

ANATOMY AND PHYSIOLOGY II - BIO 224

Lecture and Laboratory Course Objectives

The Biol 224 lecture exam and laboratory exam objectives are split into 2 sections – the lecture objectives, followed by the laboratory objectives. However there is obviously considerable overlap between the two and it is impossible to separate them fully.

Before each exam review both the lecture and lab objectives for the relevant sections. Some laboratory objectives may appear on the lecture exams and some lecture objectives may appear on the laboratory exams.

Material to be covered on Lecture Tests (also see Lab Objectives)

Chapter 18: The Heart

1. Be able to describe the following about the heart:
 - size
 - location
 - valves
 - great vessels
 - path of the blood through the heart to the to lungs
 - path of the blood through the heart to the to systemic circulation
2. Name the coverings of the heart.
3. Know the following functions of the valves of the heart.
 - when and why the valves open and close
 - what keeps certain valves from being forced to open backwards
 - what a heart murmur is
4. Trace route of blood moving through the heart, starting with the inferior and superior vena cava and exiting through the aortic arch. List all valves, chambers, and vessels involved.
5. Describe the operation of the cardiac conduction system by identifying system parts and locations and the proper action sequence for one normal cardiac cycle. Also know:
 - pacemaker areas of the heart
 - reasons for heart block
 - role of gap junctions
6. Draw a diagram of the normal electrocardiogram. Name the individual waves and indicate what each represents in terms of electrical and mechanical activity of the heart.
7. Define and know the equation that relates:
 - Cardiac output
 - Stroke volume
 - Heart Rate
8. Define and know these factors and how they affect Stroke Volume:
 - End diastolic volume

- venous return
 - End systolic volume
 - Heart Rate
 - Heart Contractility
 - Afterload
 - Preload
9. Explain the role of the sympathetic and parasympathetic (autonomic) nervous system on heart rate and contractility.
10. Know the role of potassium in regulating heart function.
11. Know the definitions of these clinical descriptions of heart function.
- Fibrillation
 - Defibrillation
 - Tachycardia
 - Bradycardia
 - Coronary or Heart Attack
 - Angina
 - Systole
 - Diastole
 - Congestive Heart Failure
 - Dilated myopathy
 - Pulmonary congestion
12. Know the long term effect that increased blood pressure (afterload) has on the heart.

Chapter 19: Blood Vessels

1. Know:
- the three layers of arteries and veins
 - how the layers differ between arteries and veins
 - lumen
 - vaso vasorum
 - endothelial cells
 - secretions of endothelial cells
 - types of arteries
 - elastic
 - muscular
 - arterioles
 - terminal
 - metarterioles
 - thoroughfare
 - capillaries
 - continuous
 - fenestrated
 - sinusoidal

- true
 - precapillary sphincter
 - postcapillary venules
 - venules
 - venous valves
 - anastomoses
 - veins
 - arterial
 - arteriovenous
2. Define, know approximate values for and how to calculate (when appropriate)
- these terms
 - systolic pressure
 - diastolic pressure
 - pulse
 - sphygmomanometer
 - sounds of Korotkoff
 - pulse pressure
 - mean arterial pressure
 - hypotension
 - orthostatic hypotension
 - hypertension
 - primary or essential hypertension
 - secondary hypertension
 - chronic hypertension
3. Compare
- blood pressure of aorta
 - with blood pressure of capillaries (why it is so low)
 - with blood pressure of veins
4. Know the equations relating:
- BP (blood pressure), BF (blood flow) and R (resistance).
 - Blood Pressure (BP) = CO (cardiac output) X peripheral resistance (PR).
 - CO (cardiac output), R, BP, and BP
 - SV (stroke volume), HR (heart rate), R, BP, and BF
5. Know how blood pressure (BP) is affected by the following factors
- blood flow (BF)
 - resistance (R)
 - blood viscosity
 - length of blood vessels
 - diameter of blood vessels
 - blood volume (BV)
 - heart rate
 - arterial elasticity

- cardiac output
 - stroke volume (SV)
 - preload
 - afterload
 - contractility
 - sympathetic stimulation
 - parasympathetic stimulation
6. Know the neural controls of short term blood pressure regulation, including:
- Chemoreceptors
 - Baroreceptors
 - Higher brain centers
 - Hormones
 - antidiuretic hormone (ADH)
 - epinephrine
 - norepinephrine
 - atrial natriuretic factor
 - angiotensin II
 - endothelium derived relaxing factor (EDFR) = Nitric Oxide
 - endothelium derived constricting factor (EDCF) = endothelin
 - effects of alcohol
7. Know these mechanism of long term regulation of blood pressure.
- renin-angiotensin mechanism
 - aldosterone
 - antidiuretic hormone (ADH)
 - the relationship between [Na] plasma , [H₂O] plasma , BV, and BP.
8. Know the following mechanisms of autoregulation:
- short term autoregulation
 - metabolic controls
 - myogenic controls
 - long term autoregulation
9. Name three medical problems caused by hypertension.
10. Know the exercise induced changes in blood flow to skeletal muscle, brain, skin, lungs, kidney and heart.
11. Define circulatory shock and explain the homeostatic mechanisms that compensate for it. Know these types of shock:
- hypovolumic shock
 - vascular shock
 - cardiogenic shock
 - orthostatic shock
12. Know the three factors aiding venous return.
13. Describe and contrast the fluid compartments of the body: ICF (plasma and interstitial fluid) versus ECF.
14. Describe the typical capillary bed and explain the factors at work within it that allow for the movement of nutrients in and out of the capillary bed. Know the role of the following factors.

- Hydrostatic pressure = HP
 - Hydrostatic pressure of capillary = HP c
 - Hydrostatic pressure of interstitial fluid = HP if
 - Osmotic pressure = OP
 - Osmotic pressure of capillary = OP c
 - Osmotic pressure of interstitial fluid = OP if
15. Describe the relationships between edema and each of the following:
- blood hydrostatic pressure
 - capillary permeability
 - lymphatic drainage
 - blood osmotic pressure
 - interstitial osmotic pressure

CHAPTER 22: RESPIRATORY SYSTEM

1. Be able to identify the following components of the respiratory system:
- primary bronchi
 - secondary bronchi
 - tertiary bronchi
 - bronchioles
 - terminal bronchioles
 - respiratory bronchioles
 - alveolar ducts
 - alveolar sacs
 - alveoli
 - respiratory zone
 - conducting zone
 - Type I cells
 - Type II cells
 - pulmonary arteries
 - bronchial arteries
 - lung compliance
 - alveolar surface tension
 - spirometer
 - anatomical dead space
 - alveolar dead space
 - total dead space
 - alveolar ventilation
 - respiratory resistance
 - nonrespiratory air movements
 - hyperbaric oxygen
 - ventilation
 - perfusion

- oxyhemoglobin
 - deoxyhemoglobin
 - carbaminohemoglobin
 - hypoxia
 - anemic hypoxia
 - ischemic hypoxia
 - histotoxic hypoxia
 - hypoxemic hypoxia
 - hyperventilation
 - hypocapnia
 - hypoventilation
2. Describe the protective mechanisms of 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 the liquid.
 6. Be able to define inspiration and expiration (quiet and forced).
 7. Be able to define and know the factors responsible for atmospheric pressure, intrapulmonary pressure, intrapleural pressure, and transpleural pressure. Know the vital roles these pressures play in inspiration and expiration.
 8. Define external respiration and explain the factors that play important roles during external respiration. Define internal respiration and the factors that play an important role in internal respiration.
 9. Differentiate between the partial pressures of O₂ and CO₂ of the atmosphere, the alveoli, venous blood, arterial blood and the interstitial space.
 10. Understand ventilation-perfusion coupling.
 11. Know the four respiratory volumes:
 - 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. Describe the actions of the following stimuli upon the bronchi:
 - sympathetic stimuli
 - epinephrine
 - parasympathetic stimuli
 - acetylcholine

- histamine
14. Trace the pathway of oxygen traveling from the atmosphere to the cells of the a tissue bed of the body.
 15. Describe the ways in which oxygen is transported in the blood.
 16. What is the oxygen-hemoglobin dissociation curve. Draw this curve and label the x axis and the y axis.
 17. How do the following factors affect the oxygen-hemoglobin dissociation curve and how do they affect the delivery of oxygen to the tissues?
 - BPG
 - P CO₂
 - pH
 - Temperature
 18. Describe the three ways in which carbon dioxide is transported in the blood.
 19. Write (and memorize) the chemical equation which describes how carbon dioxide combines with water to become dissolved in the blood.
 20. Describe the general mechanism of buffers and explain the major buffers found in the blood. How can you use this equation to describe how CO₂ buffers acid in the blood?
 21. What is the normal pH of the blood; what is its physiological range
 22. Disregarding any buffer action, describe the effect of increasing blood P CO₂ on blood pH; of decreasing blood P CO₂
 23. What is the main chemical that affects the rate and depth of breathing?
 24. How do P CO₂ , P O₂ , and pH affect the rate and depth of breathing?
 25. Describe and give one reason for the development of
 - respiratory acidosis
 - respiratory alkalosis
 - metabolic acidosis
 - metabolic alkalosis.
 26. Describe the neural controls of respiration.
 27. Identify and state the location of respiratory control centers of the central nervous system.
 28. Describe the location of respiratory stretch receptors and their role in the Hering-Breuer Reflex.
 29. Describe the location and action of respiratory chemoreceptors.
 30. Describe the characteristic of the following respiratory patterns:
 - eupnea
 - apnea
 - dyspnea
 - hyperpnea
 - chronic pulmonary diseases
 - obstructive emphysema
 - chronic bronchitis
 - tuberculosis
 - lung cancer (squamous cell, adenocarcinoma, small cell carcinoma)

CHAPTER 16: THE ENDOCRINE SYSTEM

1. Distinguish between an endocrine gland and an exocrine gland.
2. Explain the differences between how the endocrine system and the nervous system control body functions.

3. What are the three ways hormones are stimulated to be released (humoral, neural and hormonal)? What are the different chemical classifications of hormones? What are tropic hormones?
4. List the major endocrine organs, and describe their locations in the body.
5. Know the role of the following events in controlling target cell activation:
 - [hormone] blood
 - half life
 - factors controlling [hormone] blood
 - receptor affinity
 - upregulation of receptors
 - downregulation of receptors
6. Understand the following mechanisms hormones use to cause changes in their target cells to achieve their desired results.
 - Changes in membrane permeability
 - Changes in protein synthesis
 - Changes in enzyme synthesis
 - Changes in secretion
 - Mitosis
7. Know the pathways of these second messenger systems that are used by
 - hormones to communicate with their target cells.
 - Plasma membrane receptors
 - cAMP
 - cGMP
 - PIP-Ca ++ mediated mechanism
 - Intracellular receptors
8. What are protein kinases? How are they used to change cell activity?
9. Define a prostaglandin and explain how it is related to hormonal control.
10. Define negative feedback and give an example of how hormones act in this manner.
11. Define positive feedback and give an example of how hormones act in this manner.
12. Describe the structural and functional relationships between the hypothalamus and the pituitary gland. What is the hypothalamic-hypophyseal tract? What is the hypophyseal portal system?
13. Identify the hormones produced by the anterior pituitary gland and state their functions and mode of control.
14. Identify the hormones of the posterior pituitary gland and state their functions and mode of control. Why is the hypothalamus considered a neuroendocrine gland?
15. Explain the mechanism by which releasing factors control secretions of the anterior pituitary. Know the hypothalamic-pituitary relationship for and function of:
 - TRH-TSH-TH
 - GHRH, GHIH-GH-Somatostatin
 - CRH-ACTH--Mineralocorticoids (aldosterone)
 - Glucocorticoids
 - Gonadocorticoids
 - GnRh-FSH, LH-Estrogen
 - Progesterone
 - Testosterone

- PRH, PIH-Prolactin

16. Describe the function of the following glands:

- anterior pituitary
- posterior pituitary
- hypothalamus
- thyroid
- parathyroid
- thymus
- pineal
- testes
- ovary
- pancreas
- placenta
- adrenal

17. Describe the origin, target, mechanism of release, and function/s of the following hormones:

- growth hormone
- thyroid stimulating hormone
- adrenocorticotrophic hormone
- follicle stimulating hormone
- luteinizing hormone
- prolactin
- oxytocin
- antidiuretic hormone
- thyroxin
- calcitonin
- parathyroid hormone
- insulin
- glucagon
- noradrenaline
- adrenaline
- cortisol
- aldosterone
- estrogen
- progesterone
- testosterone
- melatonin
- thymosin
- glucocorticoids
- atrial natriuretic factor (ANF)
- erythropoietin
- cholecalciferol
- GI hormones

- Gastrin
 - Serotonin
 - Intestinal gastrin
 - Secretin
18. What are the different types of hormone receptors? How does their location vary with chemical classification of the hormone that binds to them?
 19. State the relationship of the adrenal medulla to the autonomic nervous system.
 20. Describe and correlate the clinical symptoms of diabetes mellitus with the pathophysiology of this disease. What are the two causes of diabetes mellitus? What are the two types of diabetes mellitus and how do they differ?
 21. Describe how the following conditions are related to specific hormones:
 - Pituitary dwarfism
 - Addison's Disease
 - Gigantism
 - Grave's Disease
 - Cretinism
 - Acromegaly
 - Exophthalmic goiter
 - Cushing's Syndrome
 - Hypersecretion of prolactin
 - Diabetogenic effect of GH
 - Progeria
 22. What are the four different ways aldosterone is controlled? What is the effect of hyperaldosteronism?
 23. Know the significance of or be able to define:
 - Follicles
 - Thyroglobulin
 - Colloid
 - Myxedema
 - Simple Goiter
 - T3
 - T4
 - Symptoms of hyperthyroidism
 - Parafollicular or C cells
 - Know the effects of calcitonin (note – see also page 189)
 - Know the location, function of parathyroid glands
 - Know the location, function of the chief cells of the stomach (see pages 900-901)
 - Know the 3 ways PTH controls [Ca] blood (see p. 625)
 - Know the symptoms of hyperparathyroidism

CHAPTER 25: THE URINARY 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. Trace the blood supply through the kidney.
4. Describe the anatomy of a nephron.
5. Identify which parts of the nephron are responsible for filtration, reabsorption, and secretion, and describe the role played by each in urine formation.
6. Discuss the role of each of the following during filtration:
 - Filtration membrane
 - Net filtration pressure
 - blood (glomerular) hydrostatic pressure
 - capsular hydrostatic pressure
 - blood (glomerular) osmotic pressure
 - GFR
 - Control of filtration
 - Renal autoregulation
 - Tubuloglomerular feedback mechanism
 - JG apparatus
 - Renin-angiotensin mechanism
 - Sympathetic nervous system
 - aldosterone
7. Discuss the role of the following during the process of reabsorption.
 - How does water move inside the nephron?
 - How does water move as solution is hypertonic inside the nephron?
 - How does water move as solution is hypotonic inside the nephron?
 - Active tubular reabsorption
 - Transport maximum TM
 - Passive tubular reabsorption
 - Obligatory water reabsorption
 - Solvent drag
 - Reabsorption properties of proximal convoluted tubule
 - Reabsorption properties of Loop of Henle
 - Reabsorption properties of distal collecting tubule
 - Reabsorption properties of collecting duct
8. Understand and be able to discuss the role of the secretion. What are the reasons for secretion? What substances are secreted?
9. Explain how the countercurrent mechanism operates and it's functional importance to the kidney. Include in your discussion know:
 - How water and NaCl move during this mechanism
 - The area permeable to water
 - The area permeable to NaCl
 - The area permeable to urea
 - How dilute urine is formed
 - How concentrated urine is formed
 - The role of the vasa recta

- The mechanism that maintains the medullary osmotic gradient
10. Describe the normal physical and chemical properties of urine (include color, odor and pH). What is the difference between plasma, glomerular filtrate and urine?
 11. Describe the basic difference between plasma, glomerular filtrate, and urine.
 12. Describe how the kidney regulates body pH.
 13. State how urine is moved from the kidney out of the body and include involvement of the autonomic nervous system.
 14. Describe the structure and function of the ureters.
 15. Describe the structure and function of the urinary bladder.
 16. Describe the structure and function of the urethra.
 17. Define micturition and describe the micturition reflex.
 18. Compare the structure of the urethra in the male and female and the clinical significance.

CHAPTER 26: FLUID, ELECTROLYTE, AND ACID-BASE BALANCE

1. Compare and contrast:
 - ECF
 - Plasma
 - Interstitial fluid
 - ICF
 - Electrolytes
 - Nonelectrolytes
 - Major cations of the ECF and ICF
 - Composition of ECF and ICF
2. Know and understand the factors that determine fluid shifts in the body between
 - Plasma and interstitial fluid
 - Interstitial fluid and intracellular fluid
 - understand the H/K shift
3. Define the following terms:
 - acid
 - base
 - buffer system
 - electrolyte
 - solution
 - solute
 - solvent
 - hypotonic
 - hypertonic
 - isotonic
 - osmotic pressure
 - oncotic pressure
 - hydrostatic pressure
 - tonicity

- ion
 - milliequivalent
 - molarity
 - molality
 - normality
 - osmolality
4. Write two equations that i) represent the formation of acidic solutions and ii) represent the formation of basic solutions.
 5. Differentiate between the chemical reactions of a strong acid, a weak acid, a strong base, and a weak base.
 6. Describe the mechanisms which regulate water intake, retention and loss. What is the difference between sensible and insensible water loss? What is the thirst mechanism?
 7. Describe what happens to the osmotic pressure within a fluid compartment when
 - fluid volume is increased
 - fluid volume is decreased
 - solutes are increased
 - solutes are decreased
 8. Outline the importance and method of regulation of each of the following electrolytes:
 - Sodium
 - Why is it important to control [Na] blood?
 - Role of aldosterone
 - Role of the baroreceptor reflex
 - Pressure diuresis
 - ADH
 - ANF
 - Estrogen
 - Progesterone
 - Chloride
 - Why important?
 - How regulated?
 - Potassium
 - Why is it important to control [K] blood?
 - Role of principle cells
 - Role of intercalated cells
 - Role of aldosterone
 - Calcium
 - Why is it important to control [Ca] blood?
 - Role of calcitonin
 - Role of parathyroid hormone
 - Phosphate
 - Why important?
 - How regulated?
 - Magnesium.

- Why is it important to control [Mg] blood?
9. Describe the physiological effects of
- Hyponatremia
 - Hypernatremia
 - Hypokalemia
 - Hyperkalemia
 - Hypocalcemia
 - Hypercalcemia.
10. Explain the factors involved in fluid movement between the interstitial space and the intracellular space.
11. What is the physiological pH range of acidosis and alkalosis:
- How does the respiratory system regulate pH?
 - Why does respiratory acidosis occur?
 - Why does respiratory alkalosis occur?
 - How does the renal system regulate acid base?
 - Why does metabolic acidosis occur?
 - Why does metabolic alkalosis occur?
12. Explain how the following buffer systems help to maintain the pH of body fluids:
- carbonic acid-bicarbonate
 - what is alkaline reserve?
 - sodium dihydrogen phosphate/sodium monohydrogen phosphate
 - hemoglobin-oxyhemoglobin/ protein.
13. State the principal physiological effects of acidosis and alkalosis upon respiration, cardiac function and the nervous system. Explain how these system work together to maintain pH.
14. Compare and contrast:
- Dehydration
 - Water intoxication
 - Edema
 - What is the role of the lymphatics in edema?

Chapter 17: Blood

1. Identify and state the function of the components of blood including:
formed elements of the blood
and plasma
2. List the components of plasma and serum and state the function of each; know why proteins are so important in plasma.
3. Know the volume of blood in men and women, what is a hematocrit, how is it calculated.
4. Describe the characteristics/function of the following as they relate to RBC production:
 - size of RBC
 - shape of RBC
 - hemoglobin characteristics
 - breakdown products of hemoglobin
 - hematopoiesis

- erythropoiesis
 - erythropoietin
 - location of erythropoietin production
 - ultimate stimulus for erythropoietin production
 - negative feedback mechanism of erythropoietin production
 - vitamin B 12
 - folic acid
 - intrinsic factor
 - iron
 - amino acids.
5. Describe the chemical events of clot formation;
- hemostasis
 - three steps of hemostasis
 - vascular spasm
 - platelet plug formation
 - coagulation
 - intrinsic vs extrinsic pathways
 - common pathway (know steps)
6. List the classes, structural characteristics, and function of leukocytes:
- neutrophils
 - lymphocytes
 - T lymphocytes
 - B lymphocytes
 - monocytes
 - eosinophils
 - basophils
7. Describe the structure and function of platelets and from what cell type they originated.
8. Differentiate between a thrombus and an embolus as to their formation and location in the body.
9. Understand balance between clot formation and inhibition and be able to explain:
- fibrinolysis
 - tissue plasminogen activator
 - conversion of plasminogen to plasmin
10. Describe the ABO and Rh blood groups. Explain the basis of transfusion reactions. Include:
- antigens of A, B, AB, and O types
 - antibodies of A, B, AB, and O types
 - universal donors
 - universal recipients
 - erythroblastosis fetalis
11. Describe the embryonic and fetal sites of erythrocyte and leukocyte production. Describe the adult sites of erythrocyte and leukocyte production.
12. Define:
- diapedesis

- colony stimulating factor
 - leukemia
 - leukopenia
13. Know the causes of these blood disorders:
- hemophilia A
 - hemophilia B
 - anemias
 - acute hemorrhagic
 - chronic hemorrhagic
 - aplastic
 - nutritional
 - pernicious
 - thalassemia
 - sickle cell anemia
 - polycythemia
 - bone marrow cancer
 - blood doping
 - secondary polycythemia

CHAPTER 20: LYMPHATIC SYSTEM

1. Describe the structure and distribution of lymphatic vessels and describe their functions; know volume of lymph collected per day; direction lymph travels.
2. Be able to trace the convergence of lymphatic vessels from lymphatic capillaries to the junction of the internal jugular and subclavian vein.
3. Know these components of lymphatic system
 - valves
 - lacteals
 - chyle
 - layers of lymphatic vessels
 - tunica intima
 - tunica media
 - tunica adventitia
 - lymphoid tissue types
 - lymphoid cell types
 - T lymphocytes
 - B lymphocytes
 - macrophages
 - dendritic cells
 - reticular cells
4. List the similarities and differences between lymphatic vessels and veins.
5. Describe the function and location of the thymus, spleen, tonsils, Peyer's patches and Mucosa Associated Lymphatic Tissue (MALT).

6. Also know:
 - where T and B cells are located in lymph nodes
 - the type of lymphocyte found in thymus
 - what is immunocompetency, when does it occur
 - the function of crypts
7. Describe the mechanisms that control the movement of lymph.
8. Define:
 - lymphangitis
 - lymphedema

Chapter 21: Immune System

1. Differentiate between specific and non-specific defense mechanisms.
2. Differentiate between the first line of defense and the second line of defense.
3. List non-specific defense mechanisms, including mechanical barriers, chemical barriers, chemical barriers, and inflammatory response.
4. Understand the events and processes of inflammation and healing.
5. Know the functions of:
 - B lymphocytes
 - T lymphocytes
 - macrophages
 - monocytes
 - Kupffer cells
 - neutrophils
 - eosinophils
 - phagocytes (phagosomes)
 - natural killer cells
6. Describe how a fever is produced and how it helps protect the body against invading pathogens.
7. Compare and contrast the origin, maturation process and function of B and T lymphocytes.
8. Describe the role of macrophages in immune response.
9. Explain what an antigen is and how it affects the immune system. What are antigenic determinants? What is a hapten? Know what are complement proteins.
10. Know the types of antigen presenting cells, know what they do and know the location of:
 - macrophages
 - activated B lymphocytes
 - Langerhan's cells
 - Major Histocompatibility Complex Proteins (MHC proteins)
11. Describe and differentiate between humoral and cell-mediated immunity. Know the definitions of:
 - humoral
 - antigen challenge
 - receptor mediated endocytosis
 - clonal selection
 - plasma cells

- memory cells
 - primary response
 - secondary response
 - cell-mediated
 - helper T lymphocytes
 - cytotoxic T lymphocytes
 - suppressor T lymphocytes
12. Compare and contrast active and passive immunity.
13. Differentiate between natural and artificial immunity. When considering these, also differentiate between active and passive immunity. Under what circumstances does immunological memory develop?
14. Explain the function of and classes of antibodies. What are monoclonal antibodies?
15. Describe the immune response. Relate this to immunodeficiencies, autoimmune diseases and hypersensitivities, including:
- SCID (Severe Combined Immunodeficiency Disease)
 - HIV
 - allergies
 - anaphylaxis
16. Describe the inflammatory response.
17. Define:
- margination
 - diapedesis
 - pus
 - abscess
 - infectious granulomas
 - interferon
 - immunogenicity
 - reactivity

Chapter 27: The Reproductive System

General Function

1. State the general functions of the human reproductive system.
2. State what is meant by primary and secondary male and female sexual characteristics.
3. Describe the difference between primary and secondary sex organs.
4. Define meiosis. Compare and contrast meiosis and mitosis. How many chromosomes are present in human? In human gametes?

MALE REPRODUCTIVE SYSTEM

- a. Name the parts of the male reproductive system and describe the general functions of each.
- b. Describe the embryonic tissue from which testes develop.
- c. Describe the structure of testes, and explain the importance of their location in the scrotum.
- d. Describe the location, structure, and function of the accessory organs of the male reproduction system.
- e. Outline the events of spermatogenesis and include:
 - Spermatogenic cells

- Spermatogonia
 - Adluminal compartment
 - Basal compartment
 - Type A cells
 - Type B cells
 - Primary spermatocyte
 - Secondary spermatocyte
 - Spermatids
 - Spermatozoa
 - Sustenticular cells (Sertoli cells)
- f. Describe the formation of sperm in the testes.
- g. Trace the path followed by sperm cells from their site of formation to the outside of the body, explain the changes that occur along this path.
- h. Describe the structure of the penis and explain in sequence how its function to produce an erection. What tissues are primarily responsible? What is the role of the sympathetic and parasympathetic nervous system in this response?
- i. Know the effects of testosterone on the male reproductive organs and on other body organs.
- j. Describe the phases of the male sexual response.
- k. 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
 - Androgen binding protein
 - Testosterone
 - Inhibin
 - Dihydroxytestosterone
- l. Describe the composition, pH, volume, and normal sperm density a normal ejaculate of semen. What are some of the specific functions of the components?

FEMALE REPRODUCTIVE SYSTEM AND EMBRIOLOGY

- a. Name the parts of the female reproductive system and describe the general function of each.
- b. Describe the location, structure, and function of the ovaries.
- c. Discuss the structure and function of the mammary glands.
- d. Describe the process of oogenesis and compare it to spermatogenesis. Include:
- Oogonia
 - Primary oocyte
 - First polar body
 - Secondary oocyte
 - Second polar body
 - Ovum
- e. Describe the phases of the ovarian cycle and relate them to events of oogenesis. Include the following
- Follicular phase

- Ovulation
 - Luteal phase
 - Primordial follicle
 - Primary follicle (what stage of meiosis?)
 - Secondary follicle
 - Vesicular follicle
 - Corpus luteum
 - Corpus albicans
 - Ovulated oocyte (what stage of meiosis?)
- f. Describe how hormones control the activities of the female reproductive system and how they are related to the development of female secondary sexual characteristics. Include the following
- GnRH
 - FSH
 - LH
 - Cell types responsive to FSH, LH
 - Estrogen role
 - Progesterone role
 - LH surge
 - How LH surge is stimulated
 - How cycle repeats itself
 - How the cycle is turned off
- m. Describe the hormonal regulation of the ovarian and menstrual cycles.
- n. Discuss the physiological effects of estrogen and progesterone both on the female reproductive organs and on other body organs.
- o. Identify hormones produced by cells of maturing follicles and the hormones produced by the cells of the corpus luteum.
- p. Describe the events and hormonal changes that occur in menopause.
- q. Describe commonly used methods of contraception and state the effectiveness of each.
- r. Discuss common STD's in regard to causes, mode of transmission, prevention, and treatment.
- s. What is the normal pH and flora of the vagina? How do these conditions protect the reproductive organs?
- t. Define:
- Dysmenorrhea
 - Endometriosis
 - Amenorrhea
- u. Trace the path of an ovum from the ovary to the uterus.
- v. Briefly discuss the development of the reproductive system in the embryo from five weeks to nine weeks.

Chapter 28: Pregnancy and Human Development

1. Describe the hormonal changes that occur during pregnancy and their anatomical and physiological effects upon the female body.
2. Describe the events of fertilization and implantation, including sperm capacitation, acrosomal reaction, corona radiata, and zona pellucida.
3. Explain the process, stages and product of cleavage.

4. Name and describe the formation, location, and function of the embryonic and extraembryonic tissues.
5. Identify tissues and structures derived from the ectoderm, mesoderm, and endoderm.
6. What is the relationship between the blastocyst, the corpus luteum, and human chorionic gonadotropin? What hormones are produced by the placenta?
7. Describe the major events of the fetal stage of development.
8. Explain how labor is initiated and describe the three stages of labor.
9. What is the role of oxytocin?
10. Define:
 - Fertilization
 - Pregnancy
 - Conceptus
 - Gestation period
 - Morula
 - Preembryo
 - Embryo
 - Fetus
 - Infant
 - Vertex presentation
 - Breech presentation
 - Dystocia
 - Apgar score
 - Teratogens
11. What is the stimulus for lactation? What is colostrum? What are the advantages of breast milk?

Chapter 29: Heredity

1. Define allele.
2. Differentiate between genotype and phenotype.
3. Describe the events that lead to genetic variability of gametes.
4. Describe dominant-recessive inheritance.
5. Describe the mechanism of sex-linked inheritance.
6. Differentiate between the events which would produce fraternal and identical twins.
7. Predict expected genotype and phenotype given parental information.

Chapters 23 & 24: The Digestive System & Nutrition

1. Identify the organs of the alimentary canal in sequence and state the general function of each.
2. Define these digestive systems activities and know the location of their occurrences:
 - Ingestion
 - Propulsion
 - Peristalsis
 - Segmentation
 - Chewing
 - Swallowing

- Mechanical digestion
 - Chemical digestion
 - Absorption
 - Defecation
3. Know the layers of the alimentary canal and the makeup of each layer
 - Mucosa
 - Lamina propria
 - MALT
 - Muscularis externa
 - Submucosa
 - serosa
 4. Know how the following affect the mechanical and chemical processes of digestion, digestive glands and the movement of food.
 - Stretch of the organ wall
 - Osmolarity
 - pH
 5. What are the locations and functions of the submucosal nerve plexus and the myenteric nerve plexus?
 6. What are the roles of the sympathetic and parasympathetic nervous systems on the GI tract?
 7. What is the short reflex pathway? What is the long reflex pathway?
 8. What is the role of the hepatic portal system?
 9. For the following cells of the stomach, know what they secrete and how these secretions are controlled.
 - Mucous neck cells
 - Parietal cells
 - Chief cells
 - Enteroendocrine cells
 10. Describe these phases of gastric secretion:
 - Cephalic phase
 - Gastric phase
 - Intestinal phase
 11. Describe gastric motility in terms of
 - The response to stomach filling
 - Gastric contractile activity
 - Regulation of gastric emptying
 12. Give the composition and function of the following and state where they come from.
 - Saliva
 - Gastric juice
 - H ions
 - Alkaline tide
 - Intestinal juice
 - Bile
 - Pancreatic juice
 13. How do the following three factors affect HCl secretion? Where do they come from and what do they do?

- ACh
 - Gastrin
 - Histamine
14. What are the basic digestive functions of the following
- Small intestine
 - Large intestine
 - Liver
 - Pancreas
 - Gall bladder
15. List the six major nutrient categories. Note the importance of each, dietary sources, and the principal cellular uses of each.
16. Describe the location and function of the salivary glands.
17. Describe the structures of a typical tooth and state the function of each.
18. Compare and contrast the function of incisors, cuspids, premolars, and molars.
19. Describe the function of hormones produced by the small intestine.
20. Define jaundice and describe different types.
21. Describe the regulation of the defecation reflex.
22. Define metabolism. Explain how catabolism and anabolism differ. Explain the metabolic fate of carbohydrates, proteins, and lipids once they have been absorbed.
23. Describe the role of the colon in vitamin formation.
24. What is enzymatic hydrolysis?
25. What is the role of the following enzymes in carbohydrate digestion?
- Salivary amylase
 - Pancreatic amylase
 - Dextrinase
 - Glycoamylase
 - Maltase
 - Sucrase
 - Lactase
26. What is the role of the following enzymes in protein digestion?
- Pepsin
 - Trypsin
 - Chymotrypsin
 - Carboxypeptidase
 - Aminopeptidase
 - Dipeptidase
27. What is the role of the following in lipid digestion?
- Lipases
 - Bile salts
 - Emulsion
28. What is the role of the following enzymes in nucleic acid digestion?
- Pancreatic nucleases

- Nucleosidases
 - phosphatases
29. Describe the absorptive processes for
- Carbohydrates
 - Proteins
 - Nucleic acids
 - Vitamins
 - Fat soluble
 - Water soluble
 - Vitamin B 12
 - Lipids
 - Micelles
 - Chylomicrons
 - Lipoprotein lipase
 - Electrolytes
 - Na
 - Ca
 - Role of PTH
 - Role of vitamin D
 - Iron
 - Ferritin
 - HCO₃⁻
 - Vitamin K, know how it is related to water absorption
30. Define and state the cause of these following GI disorders
- Peritonitis
 - Gastric ulcers
 - What is cimetidine?
 - Malabsorption
 - Lactose Intolerance

Laboratory Course Objectives

The Biol 224 lecture exam and laboratory exam objectives are split into 2 sections – the lecture objectives, followed by the laboratory objectives. However there is obviously considerable overlap between the two and it is impossible to separate them fully.

Before each exam review both the lecture and lab objectives for the relevant sections. Some laboratory objectives may appear on the lecture exams and some lecture objectives may appear on the laboratory exams.

Materials to be covered on Lab Tests (also see Lecture Objectives)

Heart

Use your textbook, lab manual and the Anatomy Coloring Book as references.

1. From diagrams, models, slides, and the cadaver be able to identify the following HEART structures:
 - fibrous pericardium
 - parietal pericardium
 - visceral pericardium
 - myocardium
 - endocardium
 - tricuspid valve
 - bicuspid valve
 - right atrium
 - left atrium
 - right ventricle
 - left ventricle
 - pulmonary artery
 - pulmonary veins
 - chordae tendineae
 - trabeculae carneae
 - papillary muscles
 - pectinate muscles
 - anterior interventricular artery
 - aorta
 - aortic arch
 - pulmonary semilunar valve
 - aortic semilunar valve
 - superior vena cava
 - inferior vena cava
 - coronary arteries
 - cardiac veins
 - coronary sinus

Blood Vessels

Use your textbook, lab manual and the Anatomy Coloring Book as references.

1. Know the three layers of a blood vessel and the major tissue components of each layer.
2. What is the center of a blood vessel called?
3. What are the structural differences between arteries and veins?
4. Trace the path of blood through pulmonary circulation.
5. Trace the path of blood through hepatic circulation.
6. Be able to identify on the cadaver, models or diagrams the following arteries and veins.

Arteries:

- aorta
- arch of the aorta
- thoracic aorta
- abdominal aorta
- axillary
- basilar
- brachial
- celiac
- common carotid (left and right)
- common iliac
- Circle of Willis (consists of the internal carotid artery, the basilar artery, anterior cerebral artery, the posterior cerebral artery, the anterior communicating artery & the posterior communicating artery)
- external carotid
- external iliac
- femoral
- inferior mesenteric
- brachiocephalic (on the right side)
- internal iliac
- internal carotid
- left coronary
- popliteal
- pulmonary
- radial
- renal
- right coronary
- spermatic (also known as the testicular or gonadal or ovarian).
- splenic
- subclavian
- suprarenal
- superior mesenteric
- ulnar
- ovarian (see spermatic above)

- vertebral
- internal carotid
- posterior tibial
- anterior tibial
- hepatic

Veins:

- anterior tibial
- posterior tibial
- peroneal (fibular)
- axillary
- azygous
- basilic
- brachial
- right brachiocephalic
- cephalic
- common iliac
- coronary sinus
- external iliac
- external jugular
- femoral
- great saphenous
- hepatic
- inferior mesenteric
- inferior vena cava
- internal iliac
- left brachiocephalic
- median cubital
- popliteal
- hepatic portal
- pulmonary
- right coronary (this is also known as the small cardiac vein)
- splenic
- right and left subclavian
- superior mesenteric
- superior sagittal sinus
- superior vena cava
- radial
- ulnar
- gonadal (same as ovarian in females and spermatic or testicular in males)
- hemiazygous

Respiratory System

Use your textbook, lab manual and the Anatomy Coloring Book as references.

1. From diagrams, models, slides, and the cadaver be able to identify the following structures:
 - hard palate
 - soft palate
 - pharynx
 - epiglottis
 - glottis
 - 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

Endocrine System

be able to identify the following structures on charts, models, slides, cadavers, and specimens.

1. Identify all of the following endocrine glands on charts, models, slides, cadavers, and specimens.
 - anterior pituitary

- posterior pituitary
 - hypothalamus
 - pineal
 - thyroid
 - parathyroid
 - thymus
 - testes
 - ovary (with primordial follicle, primary follicle, secondary follicle, corpus luteum and corpus albicans)
 - pancreas
 - placenta
 - adrenal
2. Identify histological preparations of the following endocrine glands:
- pancreas
 - islets of Langerhans
 - acinar cells
 - pituitary (anterior & posterior lobes)
 - adrenal glands
 - capsule
 - zona glomerulosa
 - zona fasciculata
 - zona reticularis
 - medulla
 - thyroid
 - follicle cells
 - colloid
 - parafollicular cells
3. Be able to name the hormones produced by all of the structures listed above in parts 1 and 2.

Urinary System

be able to identify the following structures on charts, models, slides, cadavers, and specimens.

- 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
- podocytes
- pedicles
- Bowman's capsule (glomerular capsule) which consists of the parietal surface (simple squamous epithelium)
- loop of Henle
- proximal convoluted tubule
- distal convoluted tubule
- ascending limb
- descending limb
- urinary bladder
- urethra
- renal pelvis
- minor calyx
- major calyx
- collecting ducts
- collecting tubules
- vasa recta
- renal capsule

Blood

Use your textbook, lab manual and the Anatomy Coloring Book as references.

1. Know how to:
 - Type ABO blood types.
 - Type blood for Rh factor.
 - Make and calculate a hematocrit.
2. Know the approximate percentages of a normal hematocrit.
3. Be able to identify the 5 types of leukocytes.
4. Know what a complete blood count is.
5. Know the definition of anemias, polycythemias, leukocytosis, leukopenia.
6. Know a natural anticoagulant.
7. Know how the different conditions which affect RBC count.
8. Know the normal blood volume.
9. Know the functions of the formed elements of blood.

Lymphatic System

Use your textbook, lab manual and the Anatomy Coloring Book as references.

1. Know the location of the following lymphatic structures
 - lymph nodes
 - spleen
 - tonsils
 - palatine
 - pharyngeal
 - tubal
 - inguinal
 - Peyer's patches
 - crypts of tonsils
 - mucosa-associated lymphatic tissue (MALT)
 - lacteals
2. Know the following parts of the lymphatic system
 - lymphatic capillaries
 - mini-valves
 - lymphatic collecting vessels
 - lymphatic trunks
 - lumbar
 - bronchomediastinal
 - intestinal
 - subclavian
 - jugular
 - lymphatic collecting ducts
 - right lymphatic ducts
 - thoracic duct
3. Know the following layers of lymphatic vessels, trunks, ducts
 - tunica intima
 - tunica media
 - tunica adventitia
 - right subclavian vein
 - left subclavian vein
 - internal jugular vein
 - cisterna chyli
 - cervical lymph nodes
 - axillary lymph nodes
 - inguinal lymph nodes
4. Know the following structures of the lymph node.

- afferent lymph vessels
 - efferent lymph vessels
 - hilus
 - germinal center
 - cortex
 - medulla
 - locations of B and T lymphocytes
 - capsule
 - medullary sinus
 - subcapsular sinus - space underneath the capsule
 - valves
 - trabeculae
5. Know how lymph circulates, where it returns to the cardiovascular system.
 6. Know the components of lymph.

Reproductive Systems, Pregnancy & Human Development

be able to identify the following structures on charts, models, slides, cadavers, and specimens.

In the Male:

- urinary bladder
- urethra
- scrotum
- testis
- epididymis
- ductus deferens
- seminal vesicle
- ejaculatory duct
- bulbourethral gland
- prostate gland
- penis
- spermatic cord
- lobule
- glans penis
- prepuce
- seminiferous tubules
- cells of Leydig (also known as interstitial cells)
- rete testis
- spermatogonia
- Adluminal compartment
- Basal compartment
- primary spermatocyte
- secondary spermatocyte
- spermatid

- spermatozoa
- Sertoli cells
- corpus cavernosum
- corpus spongiosum
- ureter

In the Female:

- urinary bladder
- ureter
- urethra
- ovary
- uterine tube
- fimbria
- uterus
- fundus
- body
- cervix
- vagina
- mons pubis
- labia majora
- clitoris
- labia minora
- suspensory ligament
- ovarian ligament
- round ligament
- broad ligament
- ovarian follicles
- primordial follicle
- primary follicle
- secondary follicle
- Graafian follicle
- antrum
- granulosa cells
- secondary oocyte
- zona pellucida
- corpus luteum
- corona radiata
- corpus albicans
- perimetrium
- myometrium
- endometrium
- stratum basalis
- stratum functionalis

- breast
- nipple
- areola
- lactiferous sinus
- lactiferous duct
- glandular lobe

Be able to identify:

- Fertilization
- Conceptus
- Gestation period
- Morula
- Preembryo
- Embryo
- Fetus
- Infant

Digestive System

be able to identify the following structures on charts, models, slides, cadavers, and specimens.

- oral cavity
- teeth
- crown
- neck
- root
- enamel
- dentin
- pulp cavity
- pulp
- gingiva
- cementum
- periodontal ligament (membrane)
- incisors
- cuspids (canines)
- bi-cuspids
- molars
- tongue
- salivary glands
- parotid
- sublingual
- submandibular
- palate
- hard
- soft

- uvula
- pharynx
- tonsils (including the palatine, pharyngeal and lingual tonsils)
- Mucosa
- Lamina propria
- MALT (Mucosa Associated Lymphatic Tissue)
- Muscularis externa (circular and longitudinal muscle layers plus the oblique layer in the stomach)
- Submucosa
- serosa
- myenteric nervous system
- submucosal nerve plexus
- serosal nerve plexus
- esophagus
- stomach
- cardiac sphincter
- fundus
- body
- antrum
- pylorus
- pyloric sphincter
- intestinal villi
- small intestine
- duodenum
- jejunum
- ileum
- large intestine
- taenia coli
- haustra
- ileocecal valve
- cecum
- ascending colon
- transverse colon
- descending colon
- sigmoid colon
- anal canal
- rectum
- anus
- appendix
- liver
- gallbladder
- hepatic duct
- cystic duct

- common bile duct
- spleen
- pancreas
- pancreatic duct
- sphincter of Oddi (also known as the hepatopancreatic ampulla/ampulla of Vater/hepatoduodenal ampulla)
- peritoneum (visceral & parietal surfaces)
- greater omentum
- lesser omentum
- liver
- lobules
- hepatocytes
- a portal triad (consisting of a portal arteriole, a portal venule and a bile duct)
- central vein
- sinusoids
- falciform ligament
- mesocolon
- common hepatic artery
- hepatic artery proper
- celiac trunk
- superior and inferior mesenteric artery
- hepatic veins
- Hepatic portal vein
- Hepatic portal system