isolated area of the visual field where vision is absent or depressed

Seizure - the sudden onset of a disease or of certain symptoms

Sleep apnea - sleep disturbance due to breathing interruption

Somnambulism - sleepwalking

Spasticity - a state of increased muscle tone with an exaggeration of the tendon reflexes

Stroke - a lay term denoting a sudden neurological affliction usually related to the cerebral blood supply

Syncope - fainting due to sudden drop in blood pressure

Tabes dorsalis - spinal cord disease producing lesions in the dorsal columns and the dorsal root ganglia, caused by syphilis

Tic - habit chorea or spasm

Tic douloureux - damage to CN V, causing facial pain and arising from light touch to a seemingly inappropriate area or arising spontaneously

Tinnitus - ringing in ears

Trigeminal neuralgia - (see tic douloureux)

Two-point discrimination - test for fine touch

Vascular disease - a common cause of focal or diffuse cerebrocortical dysfunction resulting from vessel occlusion, inflammation, or hemorrhages

Vertigo - dizziness, sense of whirling motion

Word deafness - verbal auditory agnosia, deficit of comprehension of spoken, but not written word, rare, associated with lesions affecting connections of primary auditory cortex to Wernicke's area