

TOP FORM, INC.



PHASE II - HEALTH SCIENCES APPLIED TO COACHING

Part I - Physiology

Organ Systems

NERVOUS SYSTEM

- Central Nervous System (CNS)
- Peripheral Nervous System (PNS)
 - Afferent Division
 - Efferent Division
 - Somatic Nervous System (SNS)
 - Autonomic Nervous System (ANS)



CENTRAL NERVOUS SYSTEM (CNS)

- Controls responses to stimuli
- Consists of all neural tissue in the body
- Neural tissue consists of two kinds of cells:
 - Neurons - basic units
 - Neuroglia - regulate environment around neurons



CNS - 3 FUNCTIONS

- Monitors internal and external environments
- Integrates sensory info
- coordinates voluntary & involuntary responses of other organ systems



CNS - 3 FUNCTIONAL GROUPS FOR NEURONS

- Sensory Neurons - form afferent div of PNS
 - Exteroceptors - info about external environment
 - Interoceptors - monitor other systems' activities
 - Proprioceptors - monitor position of skeletal muscles & joints
- Motor Neurons - in efferent div of PNS
 - carry instructions from the CNS to other tissues, organs, & organ systems
- Interneurons - only in brain & spinal cord
 - Interconnect other neurons
 - responsible for analysis of sensory inputs & motor outputs



CNS - REFLEXES

- Automatic motor responses triggered by specific stimuli
- Help us maintain homeostasis by making rapid adjustments in organ function
- caused by conditions inside or outside body changing rapidly
- Examples:
 - Heart Rate
 - Blood Pressure
 - Swallowing
 - Sneezing



CNS - REFLEXES CONT.

- Always produces same motor response to specific stimuli
- Reflex usually opposes original stimulus



CNS - REFLEX ARC (5 STEPS)

- Arrival of stimulus & activation of receptor
- Activation of sensory neuron
- Information processing
- Activation of motor neuron
- Response by an effector



CNS - SPINAL CORD

- Major highway for the passage of **sensory** impulses **to the brain**
- major highway for the passage of **motor** impulses **from the brain**
- Integrates its own info & controls spinal reflexes
 - sitting
 - standing
 - walking
 - running



CNS - BRAIN

- More complex than spinal cord
- responses to stimuli more versatile
- Yes, men have larger brains than women (about 10%), but there is NO correlation between brain size and intelligence guys!!!



6 MAJOR DIVISIONS OF THE BRAIN

- Cerebrum
- Diencephalon
- Midbrain
- Pons
- Cerebellum
- Medulla Oblongata



PERIPHERAL NERVOUS SYSTEM (PNS)

- Link between neurons of CNS & rest of body
- Includes cranial nerves
 - 12 pairs
 - connect directly to brain instead of spinal cord
 - can be sensory, motor, or mixed (both sensory & motor)
- Includes spinal nerves
 - 31 pairs
 - grouped according to region of vertebral column



PNS CONT.

- Nerve Plexuses - nerve trunks
 - Cervical Plexus - muscles of neck & thoracic cavity
 - Brachial Plexus - shoulder girdle & upper limbs
 - Lumbosacral Plexus - pelvic girdle & lower limbs



PNS - REFLEXES

- Stretch Reflex - automatic regulation of muscle length
 - important in maintaining normal posture & balance
 - tested in such ways as knee jerk
 - Muscle Spindles - sensory receptors
 - bundles of small specialized muscle fibers in skeletal muscles
- Withdrawal Reflex - move affected parts of body away from stimulus
 - usually triggered by painful stimulation, but can be touch or pressure receptors
 - Flexor Reflex - withdrawal reflex that affects a limb (ex. Stepping on a tack)



INTEGUMENTARY SYSTEM

- Skin
- Hair
- Nails
- Various Glands
 - Can give signs of problems with other systems by changing:
 - Color
 - Flexibility
 - Sensitivity



INTEGUMENTARY SYSTEM

5 FUNCTIONS

- **Protection** - protects underlying tissues & organs from impacts, chemicals, & infections; prevents loss of body fluids
- **Temperature Maintenance** - regulates heat gains & losses to maintain normal body temps
- **Storage of Nutrients** - deeper tissues reserve lipids as adipose tissue



INTEGUMENTARY SYSTEM

5 FUNCTIONS CONT.

- **Sensory Reception** - receptors detect touch, pressure, pain, & temperature and relay it to nervous system
- **Excretion & Secretion** - excrete salts, water, & organic wastes; produces milk
- As related to sport - sweating & temperature control during exercise to maintain homeostasis



ENDOCRINE SYSTEM

- Includes all endocrine cells & tissues of the body
- Hormones are chemical messengers
 - released in one tissue & carried to target cells, where they bind & are read
 - carried via circulatory system
- Hormones divided into 3 groups based on chemical structure
 - amino acid derivatives
 - peptide hormones
 - lipid derivatives



ENDOCRINE SYSTEM - 5 HORMONES & GROWTH

- Growth Hormone
 - not primary hormone involved
 - adults with deficiency can be normal if other 4 are normal
 - most noticeable w/ children where it supports muscular & skeletal development
 - under or over secretion can lead to dwarfism & gigantism
- Thyroid Hormone
 - absent in 1st yr. Nervous system fails to develop normally => mental retardation
 - if concentration decreases later in life, but before puberty => abnormal skeletal development



ENDOCRINE SYSTEM - 5 HORMONES & GROWTH CONT.

- Insulin
 - w/o it passage of glucose & amino acids across cell membranes will decrease or be eliminated
- Parathyroid Hormone
 - maintains normal calcium levels in circulation, required for normal bone growth
- Gonad Hormone
 - sexual hormones change skeletal proportions & trigger development of secondary sexual characteristics



ENDOCRINE SYSTEM - HORMONES & BEHAVIOR

- Sexual hormones cause more aggression and assertiveness
- With adults - changes in the mixture of hormones effect:
 - intellectual capabilities
 - memory
 - learning
 - emotional states
- *Hormones are being used as supplements



CIRCULATORY SYSTEM

- Two Circuits - pulmonary & systemic
- Each circuit of blood begins & ends at heart
- Arteries bring oxygenated blood to tissues & organs
- Veins bring back waste products to heart to be filtered
- during exercise the demand for oxygen increases
 - blood flow to heart may increase up to 9X's more than at rest
- When using specific body part, heart sends more oxygenated blood to that area



LYMPHATIC SYSTEM

- Lymphocytes are the dominant cells
- Lymphocytes help us to resist or overcome infection & disease
- Lymphocytes are produced & stored in lymphatic organs
- Lymphatic vessels empty into two collecting ducts, each receiving from designated areas of the body



LYMPHATIC SYSTEM - COMPONENTS

- Lymphatic Vessels
 - begin in tissues & end at the connection to the venous system
- Lymph Fluid
 - flows through vessels, resembles plasma
- Lymphoid Organs
 - connected to vessels & contain large #'s of lymphocytes (Lymph nodes, spleen, thymus)



LYMPHATIC SYSTEM - FUNCTIONS

- Production, maintenance, & distribution of lymphocytes
- Return of fluid & solutes from peripheral tissues to the blood
 - maintains normal blood volume
- Distribution of hormones, nutrients, & waste products from tissues of origin to the general circulation
 - substances unable to enter blood stream directly may do so through lymphatic vessels



RESPIRATORY SYSTEM

- Nose
- Nasal Cavity
- Sinuses
- Pharynx (throat)
- Larynx (voice box)
- Trachea (wind pipe)
- Bronchi & Bronchioles (passage ways)
- Alveoli (exchange surfaces)



RESPIRATORY SYSTEM CONT.

- Aerobic Respiration
 - requires oxygen & produces carbon dioxide
- There are respiratory exchange surfaces in the lungs
 - gets oxygen to the blood
- Blood carries oxygen from the lungs to the peripheral tissues
- Blood carries carbon dioxide from peripheral tissues to the lungs



RESPIRATORY SYSTEM - 4 FUNCTIONS

- Moves air to & from the gas-exchange surfaces where diffusion can occur between air & circulating blood
- Provides defenses against pathogenic invasion
- Permits vocal communication
- Helps control body fluid pH
- **Respiration Cycle
 - single inhalation and exhalation
- **respiration rate - between 12-20 breaths per min.



DIGESTIVE SYSTEM

- Oral Cavity
- Pharynx
- Esophagus
- Stomach
- Small Intestine
- Large Intestine
- Rectum
- Anus
- *Digestive tract lining protects surrounding tissues from:
 - corrosive effects of acids & enzymes; pathogens that are either swallowed with food or residing inside the digestive tract



DIGESTIVE SYSTEM - 6 STEPS

- Ingestion
 - when food enters digestive tract through mouth
- Mechanical Processing
 - physical breakdown of food
- Digestion
 - chemical breakdown of food
- Secretion
 - releases water, acids, enzymes, & buffers to aid digestion



DIGESTIVE SYSTEM - 6 STEPS CONT.

- Absorption

- movement of small molecules, electrolytes, vitamins, & water cross digestive epithelium to interstitial fluid of the digestive tract

- Excretion

- elimination of waste products from the body



DIGESTIVE SYSTEM - OTHER INVOLVED ORGANS

○ Pancreas

- produces digestive enzymes & buffers
- located in the upper left quadrant (mono)

○ Liver

- metabolic & hematological regulation & bile production
- located in the upper right quadrant (hepatitis)

○ Gallbladder

- bile storage & modification
- located on the back side of the liver (gall stones)



URINARY SYSTEM

- Two Kidneys
- Two Ureters
- Urinary Bladder
- Urethra
- *Removes most of organic waste from the blood & excretes it via urine which is produced by the kidneys



URINARY SYSTEM - 4 FUNCTIONS

- Regulating blood volume & blood pressure
 - by adjusting volume of water in urine & releasing hormones
- Regulating plasma concentrations of sodium, potassium, chloride, & other ions
 - controls quantities lost in urine
- Stabilizing blood pH
 - controls loss of hydrogen ions & bicarbonate ions in urine



URINARY SYSTEM - 4 FUNCTIONS

- Conserving valuable nutrients (glucose & amino acids)
 - by preventing excretion in the urine while excreting waste products
- **as related to sport - pH levels (normal - 7.35-7.45)
 - increased concentration=> dehydration



REPRODUCTIVE SYSTEM

- Produces, stores, nourishes, & transports male & female reproduction cells called gametes
- Sexual hormones are being used as supplements
- Possible problems in sport
 - males being hit in the external genitalia
 - ammenorrhea



THANK YOU!!

- Any Questions?
- Hint: If there are no Questions, YOU CAN GO HOME!!!!!!

