

## NAS 161-162 - Unit Behavioral Objectives

The following material lists the behavioral objectives which define the content of the NAS 161-162 courses. As stated in the syllabus, these objectives define what is to be mastered and on what materials the student will be tested. The resources for mastering these objectives include text readings, laboratory exercises, lab manual and text diagrams, instructor-provided handouts and study guides, LRC and on-line reference materials, and class lecture notes. It is the student's responsibility to utilize any and all of those resources to master the objectives. Students will be required to spell all terms correctly.

### NAS 162 – Health Science II

#### UNIT 1 – Brain & Cranial Nerves

1. Describe the meninges. Identify and describe the layers, spaces and structures associated with them.
2. Describe the origination, circulation and resorption of Cerebrospinal Fluid. Give some of its functions.
3. Describe the Blood-Brain Barrier.
4. Identify the following structures and anatomical features of the brain: **Cerebrum:** right and left cerebral hemispheres, frontal, parietal, temporal, occipital lobes, insula, gyri, sulci, central sulcus, precentral and postcentral gyri, corpus callosum, cerebral cortex, tracts, basal ganglia. **Diencephalon:** thalamus, hypothalamus, fornix, intermediate mass, pineal body, mammillary bodies, hypophysis, optic chiasma. **Cerebellum:** cerebellar hemispheres, arbor vitae. **Brain Stem:** midbrain, corpora quadrigemina, cerebral peduncle, pons, medulla oblongata.
5. Describe the functions of the following brain regions and structures: Cerebrum, corpus callosum, thalamus, hypothalamus, cerebellum, midbrain, pons, medulla oblongata.
6. Locate and describe the following functional areas of the cerebrum: somatosensory area, visual area, auditory area, common integrative area, primary motor (somatomotor) area, premotor area, motor speech area. Describe how some sensory and motor pathways decussate.
7. Describe the role of the limbic system.
8. Define and give examples of EEG patterns.
9. Name, in proper sequence, the 12 pairs of cranial nerves. Give major sensory and/or motor functions of each nerve.

#### UNIT 2 – Spinal Cord & Spinal Nerves

1. Identify and describe the following structures associated with the spinal cord: cervical enlargement, lumbar enlargement, conus medullaris, filum terminale, spinal nerves, cauda equina, anterior median fissure, posterior median sulcus, central canal, anterior-lateral-posterior columns, anterior-lateral-posterior gray horns, gray commissure, spinal nerve anterior root, spinal nerve posterior root, posterior root ganglion, spinal meninges, epidural space.

2. Distinguish between ascending and descending tracts of the spinal cord. Give examples of each kind.
3. Describe the characteristics and components of a reflex and spinal reflex arc. Distinguish between somatic and visceral reflexes and spinal and cranial reflexes.
4. Describe and give examples of ipsilateral, contralateral and intersegmental spinal reflex pathways. Demonstrate some clinically important spinal reflexes.
5. Describe the distribution of the 31 pairs of spinal nerves. Give the functional distinctions of the anterior and posterior roots of the spinal nerves.
6. Describe the connective tissues of a nerve.
7. Locate the cervical, brachial, lumbar and sacral plexi. Name the spinal nerves that contribute to them and identify some major nerves that emerge from them.
8. Describe the roles of the following nerves; phrenic, axillary, radial, median, ulnar, femoral, sciatic.
9. Define dermatomes.

### **UNIT 3 – Sensory, Motor, Integrative Functions**

1. Define SENSATION. Give prerequisites for perception of sensations.
2. Describe sensory projection and adaptation.
3. Describe how sensory receptors are classified on the basis of location and by types of stimuli.
4. Differentiate between General (somatic) and Special senses. Give examples.
5. Describe some of the receptors and their locations for fine touch, pressure, thermal senses and pain.
6. Differentiate between somatic and visceral pain. Describe the phenomena of referred pain and phantom-limb pain.
7. Describe the proprioceptive and kinesthetic senses and the receptors responsible.
8. Describe the roles of the Posterior Column Tracts, Spinothalamic Tracts and Spinocerebellar Tracts.
9. Describe the location and roles of the Somatosensory Areas of cerebral cortex.
10. Identify the principle parts of the brain involved in control of the skeletal muscles.
11. Differentiate between the Direct (Pyramidal) and Indirect (Extrapyramidal) descending tracts of the spinal cord. Give examples and roles of each.
12. Define what is meant by the “final common pathway” of skeletal muscle control.
13. Describe the components and functions of the Reticular Activating System.
14. Give at least 5 examples of Integrative functions carried out by the brain.

### **UNIT 4 – Special Senses**

1. Describe the locations, characteristics and actions of the olfactory and gustatory receptors and senses.
2. Describe the following accessory structures associated with the eyes: lacrimal apparatus, palpebrae, conjunctiva.
3. Describe the extrinsic eye muscles.

4. Locate and describe the following eye structures: sclera, choroid, retina, optic disc, optic nerve, central fovea, retinal blood vessels, cornea, iris, pupil, ciliary body, suspensory ligaments, lens, anterior cavity, aqueous humor, scleral venous sinus ( canal of Schlemm), vitreous chamber, vitreous body.
5. Define/describe refraction, accommodation of the lens, pupil constriction/dilation, convergence.
6. Describe how the eye adjusts for near and far focusing and in dim and bright light.
7. Differentiate between rods and cones.
8. Describe the neural pathway of visual fibers to the brain.
9. Locate and describe the following structures associated with the ear: pinna, external auditory canal, tympanic membrane, middle ear, malleus, incus, stapes, auditory tube, cochlea, cochlear duct, spiral organ, vestibule, oval window, round window, utricle, saccule, semicircular canals, semicircular ducts, vestibular nerve, cochlear nerve, perilymph and endolymph.
10. Describe how sound is conducted into the inner ear.
11. Describe the location and functions of the following sensory organs: spiral organ, maculae, cristae ampullaris and how they contribute to the physiology of hearing, static equilibrium and dynamic equilibrium.

#### **UNIT 5 – Autonomic Nervous System**

1. Describe the components and general functions of the Autonomic Nervous System.
2. Describe the roles of preganglionic and postganglionic neurons in autonomic efferent pathways.
3. List and describe the components of a visceral autonomic reflex pathway.
4. Differentiate between the Sympathetic and Parasympathetic Divisions of the ANS on the basis of: preganglionic outflow, ganglion and nerve locations, adrenergic and cholinergic, alpha-beta & muscarinic- nicotinic receptors, general effects and specific effects on selected effectors.
5. Describe the role of the hypothalamus in control of the ANS.

#### **UNIT 6 – Endocrine System.**

1. Describe the components of the endocrine system. Compare and contrast the functioning of the endocrine and nervous systems.
2. Distinguish between circulating hormones and local hormones (paracrines and autocrines).
3. Identify and give examples of the major chemical classes of hormones.
4. Describe how hormones interact with their target cells. Discuss the roles of receptors and “second messengers”.
5. Describe the means of regulation of hormone secretion.
6. Describe the locations and endocrine functions of the following glands; name the major hormones and their effects; describe the processes involved in the control of their secretion; for some of the hormones, describe the effects of hyposecretion and hypersecretion: Hypothalamus, Pituitary (Anterior Pituitary & Posterior

- Pituitary), Pineal Gland, Thyroid Gland, Parathyroid Glands, Adrenal Glands ( Adrenal Cortex & Adrenal Medulla), Pancreatic Islets, Ovaries & Testes (specific details to be covered in Reproductive System unit).
7. Describe the Stress Response ( General Adaptation Syndrome ). Discuss the Fight-or-Flight Response and the Resistance Reaction. Describe stress related exhaustion.

## **UNIT 7 – Cardiovascular System**

### **BLOOD**

1. Describe the components and major functions of the cardiovascular system.
2. List and describe important characteristics of the blood.
3. Distinguish among the formed elements of the blood. Describe their numbers, characteristics, functions, production. Discuss each of the following: erythropoietin, reticulocytes, hemoglobin, bilirubin, transferrin, granulocytes, agranulocytes, differential count, emigration, megakaryocytes.
4. Describe the process of hemopoiesis. Identify its location and the role of hemopoietic stem cells.
5. Describe the components and characteristics of the blood plasma.
6. Describe the mechanisms of hemostasis. Distinguish between the Extrinsic Pathway and Intrinsic Pathway of blood clotting. Summarize the 3 Stages of the blood clotting cascade.
7. Describe the fibrinolytic system. Identify important anticoagulants. Describe/define Thrombosis.
8. Describe the distribution of A & B antigens and A & B antibodies among the ABO blood groups. Identify compatible and incompatible transfusion types for each blood type.
9. Distinguish between Rh<sup>+</sup> and Rh<sup>-</sup> blood groups. Relate the circumstances of Rh incompatibility to Hemolytic Disease of the Newborn.

### **HEART**

1. Define/describe/identify the following structures associated with the heart: pericardium, pericardial cavity, epicardium, myocardium, endocardium, right and left atria, right and left auricles, right and left ventricles, superior and inferior vena cavae, pulmonary artery, pulmonary veins, aorta, tricuspid valve, bicuspid (mitral) valve, pulmonary semilunar valve, aortic semilunar valve, interatrial septum, interventricular septum, chordae tendineae, papillary muscles.
2. Describe the major blood vessels of coronary circulation.
3. Trace the flow of “oxygenated” and “deoxygenated” blood through the heart. Distinguish between pulmonary and systemic circuits.
4. Describe the heart’s Conduction System. Give the functions of the Sinoatrial (SA) Node, Atrioventricular (AV) Node, Atrioventricular Bundle, Right & Left Branch Bundles and Purkinje Fibers.
5. Describe the role of Ca<sup>++</sup> channels and Ca<sup>++</sup> in cardiac muscle contraction.
6. Define EKG and describe the events of a normal EKG.

7. Describe the events associated with each of the following phases of a Cardiac Cycle: Atrial Systole, Ventricular Systole, Relaxation Period. Relate the events of the cardiac cycle to the filling of the chambers, the pumping action of the ventricles, pressure changes within the chambers, opening and closing of valves, generation of heart sounds.
8. Define Cardiac Output. Give examples of Cardiac Output volumes under changing circumstances. Describe factors and conditions which effect Stroke Volume and Heart Rate.
9. Describe neural, hormonal and chemical regulation of the heart.

## **BLOOD VESSELS**

1. Distinguish among arteries, arterioles, capillaries, venules and veins on the basis of function and structure.
2. Describe those mechanisms which aid the flow of blood through veins.
3. Define/describe the following terms associated with blood vessels: vasoconstriction, vasodilation, anastomoses, collateral circulation, sinuses, sinusoids.
4. Define pulse. Identify important pulse points.
5. Locate the following systemic arteries and veins and identify the organs or regions served by each: **ARTERIES:** Aorta (ascending, arch, descending thoracic & abdominal), rt. & left coronary, brachiocephalic, common carotid, internal & external carotid, vertebral, basilar, anterior & posterior communicating, subclavian, axillary, brachial, radial, ulnar, celiac trunk, splenic, gastric, common hepatic, superior mesenteric, renal, gonadal, inferior mesenteric, common iliac, internal & external iliac, femoral, popliteal, posterior & anterior tibial **VEINS:** superior vena cava, coronary sinus, azygos, brachiocephalic, internal jugular, external jugular, subclavian, axillary, brachial, basilic, cephalic, median cubital, dorsal venous arch, inferior vena cava, hepatics, hepatic portal, superior & inferior mesenteric, renal, gonadal, common iliac, internal & external iliac, femoral, popliteal, posterior & anterior tibial, great saphenous.
6. Describe the Hepatic Portal Circuit and its significance.
7. Identify and describe the major differences between fetal and post-natal circulation pathways.
8. Define Blood Pressure. Define and distinguish between systolic, diastolic, pulse and mean arterial pressure.
9. Describe how Cardiac Output and Systemic Vascular Resistance effect arterial blood pressure. Identify and describe those factors which contribute to and effect CO and SVR.
10. Describe the cardiac and vasomotor reflexes which contribute to the homeostatic control of arterial blood pressure.

## **UNIT 8 – Lymphatic System & Resistance**

1. Describe the components and functions of the lymphatic system.
2. Describe the structure, tissues and functions of the following: lymphatic capillaries, lymph, lymphatic vessels, cisterna chili, thoracic duct, right lymphatic duct, lymph nodes, lymphatic nodules, diffuse lymphatic tissue.
3. Describe the general plan of lymphatic drainage and describe those processes that assure and maintain lymph flow.
4. Locate major regional groupings of lymph nodes.
5. Describe the location, structure, tissues and functions of the spleen.
6. Describe the characteristics of the tonsils.
7. Describe the location, characteristics and functions of the thymus gland.
8. Define Resistance. Distinguish between Non-Specific Resistance and Specific Resistance.
9. Define/describe the following examples and components of the body's non-specific resistance: skin & mucous membranes, external chemical defenses, external cleansing mechanisms, complement, interferon, phagocytes, natural killer cells, inflammation, fever.
10. Define and describe the characteristics of an Antigen.
11. Distinguish between Antibody-Mediated Immune Responses and Cell-Mediated Immune Responses. Describe the processes involved in activating and carrying out AMI and CMI responses. Identify the cells involved and their functions.
12. Define/describe the roles and significance of each of the following as they relate to or participate in immune responses: B-cells, T-cells, CD4+ T-cells, CD8+ T-cells, T<sub>c</sub> cells, T<sub>H</sub> cells, plasma cells, memory cells, cytokines, antigen-presenting cells, major histocompatibility complex, immunoglobulins.
13. Describe how immunological memory develops. Distinguish between primary and secondary immune responses.
14. Distinguish between Active & Passive Immunity.
15. Define and give examples of allergic reactions and autoimmune diseases.

## **UNIT 9 – Respiratory & Digestive Systems**

### **RESPIRATORY SYSTEM**

1. Identify the respiratory gasses. Describe the processes of Cellular Respiration, Internal Respiration and External Respiration. Relate Partial Pressures of Oxygen and Carbon Dioxide to net diffusion.
2. Locate, identify and describe the characteristics and functions of the following structures associated with the respiratory system: nose and nasal cavity, nasal conchae, nasal septum, paranasal sinuses, mouth and oral cavity, hard and soft palate, uvula, pharynx, nasopharynx, oropharynx, laryngopharynx, pharyngeal tonsils, palatine tonsils, lingual tonsils, larynx, epiglottis, glottis, true vocal cords, thyroid cartilage, cricoid cartilage, trachea, carina, right and left primary bronchi, secondary bronchi, tertiary bronchi, bronchioles, terminal bronchioles, alveolar ducts, alveoli, right and left lungs, pulmonary and parietal pleurae.

3. Identify the roles played by the following: respiratory membrane, pulmonary capillaries, Type I & II alveolar cells, alveolar macrophages, surfactant.
4. Describe the mechanisms of pulmonary ventilation. Identify the roles of the diaphragm and intercostal muscles. Relate changes in alveolar, intrapleural, and atmospheric pressures to inspiration and expiration. Define Compliance and describe its importance.
5. Define and give normal volumes of the following pulmonary capacities: Tidal Volume, Minute Respiratory Volume, Forced Expiratory Volume-1 sec., Inspiratory & Expiratory Reserve Volumes, Inspiratory & Expiratory Capacities, Vital Capacity, Total Lung Volume, Minimal Volume.
6. Relate the physiological importance or application of the following gas laws: Boyle's Law, Dalton's Law, Henry's Law.
7. Describe how oxygen is transported in the blood. Identify those factors which promote or inhibit oxyhemoglobin association and dissociation.
8. Describe how carbon dioxide is transported by the blood. Identify the roles played by carbonic anhydrase and Cl<sup>-</sup> ions. Relate blood CO<sub>2</sub> levels to blood pH.
9. Describe the neural regulation of breathing. Identify the respiratory centers of the brain. Identify and describe the various stimuli that effect respiratory rate and depth.

### **DIGESTIVE SYSTEM**

1. List and describe the components and principle functions of the digestive system.
2. Distinguish between the organs of the alimentary canal and accessory digestive organs.
3. Describe the histology and characteristics of the layers composing the wall of the alimentary organs.
4. Identify and describe the parietal and visceral layers of peritoneum, greater and lesser omentum, mesentery and mesocolon.
5. Describe the structures, tissues and functions of the following: mouth & oral cavity, teeth, tongue, salivary glands, pharynx, esophagus, stomach, duodenum, jejunum, ileum, cecum, appendix, ascending-transverse-descending-sigmoid colons, rectum, anus. Identify all major sphincters.
6. Describe the structure and functions of the pancreas.
7. Describe the structure and functions of the liver, gall bladder, hepatic-cystic-common bile ducts.
8. Identify important digestive enzymes; where they are secreted, what their substrates and actions are.
9. Describe the neural and hormonal control of the digestive organs.

### **UNIT 10 – Urinary System / Water, Electrolyte, pH Regulation**

1. Describe the major functions and contributions of the urinary system.
2. Locate and describe the structures and characteristics of the following: kidneys, renal cortex, renal medulla, renal pyramids, renal columns, renal papillae, minor & major calyces, renal pelvis, ureters, urinary bladder, urethra.

3. Describe the structures and blood vessels associated with a nephron. Distinguish between cortical and juxtamedullary nephrons.
4. Describe the process of Glomerular Filtration. Identify how net effective filtration pressure is determined. Give the normal filtration rates and contrast the composition of blood plasma and filtrate.
5. Describe the process of Tubular Reabsorption. Identify the roles played by ADH, aldosterone and Angiotensin II in regulating the rates of tubular reabsorption of water and solutes. Describe how dilute or concentrated urine can be produced.
6. Describe the process of Tubular Secretion. Identify those substances that are normally secreted. Describe how tubular secretion of H<sup>+</sup> contributes to pH regulation of the blood.
7. Describe the Renin-Angiotensin Mechanism. Explain how it contributes to regulation of arterial blood pressure.
8. Describe the physical characteristics and chemical composition of normal urine.
9. Give the normal water composition of the body. Identify the fluid compartments of the body. List means of water intake and water output and how intake and output are regulated.
10. Identify the forces which regulate net movement of water to and from the blood plasma, interstitial fluid and intracellular fluid.
11. Contrast the electrolyte composition of IntraCellular Fluid and ExtraCellular Fluid. Given sufficient data, determine normal and abnormal levels of the following: Na<sup>+</sup>, Cl<sup>-</sup>, K<sup>+</sup>, Ca<sup>++</sup>, HPO<sub>4</sub><sup>=</sup>, Mg<sup>+</sup>.
12. State the normal pH range of ECF.
13. Describe how buffers, the lungs and kidneys contribute to acid-base balance in the body. Identify important buffers.
14. Differentiate between respiratory and metabolic forms of acidosis and alkalosis and relate changes in blood pCO<sub>2</sub> and -HCO<sub>3</sub> to them.

## **UNIT 11 – Reproduction**

1. Describe the functional anatomy of the human male reproductive system. Identify the organs and tissues and describe their functions.
2. Trace the course followed by a spermatozoa from its production to its ejaculation.
3. Describe the sources, composition and functions of semen. Describe the mechanisms of erection and ejaculation.
4. Identify the roles played by the following hormones as they relate to male reproductive physiology: FSH, LH(ICSH), androgens (testosterone), inhibin. Describe their actions and the processes that regulate their secretion.
5. Describe the functional anatomy of the human female reproductive system. Identify the organs and tissues and describe their functions.
6. Describe the stages of ovarian follicular development, from primordial follicles through the corpus albicans.
7. Describe the course taken by an ovulated oocyte and spermatozoa through the female reproductive tract to the point of fertilization.
8. Describe the structures and characteristics of the breasts and mammary glands.

9. Identify the roles played by the following hormones as they relate to female reproductive physiology: FSH, LH, estrogen, progesterone, relaxin, inhibin, HCG.
10. Identify and describe the events and stages associated with the ovarian and menstrual cycles. Describe the changes that occur with the endometrium and ovarian follicles. Describe the roles played by FSH, LH, estrogen, progesterone and HCG. Relate the events of fertilization and embryo implantation to the appropriate stages of the menstrual cycle.
11. Describe and contrast the processes of oogenesis and spermatogenesis. Describe the characteristics of a mature ovum and spermatozoa.
12. Describe the following processes and stages: fertilization, zygote, cleavage divisions, morula, blastula, implantation, gastrulation, endoderm, ectoderm, mesoderm, embryo, fetus.
13. Describe the development of the placenta and amnion.
14. Describe the events and stages that lead to and occur during parturition.
15. Identify and describe some of the methods of contraception.