

HUMAN STRUCTURE AND FUNCTION II

COURSE OBJECTIVES AND STUDY GUIDE

Fall, 2006 and Spring, 2007

MATERIAL TO BE COVERED ON LECTURE TESTS

LECTURE TEST #1:

I. Chapter 8: Nervous System

1. List the basic function(s) of the nervous system. What other system works to achieve the same goals as the nervous system?
2. Explain the functional divisions of the nervous system and note what anatomical structures belong to each major division.
3. Describe the following structural components of a neuron and give the function of each. Why are microtubules important?

node of ranvier
cell body (soma)
axon hillock
axon
 collateral axon
dendrite
myelin sheath
neurofibril
Nissl bodies

4. Define the resting membrane potential and describe its electrochemical basis. Describe the principle steps in the origin and conduction of an action potential of a neuron. What part of the neuron is important in generating action potentials?
5. What is the importance of action potential frequency?

6. Describe and identify the following characteristics of neurons:

threshold
polarized state
depolarized state
repolarization
refractory period
hyperpolarized state

7. What are the three structural classifications of nerves?

8. What are the functions of the following supporting cells of the CNS? What do microglia do when the brain is damaged?

Astrocytes
Ependymal cells
Microglia

9. What are the functions of the following support cells of the PNS?

Schwann cells
Satellite cells

10. Describe the function of myelin sheath and explain how it is formed in the PNS and CNS. What cell types actually form the myelin sheath in the PNS? in the CNS?

11. Describe a chemical synapse and an electrical synapse. Which do you think is faster?

12. What are the substances that are acting as chemical transmitters at a chemical synapse or neuron junction called? How do they work?

13. Distinguish between excitatory and inhibitory postsynaptic potentials.

14. What is the cause of multiple sclerosis. How is this related to the symptoms of this

disease?

15. As review, what are the components of the peripheral nervous system?
16. Describe the cross section of the spinal cord.
17. Describe the meninges and the related spaces that surround the spinal cord. (See Fig 12.2) In what two places can anesthesia be administered? Why are these locations used?
18. What is a spinal tap? What is it used for?
19. What is a myelogram?
20. What are the five components of a reflex arc?
21. Describe the events of a stretch reflex. What is the importance of this reflex?
22. What is the knee-jerk reflex?
23. What is a withdrawal or flexor reflex? What is the importance of this reflex?
24. Define nerve and describe the general structure of a nerve.
25. What are the possible outcomes of spinal cord injury?

26. Define the following terms:

anesthesia
hyperesthesia
paresthesia
neuralgia
 sciatica
neuritis

27. What is the cause of poliomyelitis? Why does this disease result in paralysis?

28. Name the major regions of the brain and know their functions

Cerebrum
 Basal nuclei
 Limbic system
Diencephalon
 Thalamus
 Hypothalamus
 Epithalamus
Brainstem
 Medulla oblongata
 Pons
 Midbrain
 Reticular formation
Cerebellum

29. Describe the meninges and spaces surrounding the brain.

30. Describe the production and circulation of cerebrospinal fluid.

31. Define the term ventricle and indicate the location of the ventricles of the brain.

32. Describe how the meninges and cerebrospinal fluid protect the CNS?

33. Name the arteries which supply blood to the brain. What is the blood brain barrier

and how does it protect the brain?

34. Define sensation/ perception. How are the senses classified?
35. What are the types of sensory receptors?
36. What are sensory nerve tracts? Where are they (in general)?
37. What areas of the cerebral cortex receive sensory information and how is this sensory information anatomically organized?
38. How are skeletal muscles controlled and how is this related to the motor cortex?
39. What is the function of the reticular activating system?
40. What are the functions of the brainstem?
41. What skills are usually governed by the right hemisphere? The left hemisphere?
42. What is an EEG? What does it measure? How can it be used?
43. Define the following CNS disorders:
 - encephalitis
 - myelitis
 - meningitis
 - Reye's Syndrome

Rabies
Tabes Dorsalis
Multiple Sclerosis
Tumors
 Meningiomas
Stroke (Cerebrovascular accident, CVA)
Aneurysm
Cerebral compression
Alzheimer's disease
Tay-Sachs disease
Mercury poisoning
Lead poisoning
Epilepsy
Depression
Headache
Alexia
Dyslexia
Attention deficit disorder

44. What are the two types of stroke? What are the signs of stroke?
45. What are the two subdivisions of the motor (efferent) subdivision of the PNS?
46. What does the somatic nervous system control? What does the autonomic nervous system control? What are the two subdivisions of the autonomic nervous system?
47. What is the layman's name for the Sympathetic Nervous System? What is the layman's name for the Parasympathetic Nervous System? How do these names relate to the functions of the sympathetic and parasympathetic nervous systems?
48. Compare and contrast the preganglionic and postganglionic neurons of both the Sympathetic and Parasympathetic Nervous System in terms of the following:
- origin in the CNS
 - length
 - neurotransmitters
49. Describe the effects of the Sympathetic and Parasympathetic Nervous System on

the following organ or physiological mechanisms. How do these relate to the overall actions of these two nervous systems?

blood coagulation
blood vessels
digestive system
heart
kidneys
lungs
skeletal muscle
skin
eye
 pupil
glands
 adrenal
 gastric
 sweat
heart
liver
lungs
metabolism

50. Discuss autonomic reflexes. How does the baroreceptor reflex work?
51. What area of the brain is in overall control of the Autonomic Nervous System?

II. **CHAPTER 9:**

1. List the primary odors and describe how odorants stimulate the olfactory neurons.
2. Describe the basic taste groups.
3. Describe how a sense of taste is triggered. Which cranial nerves serve the sense of taste?
4. List the anatomical parts of the eye and explain the function of each.

5. How does light travel? Which type of light has the most energy?
6. Trace the pathway of light through the eye to the retina. How does the lens change for distant and close vision?
7. Explain how light is detected by the eye. What types of receptors are involved?
8. Where are the visual pigments and what is their role in light detection?
9. Describe the role of vitamin A in vision.
10. Compare and contrast the roles of rods and cones in vision.
11. Describe the structure and general function of the outer, middle, and inner ears.
12. Describe the sound conduction pathway to the fluids of the inner ear, and to the cochlear nerve.
13. How does sound travel?
14. Explain the difference between pitch and intensity of sound.
15. Distinguish between static and dynamic equilibrium.

16. Describe the activity of maculae and crista ampullaris in detecting the change in body position.

LECTURE EXAM #2: CHAPTERS 5 AND 15

I. CHAPTER 5: INTEGUMENTARY SYSTEM

1. Explain the general function of skin.

2. Describe the layers of the epidermis, the kinds of cells found in the epidermis, the specialized proteins of these cells and the function of those cells.

3. Describe the structure and function of the dermis.

4. Describe the elementary structure of hair and nails.

5. Describe the functions and secretions of sebaceous glands, ceruminous glands, and eccrine sweat glands.

6. Describe the following functions of skin:

 thermoregulation
 protection
 sensory
 synthetic
 mechanical
 blood reservoir
 excretion

7. What are the factors that determine skin color.

8. Explain the effect of serious burns. Describe how the rule of nines and degree of burn is used to determine the seriousness of the burn.

9. Know and be able to describe the three types of skin cancer. Know which one is the most dangerous. What is the ABCD rule?

II. CHAPTER 15: RESPIRATORY SYSTEM

1. Be able to Identify the following components/conditions of the respiratory system:

primary bronchi
secondary bronchi
alveoli
respiratory zone
conducting zone
Type I cells
Type II cells
pulmonary arteries
bronchial arteries
lung compliance
alveolar surface tension
anatomical dead space
alveolar ventilation
ventilation
perfusion
oxyhemoglobin
deoxyhemoglobin
carbaminohemoglobin
hypoxia
hyperventilation
hypocapnia
hypoventilation

2. Describe how cilia protect the respiratory system.
3. Describe the structure and function of the lungs. Name the pleural membranes.
4. Know and understand how these laws are related to respiration

Boyle's Law
Dalton's Law of Partial Pressure
 be able to calculate a partial pressure
Henry's Law

5. Given a gas mixture over a liquid, describe the effects of increasing and decreasing the partial pressures of that gas on the amount of dissolved gas in liquid.
6. Be able to define inspiration and expiration. Which one is active and which one is passive when one is at rest?
7. Be able to describe the process of lung ventilation in terms and the relationship of atmospheric pressure, intrapulmonary pressure, and intrapleural pressure. Know the roles these pressures play in inspiration and expiration.
8. What is surfactant and what does it do? What is respiratory distress syndrome?
9. Know the relative differences between the partial pressures of O_2 and CO_2 of the atmosphere, the alveoli, venous blood, arterial blood and the interstitial space.
10. Explain ventilation-perfusion coupling.
11. What do these four respiratory volumes represent?
 - Tidal volume
 - Inspiratory reserve volume
 - Expiratory reserve volume
 - Residual volume
12. Know the four respiratory capacities:
 - Total lung capacity
 - Vital capacity
 - Inspiratory capacity
 - Functional Residual Capacity

13. Trace the pathway of oxygen traveling from the atmosphere to the cells of a tissue bed of the body.
14. Describe the two ways in which oxygen is transported in the blood.
15. Describe the three ways in which carbon dioxide is transported in the blood.
16. Describe the general mechanism of buffers. What is the main buffer system of the blood? How does it work?
17. What is the normal pH of the blood? What is its physiological range?
18. Disregarding any buffer action, describe the effect of increasing blood P_{CO_2} on blood pH and of decreasing blood P_{CO_2} on blood pH.
19. What is the main chemical that affects the rate and depth of breathing?
20. What areas of the brain are involved in the control of breathing?

21. Know the meaning of the following terms:

eupnea
apnea
dyspnea
hyperpnea
pneumothorax
Heimlich maneuver
tracheotomy
emphysema
bronchitis
cystic fibrosis
laryngitis
whooping cough
tuberculosis
pneumonia
flu
histoplasmosis
asthma
chronic pulmonary diseases
obstructive emphysema
chronic bronchitis
tuberculosis
lung cancer
 squamous cell
 adenocarcinoma
 small cell carcinoma

LECTURE EXAM #3: CHAPTERS 18 AND 19

I. CHAPTER 18: UNINARY SYSTEM

1. List the organs of the urinary system and state the general function of each as well as the functions of the system as a whole.

2. Describe the gross anatomy of the kidney.

3. What is a nephron? Where is it located? Describe the anatomy of a nephron.

4. Identify which parts of the nephron are responsible for filtration, reabsorption, and

secretion, and describe the role played by each in urine formation.

5. Describe the process of filtration. What is the glomerular filtration rate (GFR)?
6. What is reabsorption? What is the role of reabsorption in urine formation? Which way does water move as [solute] ↑ or [solute] ↓ inside the nephron?
7. What hormone affects water resorption? What hormone affects Na reabsorption? How do the above two hormones work to maintain normal blood volume? How does this effect blood pressure?
8. Understand and be able to discuss the role of secretion in urine formation. What are the reasons for secretion? What types of substances are secreted?
9. Explain how urine is formed. What is urine made from?
10. What are some simple differences between plasma, glomerular filtrate and urine?
11. What are some basic, normal components and characteristics of urine?
12. Describe how the kidney regulates body pH.
13. Define micturition and describe the micturition reflex.

14. Compare and contrast:
- ECF
 - Plasma
 - Interstitial fluid
 - ICF
 - Electrolytes
 - Nonelectrolytes
 - Major cations of the ECF and ICF
 - Composition of ECF and ICF
15. Know and understand the factors that determine fluid shifts in the body between
- Plasma and interstitial fluid
 - Interstitial fluid and intracellular fluid
16. Describe the mechanisms that regulate water intake, retention and loss. What is the difference between sensible and insensible water loss? What is the thirst mechanism?
17. Describe what happens to the osmotic pressure within a fluid compartment when
- fluid volume is increased
 - fluid volume is decreased
 - solute are increased
 - solute are decreased
18. During osmosis, which way does water move when you have a semipermeable membrane and the solution on one side is more concentrated than the other side.
19. How do blood proteins, capillary osmotic pressure, and blood pressure affect the movement of plasma across the capillary wall. What makes fluid move out of the capillary? What makes fluid move into the capillary?
20. Compare and contrast:
- Dehydration
 - Water intoxication
 - Edema
 - What is the role of the lymphatics in edema?

21. Outline the importance and method of regulation of Sodium with regard to the following:

Role of aldosterone
Pressure diuresis
ADH
ANF

Why is it important to control $[Na]_{\text{blood}}$?

II. CHAPTER 20: THE REPRODUCTIVE SYSTEM

1. Compare and contrast mitosis and meiosis. Why is each important? How many chromosomes are present in humans? In human gametes?
2. Define
 - autosomes
 - sex chromosomes
 - genes
 - alleles
 - genotype
 - phenotype
 - homozygous
 - heterozygous
 - dominant traits
 - recessive traits
 - haploid
 - diploid
3. What are genetic diseases?
2. Describe the simple differences between spermatogenesis and oogenesis. How many sperm are formed in spermatogenesis? How many oocytes are formed in oogenesis?
3. What hypothalamic and anterior pituitary hormones are important in the formation of spermatogenesis and oogenesis?

Male Reproductive System

1. Name the parts of the male reproductive system and describe the general functions of each. Which are the accessory organs?
2. Outline the events of spermatogenesis and include:

Spermatogenic cells
Spermatogonia
Primary spermatocyte
Secondary spermatocyte
Spermatids
Spermatozoa
Sustenticular cells (Sertoli cells)
3. Explain how hormones control the activities of the male reproductive organs and how they are related to the development of the male secondary sexual characteristics. Include:

GnRH
FSH
LH
Testosterone
Inhibin
4. Describe the pH, volume, and normal sperm density a normal ejaculate of semen. Trace the flow of seminal fluid.

Female Reproductive System

- 1 Name the parts of the female reproductive system and describe the general functions of each.
2. Briefly describe the life cycle of an oocyte. Include:

Oogonia

Primary oocyte
First polar body
Secondary oocyte
Second polar body
Ovum

3. Describe the following phases of the ovarian cycle (first group) and relate them to events of oogenesis (second group) and the uterine cycle (third group)?

Ovarian Cycle
Follicular phase
Ovulation
Luteal phase

Oogenesis
Primordial follicle
Primary follicle (what stage of meiosis?)
Secondary follicle
Vesicular follicle
Corpus luteum
Corpus albicans
Ovulated oocyte (what stage of meiosis?)

Uterine Cycle
Mensual phase
Proliferative phase
secretory phase

4. Trace the path an ovum takes from the ovary to the uterus.
5. What hormones are produced by cells of maturing follicles. What is the LH surge and why is it important? What hormones are produced by the cells of the corpus luteum? How do all of these hormones relate to the condition of the endometrium?
6. Discuss the physiological effects of estrogen on the female reproductive organs and on other body organs. What other hormone may work with estrogen?

7. Define:

Dysmenorrhea
Endometriosis
Amenorrhea
8. What are the hormonal changes that occur in menopause. What are the consequences of these changes?

LECTURE FINAL: CHAPTERS 20, 14

I. CHAPTER 20: DEVELOPMENT, HEREDITY AND AGING

1. Describe the hormonal changes that occur during pregnancy and their anatomical and physiological effects upon the female body.
2. Describe the structure and function of the placenta and the umbilical cord. What hormones are produced by the placenta? What are their functions?
3. Beginning with fertilization, briefly describe the major developmental changes during gestation.
4. Identify tissues and structures derived from the ectoderm, mesoderm, and endoderm. What are the major developmental changes during gestation? What is the average gestation period in humans? (See Table 29.1)
5. Define:

fertilization
pregnancy
conceptus
morula
blastocyst
gestation period
embryo
fetus
infant
vertex presentation

breech presentation
dystocia
teratogens

6. Describe the stages of labor. What is the role of oxytocin?
7. Describe the differences between fetal circulation and respiration and adult circulation and respiration.
8. Know the functions of mammary glands. What hormones control breast development? What is the stimulus for lactation? What is colostrum? What are the advantages of breast milk?
9. What are the major changes that take place in an infant after birth? What is an Apgar Score?

II. CHAPTER 14: IMMUNITY (pages 378-398 only)

1. Define immunity.
2. List the components of the immune system and explain their function. What
3. What are the differences between adaptive (specific) and innate (non-specific) defense mechanisms.

4. Understand how the following innate (non-specific) defense mechanisms work and give examples of each:

physical barriers
chemical barriers
phagocytic cells
complement
inflammation
natural killer cells

6. Understand the aspects of adaptive (specific) defense mechanisms including:

cell mediated immunity
 what cells are involved?
humoral immunity
 what cells are involved?

7. Compare and contrast B and T cells. What is immunological competence? How does it develop?

8. Understand the differences between active and passive immunity and between natural and artificial immunity. How do vaccines work?

9. Describe the differences between acquired immunity and genetic immunity.

10. Describe how a fever is produced and how it helps protect the body against invading pathogens.

11. Explain what is meant by infectious disease.

12. How are infectious diseases spread?

13. Know a simple nomenclature and classification scheme for infectious organisms.

MATERIAL TO BE COVERED ON LAB TESTS

LAB TEST #1:

I. NERVOUS SYSTEM

Basic Organization of the Nervous System

Quiz #1: ↓

CNS (Central Nervous System)

Brain

Cerebrum

Brainstem

Diencephalon

Cerebellum

Spinal Cord

Cervical region

Thoracic region

Lumbar region

Sacral region

Coccygeal region

PNS (Peripheral Nervous System)

Cranial Nerves

Spinal Nerves

Neuronal microanatomy

node of ranvier

cell body (soma)

nucleus

nucleolus

axon hillock

axon

collateral axon

dendrite

myelin sheath

neurofibril

Nissl substance (bodies)

Schwann cell

Structural Classification of Neurons

multipolar

bipolar

unipolar

Axons

myelinated
unmyelinated

Quiz #1: ↑

Types of Neurons

Sensory (afferent) neurons

Motor (efferent) neurons

 Somatic

 Autonomic

Interneurons

Schwann cells

Purkinje cells

Pyramidal cells

Types of Support Cells

CNS

 Astrocytes

 Oligodendrocytes

 Microglia

PNS

 Schwann Cells

CNS

Quiz #2: ↓

Brain

corpus callosum

gyrus

sulcus

pineal body

olfactory bulbs

optic chiasma

cortex

gray matter

white matter

cerebrum

 frontal lobe

 parietal lobe

 occipital lobe

 temporal lobe

 insula

cerebellum

arbor vitae
pons
medulla oblongata
 pyramid
 choroid plexus
spinal cord
hypothalamus
thalamus
 intermediate mass
pituitary gland
lateral ventricles
third ventricle
fourth ventricle
foramen of Monro
cerebral aqueduct
longitudinal fissure
central sulcus
lateral fissure

Quiz #2: ↑

dura mater
 falx cerebri
arachnoid membrane
pia mater
Circle of Willis
 vertebral artery
 basilar artery
 internal carotid artery
 posterior/anterior/middle cerebral arteries
 posterior/anterior communicating arteries

Quiz #3: ↓

Meninges of Brain / Spinal Cord

central canal
conus medullaris
cauda equina
subdural space
subarachnoid space
epidural space
pia mater
dura mater
arachnoid membrane
white matter
gray matter
dorsal horn
ventral horn

lateral horn
dorsal root
ventral root
dorsal root ganglia
spinal nerve

Know the relationship between the vertebral column, the spinal cord and the meninges.

Quiz #3: ↑

PNS

Quiz #4: ↓

1. For each of the 12 pairs of cranial nerves, list its name, number, and function.
2. Define plexus. Name the major plexuses listed below, their sites of origin, and the major nerves arising from each.

Cranial Nerves

olfactory
optic
oculomotor
trochlear
trigeminal
abducens
facial
vestibulocochlear
glossopharyngeal
vagus
accessory
hypoglossal

Spinal Nerves

cervical plexus
brachial plexus
lumbar plexus
sacral plexus
cervical nerves
thoracic nerves
lumbar nerves
sacral nerves
phrenic nerve
musculocutaneous nerve
median nerve
ulnar nerve

radial nerve
axillary nerve
femoral nerve
obturator nerve
sciatic nerve

Nerve coverings

Epineurium
Perineurium
Endoneurium
axon

Quiz #4: ↑

LAB PRACTICAL #1: ↑↑↑↑

LAB TEST #2: ↓↓↓↓

I. SPECIAL SENSES

Taste Reception

Quiz #5: ↓

papillae
 filiform
 fungiform
 circumvallate
supporting cells
gustatory cells (receptor cells)
gustatory hairs
taste bud
taste pore (pore canal)
basal cells

Olfactory Reception

olfactory epithelium
olfactory receptor cells (neurons)

supporting cells
basal cells
olfactory cilia
mitral cell
olfactory bulb

Visual Reception

optic nerve
sclera
choroid
retina
 rods
 cones
 bipolar neurons
 ganglion cells
macula lutea
fovia centralis
vitreous humor
aqueous humor
ciliary body
conjunctiva
optic disc
pupil
cornea
lacrimal apparatus
 lacrimal gland
 lacrimal ducts
 lacrimal canal
 lacrimal sac
 nasolacrimal duct
iris
medial canthus
lateral canthus
lens
suspensory ligaments
extrinsic muscles
 superior rectus
 inferior rectus
 medial rectus
 lateral rectus
 superior oblique
 inferior oblique

Quiz #5: ↑

Auditory Reception

Quiz #6: ↓

external auditory meatus
auricle
tympanic membrane
eustachian canal
malleus
incus
stapes
cochlea
semicircular canal
round window
oval window
cochlear nerve
vestibule
vestibular nerve
vestibulocochlear nerve
organ of Corti
 hair cells
ampulla
macula

II. INTEGUMENTARY SYSTEM

1. Be able to identify the following structures of the skin on slides, models and diagrams..

Stratum corneum
Stratum lucidum
Stratum granulosum
Stratum spinosum
Stratum basale
Papillary layer
Reticular layer
Epidermis
Dermis
Hypodermis
Eccrine sweat gland
Adipose tissue
Root hair plexus
Pacinian corpuscle
Hair follicle
Hair root
Sebaceous (oil) gland
Meissner's corpuscle
Keratinocyte
Melanocyte
Nail plate
Nail root
Matrix
Eponychium
Lunula

Quiz #6: ↑

III. RESPIRATORY SYSTEM LABORATORY

1. From diagrams, models, slides, and the cadaver be able to identify the following structures:

hard palate
soft palate
pharynx
epiglottis
glottis

Quiz #7: ↓

vocal cords
trachea
conchae (turbinate)
 superior
 middle
 inferior
lungs
 superior lobe
 middle lobe
 inferior lobe
visceral pleura
parietal pleura
diaphragm
bronchi
 primary
 secondary
 tertiary
bronchioles
alveolus
nasal bones
perpendicular plate of ethmoid
sinuses
 frontal
 maxillary
 ethmoid
 sphenoid
hyoid bone
larynx
 thyroid cartilage
 cricoid cartilage

Quiz #7: ↑

LAB PRACTICAL #2: ↑↑↑↑

LAB PRACTICAL #3: ↓↓↓↓

III. URINARY LAB

renal vein
renal artery
afferent arteriole
efferent arteriole
interlobar artery
interlobar vein
interlobular artery
interlobular vein
arcuate artery
arcuate vein
kidney
ureter
papillae
renal pyramid
medulla
cortex
peritubular capillary bed
renal column
nephron
glomerulus
Bowman's capsule
loop of Henle
proximal convoluted tubule
distal convoluted tubule
ascending limb
descending limb
urinary bladder
urethra
renal pelvis
minor calyx
major calyx
collecting duct or tubule
glomerular capillaries
renal capsule
vasa recta

Quiz #8: ↓

Quiz #8: ↑

II. REPRODUCTIVE LAB

Male

Quiz #9: ↓

scrotum
testis
ductus deferens
ejaculatory duct
urethra
prostate gland
penis
glans
prepuce
corpus cavernosum
corpus spongiosum
sperm
 head
 acrosome
 midpiece
 tail
epididymus

Female

Ovary
 oocyte
 primary follicle
 secondary follicle
 corpus luteum
 corpus albicans
uterine tube
 fimbria
uterus
 endometrium
 myometrium
 cervix
vagina
clitoris
suspensory ligament
ovarian ligament
round ligament
broad ligament

breast
 nipple
 areola

glandular lobes

Quiz #9: ↑

LAB PRACTICAL, FINAL: ↑↑↑