

STUDY GUIDE CHAPTER THREE NEUROCYTOLOGY

1. On a blank piece of paper, draw a multipolar cell with its soma, dendrites, axon, and synaptic telodendria. Then add the synapses from other neurons to the appropriate parts of the nerve cell. Next add astrocytes to this picture, including their relationship to blood vessels, pial and ependymal surfaces, and neurons. Finally, add the oligodendrocytes, and diagram their relation to the myelin sheath.
2. Identify the organelles and their location within the neuron. Determine the functions of each organelle within the nervous system. Are there any organelles that are unique to the neuron?
3. Review the constituent parts of the blood-brain barrier, and describe how it works. List places in the central nervous system that have an a leaky blood-brain barrier.
4. Axoplasmic flow is another of the very important mechanisms within the nervous system. Review the structural basis for the axoplasmic flow and explain why it is necessary. What is actually transported by this mechanism and what is returned to the cell body?
5. Compare the difference in response between a central nerve cell and a glial cell to injury.
6. The synaptic telodendria of a neuron is a unique structure. Review its anatomical parts and understand the physiological basis of its functions. Compare a synapse to a motor end plate.

STUDY GUIDE NEUROEMBRYOLOGY CHAPTER 4

One of the most incredible changes in the development of an organ is seen in utero where the brain starts from a flat plate evolves to a tube and finally the definitive formation of a convoluted brain. This complex evolution will result in structures that were once very close to each other being now at a distance from each other and the best evidence for the growth in the brain is seen in the stretching of the fornix, stria terminalis, corpus callosum and anterior commissure.

- 1) Review the changes seen in the development from neural plate to neural tube to the beginnings of the separate parts of the CNS in the spinal cord brain stem and cerebrum.
- 2) Identify the developmental features in each trimester.
- 3) What is the significance of the neural crest cells.
- 4) What cells give origin to the nerve cells, astrocytes, oligodendrocytes and microglia.
- 5) Why is there so much interest generated in transplanting neuroblasts from fetuses into adult brain and why is there great controversy in this field.
- 6) Identify the parts of the adult nervous system that develop in the following embryological layers-
 - a) germinal cell layer,
 - b) mantle layer,
 - c) marginal layer,
 - d) subventricular layer
 - e) ventricular layers.
- 7) Review the rules which help to explain differentiation within the nervous system.
- 8) Many of the areas in the brain form by migration of nerve cells.
Review how the migration of cells helps form the cerebral and cerebellar cortex.
- 9) In the development of the cerebrum it is especially important to understand the relationship of the following structures to the ventricular system- fornix and hippocampus, corpus callosum, corpus striatum. At this time review these relationships and their implication for the adult nervous system.
- 10) Review the structures innervated by the spinal and cranial nerves. Pay especial attention to the relationship of the cranial nerves to the branchial (gill arches).
- 11). There are many environmental toxins including controlled substances which might effect the growth and development of the embryo and fetus. List at least 6 compounds that are unquestionably toxic and the consequences of exposure to these compounds.
- 12) Review the types of malformations that are seen in each of the following categories-
 - a) Malformations resulting from Abnormalities in Growth and Migration.
 - b) Malformations resulting from Chromosomal Trisomy and Translocation.
 - c) Malformations resulting from Defective Fusion.

d) Malformations Resulting from Abnormalities in the Ventricular System.

Study Guide Chapter 12 Cranial Nerves

1. The concept of nerve components helps in explaining the functions of cranial nerves. Which components serve the following:
 - a. Skeletal muscles in the body?
 - b. Skeletal muscles in the head and neck?
 - c. Smooth muscles in the body?
 - d. Smooth muscles in the viscera?
 - e. Cardiac muscles?
 - f. Proprioceptive and exteroceptive sensation from the skin?
 - g. Interoceptive sensation in the body?
 - h. Special senses?
2. In the cross sections of the medulla, pons, and midbrain (Figs. 11-4, 11-7, and 11-9&10). identify at each level the appropriate cranial nerve nuclei. Compare and contrast the location of the three motor neuronal groups (somatic motor, branchiomotor, and visceromotor) with the three sensory neuronal groups (general somatic sensory, special sensory, and visceral sensory[general & special]).
 - a. In the medulla identify the nuclei of nerves XII, XI, X, IX, VIII, and V.
 - b. In the pons identify the nuclei of nerves V, VI, VII, and VIII.
 - c. In the midbrain identify the nuclei of nerves III, IV, and V.
3. Note the relation between the following tracts:
 - a. medial longitudinal fasciculus to somatic motor,
 - b. tractus solitarius to visceromotor,
 - c. corticospinal and bulbar to all the motor nuclei, and
 - d. the rootlet of nerve V to the secondary nuclei of V.
4. One of the most difficult motor nuclear groups to identify in cross section is the superior and inferior salivatory nuclei. Review their functions and indicate their general location.
5. Concerning eye movements
 - a. what is the role of cranial nerves II, III, IV, and VI in eye movements?
 - b. With regard to the eye, contrast the relations of nerves III, IV, and VI to that of nerves V and VII. As a further review identify the innervation of the pupil and explain the pupils seen in the following conditions: Horner's syndrome, lesions of Edinger-Westphal nucleus, and the Argyll Robertson pupil.
 - c. Identify the cerebral cortical regions that form the upper motor neurons to cranial nerves III, IV, and VI.
6. Review the motor control by cranial nerve VII of the mimetic muscles. What is the difference between Bell's palsy and an upper motor involvement of the corticobulbar pathway?
7. Review the cerebral cortical control of nerves IX to XII by discussing the innervation of the nucleus ambiguus and tongue, particularly the lower motor neurons involved with speech.
8. Compare the motor control of the upper and lower limb to that of the face.

STUDY GUIDE CHAPTER 15: DIENCEPHALON

1. The five diencephalon subdivisions are:
 - _____ thalamus
 - _____ thalamus
 - _____ thalamus
 - _____ thalamus
 - _____ thalamus
2. To understand the dorsal thalamus one must first divide the nuclei into functional zones. Identify the nuclei that are:
 - a. limbic (emotional)
 - b. gustatory
 - c. motor
 - d. auditory
 - e. general sensory
 - f. visual
 - g. pain
 - h. associational
3. Identify the dorsal thalamic and metathalamic nuclei which receives each of the following ascending pathways.
 - a. lateral lemniscus(brachium of inferior colliculus)
 - b. medial lemniscus(gracile versus cuneate versus trigeminothalamic)
 - c. superior cerebellar peduncle
 - d. spinothalamic vs spinoreticulothalamic
 - e. reticulothalamic
 - f. thalamic fasciculus
 - g. pallidothalamic
 - h. optic tract
 - i. gustatory fibers
4. Identify the cerebral cortical region that the following nuclei project to.
 - a. anterior
 - b. dorsomedial
 - c. ventral lateral
 - d. ventral posterior pars medialis
 - e. ventral posterior pars lateralis
 - f. pulvinar:
 - (1) pars medial
 - (2) pars inferioris
 - (3) pars lateralis
 - g. lateral dorsal
 - h. lateral geniculate
 - i. medial geniculate
 - j. central median
- 5a. The subnuclei of the subthalamus are listed below. Identify the fiber tracts that project to these nuclei:
 - (1) subthalamus
 - (2) zona incerta
 - (3) fields of Forel
- b. What is the function of the subthalamus?
6. Identify the nuclei and pathways found in the epithalamus. What might be the function of this

- region?
7. The nuclei of the metathalamus are _____ and _____. From your identification of these nuclei it should then be obvious to you the functions of this region are related to _____ and _____.
 8. The internal capsule is at the margin between the diencephalon and cerebrum, in the horizontal section (Fig. 15-6). Draw in the functionally significant components found in the respective portions of the internal capsule.
 9. The blood supply to this region is especially complicated: differentiate the blood supply of the posterior thalamus from the anterior thalamus and the anterior limb, genu, and posterior limb of internal capsule.
 10. In order to fully understand functional localization in this region, review the consequence of a lesion in the internal capsule to that in the thalamus (thalamic syndrome).

STUDY GUIDE -FIBER TRACTS

Identify the tracts and nuclei in Atlas Still Born Figures Levels 1-4. These myelin stained levels of the brain are from a Still Born infant 1-4 are myelin-stained sections of a stillborn term infant. The sequence of myelination in the developing central nervous system is such that certain tracts are clearly seen at this stage. Fiber bundles that obscure these tracts in the adult brain have not yet myelinated in the newborn. Certain structures have been labeled: the student should identify the remaining unlabeled tracts and nuclei using the descriptive Atlas and the Spinal Cord Chapter Figure 7-28 to 7-34, Chapters 11 and 15 for reference.

1. First determine which of the tracts and nuclei should be functional at birth and therefore should be myelinated, then examine the brain sections to see if you are correct.

2. Identify the following parts of the ventricular system in the appropriate levels:

Fourth ventricle

Cerebral aqueduct

3. Identify the following tracts, determine if they are myelinated, and review their functions in Figures 11-3 to 11-10.

Descending Pathways

corticospinal

corticonuclear

corticopontine

middle cerebellar peduncle

tectospinal

tectobulbar

vestibulospinal

reticulospinal

sympathetics

medial longitudinal fasciculus

Ascending pathways

central tegmental tract

lateral lemniscus

medial lemniscus

posterior columns

trigeminothalamic

superior cerebellar peduncle

inferior cerebellar peduncle

4. Identify the following nuclei at all levels and review their functions:

Primary trigeminal nerve rootlet in medulla:

Primary vestibuloacoustic rootlet in medulla and pons

Nuclei of cranial nerves II to XII

Inferior olivary complex

Nuclei gracilis and cuneatus

External cuneate nucleus

Pontine gray

Cerebellar deep nuclei:

- dentate

- emboliform

- fastigii

- globosus

8. Compare the distribution of:
 - associational fibers
 - commissural fibers
 - projectional fibers.
9. Diagram the location of fibers in the internal capsule. What artery(ies) supplies the internal capsule?

STUDY GUIDE HYPOTHALAMUS

1. Present a logical organization to the individual nuclei in the hypothalamus.
2. List the major efferent and afferent pathways to the hypothalamus and explain their functions.
3. Identify the regions in the hypothalamus responsible for:
 - a. Regulation of heat loss and heat production
 - b. Water balance and neurosecretion
 - c. Food intake. Sleep cycle
 - e. Control of parasympathetic and sympathetic functions
 - f. Light levels
 - g. Control of emotions
 - h. Reproduction
 - i. Sexual behavior
4. Compare the functions of the hypothalamic-hypophyseal portal system to that of the hypothalamic-hypophyseal tract.
5.
 - a. Identify the sites in the hypothalamus where releasing factors are made. How do they get to the adenohypophysis?
 - b. Identify the adenohypophyseal hormones and their functions.
 - c. Review the hormones made in the hypothalamus and their site of action.

Autonomic Nervous System

6. Review which cranial nerves have autonomic components and their sites of action.
7. Compare the sympathetic and parasympathetic inputs to the following organs:
 - a. Eye
 - b. Salivary glands
 - c. Heart
 - d. Lungs
 - e. Abdominal viscera
 - f. Adrenal gland
 - g. Bladder
 - h. External genitalia
 - i. skin
8. Review the effects of the following:
 - a. Pituitary tumor
 - b. Diabetes insipidus versus mellitus
 - c. Craniopharyngioma

STUDY GUIDE CEREBRAL HEMISPHERES Chapters 17 & 18

Students should start their detailed examination of the cerebral hemispheres by identifying the motor-sensory strip and reviewing its somatotopic organization. They should undertake this review of cortical and subcortical structures as a prelude to starting the section on Clinical Considerations of the Cerebral Cortex.

1. In Chapter 17, figure 17-1 on the lateral surface of the hemisphere: and on 17-2 the medial surface identify the following gyri and include the areal numbers of Brodmann:
 - Frontal Lobe
 - Superior gyrus
 - Middle gyrus
 - Inferior frontal gyri
 - * Pars orbital
 - * Pars triangular
 - * Pars opercular
 - Precentral gyrus
 - Parietal Lobe
 - Postcentral gyrus
 - Superior parietal lobule
 - Inferior parietal lobule
 - * Marginal gyrus
 - * Angular gyrus
 - Occipital Lobe
 - Lateral occipital gyrus
 - Temporal Lobe
 - Superior temporal gyrus
 - Middle temporal gyrus
 - Inferior temporal gyrus

2. On the medial surface of the hemisphere shown in Figure 17-2, identify and in the cortical surface add the areal numbers of Brodmann:
 - Corpus callosum
 - Rostrum
 - Genu
 - Body
 - Splenum
 - Anterior commissure
 - Fornix
 - Third ventricle
 - Lateral ventricle
 - Superior frontal gyrus (medial portion)
 - Paracentral lobule
 - Precuneus gyrus
 - Cuneus gyrus
 - Lingula gyrus
 - Parahippocampal gyrus
 - Uncus (amygdala)
 - Occipitotemporal gyrus

3. Identify the following functional regions in Figs. 17-1 and 17-2:

Motor-sensory (head, arm, leg)

Premotor

Prefrontal

Visual cortex (upper visual field and lower visual field)

Auditory cortex

Wernicke's area

Broca's area

4. Identify the thalamic nucleus that projects onto the areas listed in Question 3.
5. Be certain you know the cerebral regions:
 - a. Those in which the corticobulbar and corticospinal tracts originate.
 - b. Those that receive terminations indirectly from cranial nerves VIII, V, II, and I.
 - c. Those that receive input indirectly (after thalamic synapses) from the following tracts:
 - posterior columns
 - spinothalamic
 - gustatory
 - superior cerebellar peduncle.
6. Diagram the major arterial branches to the lateral and medial surface of the cerebral hemispheres.

STUDY GUIDE CHAPTER 23 VISUAL SYSTEM

1. Explain the difference in the rods and cones that permits color vision and vision at night.
2. Trace the visual pathway from the retina to the visual cortex and be able to differentiate lesions in:
 - a. Retina or optic nerve
 - b. Optic chiasm
 - c. Superior visual radiation,
 - d. Inferior visual radiation
 - e. Calcarine cortex.
3. Explain the difference in a lesion that is congruent from one which is incongruent! Where would these lesions be located?
4. Review the functional differences in occipital lobe in regions V1, V2, V3, and V4.
5. What visual information is carried through the corpus callosum?
6.
 - a. Review the pupillary reflexes as listed in Chapter 11.
 - b. Review and explain the relationships between cranial nerves III, IV and VI.
 - c. Review the relationships between cranial nerve VII, V and the eye.
7. How does the occipital lobe control eye movements?
8. Compare and contrast the visual field defect seen in :
 - a. lesions in front of the chiasm in the optic nerve or retinae,
 - b. lesion at the chiasm ,
 - c, optic tract or lateral geniculate
 - c. visual radiations in parietal lobe,
 - d. visual radiations in temporal lobe
 - e. calcarine cortex:

The Problem Solving Chapters, 10, 14, 28, 31 and 31A also contain Review Questions for respectively spinal cord, brain stem, cerebrum and higher cortical functions.