M-I NEUROSCIENCES
Gross and Sectional Anatomy of the Brain, Blood Vessels, and Meninges
Laboratory Sessions

OVERVIEW

The following list indicates structures to be identified during the laboratory sessions listed above, directing your attention in a systematic order to the most important features of the gross and sectional anatomy of the brain, its blood supply, and its meninges.

The white crocks in the laboratory contain a whole brain and a half brain (cut in mid-sagittal section). Please do not use sharp instruments or pens when pointing out structures for identification on the brain.

DO NOT SECTION THE BRAIN. A video on DVD #1 entitled “Coronal Sectioning of the Brain” has been made to give you this experience.

The student is encouraged to spend enough time with the actual gross brain and brain sections for orientation prior to moving to the two-dimensional images in Chapters 4 “Gross Anatomy of the Brain” and Chapter 5 “Sectional Anatomy of the Brain” of the Digital Neuroanatomy PPT’s (on the lab computers). Then the same chapters in the Digital Neuroanatomy Interactive CBI Program on the E-Curriculum website should be used for self-test on this material. The practical exam is a PPT using images similar to those in Digital Neuroanatomy.

DVD#1 of the Neuroanatomy Laboratory Sessions contains videos on “Coronal Sectioning of the Brain” and “Review of the Gross and Sectional Anatomy of the Brain” which should be seen as independent self-study. These videos point out most of the structures on this laboratory list.

I. TELENCEPHALON: CEREBRAL HEMISPHERE

A. Lateral Aspect

Central Sulcus - separates pre- and post-central gyri
Lateral Sulcus - separates frontal/parietal lobes from temporal lobe
Preoccipital Notch - indentation on inf. margin, delineates temporal from occipital lobe
Frontal, Parietal, Occipital, Temporal, and Insular Lobes- 5 anatomical lobes
Precentral Gyrus - primary motor cortex
Postcentral Gyrus - primary somatosensory cortex
Superior and middle frontal gyri, superior and inferior frontal sulci
Inferior frontal gyrus (pars opercularis and triangularis) - Broca's motor speech area
Superior parietal lobule, intraparietal sulcus
Supramarginal gyrus - Inferior parietal lobule (part of Wernicke's speech area)
Angular gyrus - Inferior parietal lobule (part of Wernicke's speech area)
Superior, middle, and inferior temporal gyri
Superior transverse temporal gyri (of Heschl) - primary auditory cortex
Lateral occipital gyri - all gyri on lateral aspect of occipital lobe
B. Inferior (Ventral) Aspect

Olfactory bulb and tract - associated with C.N. I - Frontal lobe
Orbitofrontal gyri - inferior surface of frontal lobe

Inferior temporal gyrus and sulcus - Temporal lobe
Occipitotemporal gyrus - Temporal lobe
Collateral sulcus - Temporal lobe
Parahippocampal gyrus and uncus - Temporal lobe
C. Medial Aspect - (mid-sagittal)

Corpus callosum - rostrum, genu, body, splenium
Septum pellucidum - vertical membrane, separates lateral ventricles
Fornix - large tract (from hippocampus) running in lower margin of septum pellucidum
Interventricular foramen of Monro - connects lateral ventricles to third ventricle
Lateral ventricles (and choroid plexus) - cavity within cerebral hemisphere
Caudate nucleus - in lateral wall of the lateral ventricle
Stria terminalis - tract runs with vein in floor of lat. vent. between caudate and thalamus
Anterior commissure - connects lower portions of the temporal lobes
Lamina terminalis - memb. between ant. comm. and optic chiasm; closes rostral 3rd vent.
Limbic lobe - subcallosal gyrus, cingulate gyrus, parahippocampal gyrus
Paracentral lobule - around central sulcus; continuation of pre- and post-central gyri onto medial aspect; primary motor and sensory cortex representing lower limb
Parieto-occipital sulcus - delineates parietal and occipital lobes; intersects calcarine fissure
Calcarine fissure - separates cuneus and lingual gyrus
Cuneus gyrus - primary visual cortex
Lingual gyrus - primary visual cortex

II. DIENCEPHALON - consists of thalamus, hypothalamus, subthalamus and epithalamus

A. Ventral Aspect

Optic nerves, optic chiasm, optic tracts (CN II)
Tuber cinereum/ hypothalamus - elevation from which pituitary stalk (infundibulum) emerges
Mammillary bodies
B. Medial Aspect - (mid-sagittal)

Thalamus
Pulvinar - protruding posterior end of thalamus
Massa intermedia (interthalamic adhesion) - crosses 3rd vent.; conn. thalami (not a commissure)
Third ventricle - narrow, unpaired vertical space between thalami
Hypothalamus - vent. part of diencephalon below hypothalamic sulcus
Pineal gland - attaches by pineal stalk above post. commissure and habenula
Posterior commissure - interconnects pretectal areas of midbrain (not a cerebral commissure)

III. MESENCEPHALON (or Midbrain)

A. Dorsal Aspect

Superior colliculi - visual/visuomotor (orientation) reflexes
Inferior colliculi - auditory reflexes
Trochlear nerve (CN IV) - Note: only CN to exit from dorsal brainstem (behind inf. coll.)

B. Ventral Aspect

Cerebral peduncles (crus cerebri) - large bundles connect cerebrum to brainstem
Interpeduncular fossa - space between cerebral peduncles
Oculomotor nerve (CN III) - exits from interpeduncular fossa

C. Medial Aspect

Cerebral aqueduct - connects third ventricle to fourth ventricle
Tectum (roof of midbrain) - contains sup. and inf. colliculi (corpora quadrigemina)
Tegmentum of midbrain - region between cerebral aqueduct and crus cerebri

IV. CEREBELLUM AND PONS (derived from metencephalon)

A. Dorsal Aspect of Cerebellum

Lateral hemispheres of cerebellum
Vermis of cerebellum - midline worm-like convolution between hemispheres
Primary fissure - separates anterior and posterior lobes
Anterior and posterior lobes of cerebellum

B. Lateral Aspect

Inferior cerebellar peduncle- elevation on dorsolat. medulla; connects medulla to cerebellum
Middle cerebellar peduncle (brachium pontis) - largest peduncle; connects pons to cerebellum
Superior cerebellar peduncle (brachium conjunctivum) - connects cerebellum to midbrain
Trigeminal nerve (CN V) - largest cranial nerve, comes off middle cerebral peduncle

C. Medial Aspect (midsagittal)

Anterior medullary velum - thin membrane forms roof over rostral 4th ventricle; stretches between the dorsal aspect of the two superior cerebellar peduncles
Posterior medullary velum- thin roof of 4th vent; & foramen of Magendie (hole in post. m.v.)
IVth ventricle - space under cerebellum, above pons and medulla (floor is rhomboid fossa)
Tegmentum of pons, basilar pons
Vermis of cerebellum - entire medial surface of cerebellum in mid-sagittal section is vermis
Anterior lobe, primary fissure, posterior lobe of cerebellum (identify on vermis)
Nodule - vermis portion of flocculonodular lobe of cerebellum; separated from post. lobe vermis by prenodular fissure (same as posterolat. fissure; see below)

D. Ventral Aspect

Flocculus (hemispheric portion of flocculonodular lobe; see relationship to CN VIII, vestibular div.)
Pontocerebellar angle - contains exiting C.N.'s VII, VIII, IX, X

E. Dorsal Aspect of Pons and Medulla

Rhomboid fossa - diamond-shaped floor of IVth vent. above pons and medulla
Median sulcus - midline groove continued rostrally from dorsal medulla and spinal cord
Sulcus limitans - groove on each side of rhomboid fossa, remnant of embryonic S.L. separates motor and sensory areas;
Facial colliculus - over abducens nucleus and int. genu of facial nerve (CN VII)
Lateral recesses of IVth ventricle - lead into foramina of Luschka- CSF moves into cisterna magna
Obex - caudal point of diamond-shaped rhomboid fossa above medulla (between gracile tubercles)
V. MEDULLA OBLONGATA (derived from myelencephalon)

A. Dorsal Aspect

Dorsal median sulcus - cont. rostrally into rhomboid fossa from same sulcus in spinal cord
Gracile tubercle (clava; elevation over nuc. gracilis)
Dorsal intermediate sulcus - separates fasc. gracilis and cuneatus
Cuneate tubercle (elevation over nuc. cuneatus) and fasciculus cuneatus
B. Ventral Aspect

Pontomedullary junction - horizontal groove separates basilar pons and medulla
Abducens nerve - CN VI - exits pontomedullary junction in line with preolivary sulcus
Facial nerve - CN VII - exits from pontocerebellar angle, just medial to C.N. VIII
Vestibulocochlear nerve - CN VIII- large nerve; exits from pontocerebellar angle next to flocculus
Ventral median fissure - sulcus on midline; continues rostr. from same fissure in spinal cord
Pyramids - contain pyramidal (corticospinal) tracts
Pyramidal decussation - crossing of pyramidal motor tracts - interrupts ventral median fissure
Olive - elevation over inf. olivary nucleus
Preolivary sulcus - exit of rootlets of hypoglossal n. (CN XII); between olive and pyramid
Hypoglossal Nerve - CN XII - several rootlets exiting along preolivary sulcus
Postolivary sulcus - exit of C.N. IX, X, and bulbar rootlets of XI
Glossopharyngeal nerve - CN IX
Vagus nerve - CN X
Spinal Accessory nerve - CN XI- ascends from cervical spinal cord parallel to medulla

VI. MENINGES

Dura mater - Falx cerebri, tentorium cerebelli and dural sinuses (superior sagittal sinus,
transverse sinus, confluence of sinuses - see also impressions in the skull)

NOTE: In skull, there is no epidural space. The dura is attached to cranial bone periosteum.

Arachnoid membrane - see arachnoid granulations (villi) - tufts of arachnoid bulge into sup. sagittal sinus; arachnoid trabeculae (filaments attach arachnoid to pia across subarachnoid space)

Pia mater - epi-pia loosely invests blood vessels; intimal pia forms pia-glial limiting membrane of the brain

VII. ARTERIES

Vertebral arteries
Anterior spinal artery - unpaired artery in ventral median fissure (can use to i.d. ventral aspect)
Posterior inferior cerebellar arteries (PICA)
Basilar artery - runs in groove along basilar pons
Anterior inferior cerebellar arteries
Labyrinthine (int. auditory) arteries
Pontine arteries - short branches off basilar artery to basilar pons
Superior cerebellar arteries- last branches before posterior cerebals; see C.N. III exit
Posterior cerebral arteries - from bifurcation of basilar artery rostrally; supply inf. aspect of temp. lobe and most of occ. lobe
Posterior communicating arteries - connect post. cerebral to int. carotid art.’s
Internal carotid arteries
Anterior cerebral arteries - supply medial aspect of hemisphere (frontal and parietal lobes)
Anterior communicating artery - connects ant. cerebral arteries
Middle cerebral arteries - large branches of int. Carotids; course laterally into lateral sulcus to supply lateral aspect of hemisphere; see small caliber branches (lenticulostriate arteries, penetrate ant. perforated substance of basal forebrain to supply basal ganglia and internal capsule)
Circle of Willis - consists of posterior cerebral, post. communicating, internal carotid, anterior cerebral, and ant. communicating arteries.

VIII. DURAL SINUSES
These are endothelial-lined venous channels running between the two layers of the dura

Superior sagittal sinus- in attached margin of falx cerebri
Inferior sagittal sinus- in free margin of falx cereeri
Straight sinus- runs in attachment of the falx cerebri to the tentorium cerebelli (receives the Great vein of Galen- drainage of deep cerebral structures)
Transverse sinus- in attached margin of the tentorium cerebelli
Sigmoid sinus- in posterior fossa, connects transverse sinus to internal jugular vein
Cavernous sinus- flat sinus on either side of the body of the sphenoid; traversed by the internal carotid artery, and cranial nerves III, IV, V (ophthalmic & maxillary divisions), and VI

IX. CROSS SECTIONS
Identify the following major structures in cross section in both wet material and on plastic embedded specimens. The student is also responsible for identifying structures which were mentioned previously in the list but are not repeated here.

Note: See DVD #1 video segment on "Coronal Sectioning of the Brain."

<table>
<thead>
<tr>
<th>Structure</th>
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<tbody>
<tr>
<td>Cerebral cortex</td>
<td>Posterior limb of int. capsule</td>
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<tr>
<td>Subcortical white matter</td>
<td>Pulvinar (caudal end of thalamus)</td>
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<tr>
<td>Longitudinal fissure</td>
<td>Lateral and medial geniculate bodies</td>
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<tr>
<td>Corpus callosum</td>
<td>Hippocampus</td>
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<td>Septum pellucidum</td>
<td>Tectum of midbrain</td>
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<td>Lateral ventricles</td>
<td>Tegmentum of midbrain</td>
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<tr>
<td>Caudate nucleus- head, body, tail</td>
<td>Superior and inferior colliculi</td>
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<tr>
<td>Anterior limb, int. capsule</td>
<td>Substantia nigra</td>
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<tr>
<td>Putamen</td>
<td>Cerebral peduncles (Crus cerebri)</td>
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<td>External capsule</td>
<td>Red nucleus</td>
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<td>Claustrum</td>
<td>Cerebral aqueduct</td>
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<td>Extreme capsule</td>
<td>Posterior commissure</td>
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<td>Globus pallidus</td>
<td>Superior cerebellar peduncle</td>
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<tr>
<td>Anterior commissure</td>
<td>Anterior medullary velum</td>
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<tr>
<td>Insular cortex (Insula)</td>
<td>Peri (IVth) ventricular gray</td>
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<tr>
<td>Optic chiasm and optic tracts</td>
<td>Locus ceruleus</td>
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<tr>
<td>Fornix</td>
<td>Deep cerebellar nuclei (e.g., dentate nucleus)</td>
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<tr>
<td>Interventricular foramen of Monro</td>
<td>Tegmentum of pons</td>
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<td>Third ventricle</td>
<td>Basilar pons</td>
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<td>Thalamus</td>
<td>Middle cerebellar peduncle</td>
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<td>Hypothalamus</td>
<td>Fourth ventricle</td>
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<tr>
<td>Subthalamus- inc. subthalamic nucleus</td>
<td>Inferior cerebellar peduncle</td>
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<tr>
<td>Amygdala nucleus</td>
<td>Medullary pyramids) pyramidal tracts)</td>
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<tr>
<td>Temporal horn, lat. ventricle</td>
<td>Inferior olivary nucleus</td>
</tr>
<tr>
<td>Posterior horn, lat. ventricle</td>
<td>Nucleus gracilis and cuneatus</td>
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