BLOOD

1. Describe the basic functions, physical characteristics, and components of blood.
2. Describe the appearance, constituents and functions of plasma.
3. Describe the functions, structural features, production and destruction of erythrocytes. Include the roles of hemoglobin and erythropoietin in your discussion.
4. Describe the production, basic functions and properties of each of the 5 main varieties of leukocytes.
5. Describe the structural appearance and basic function of platelets.
6. Describe all 3 stages of hemostasis including all pertinent proteins, organs, and other structures.
7. Describe the process of fibrinolysis.

HEART

1. Describe the pathway of blood as it completes a round trip through the pulmonary and systemic circuits beginning and ending in the right atrium.
2. Compare the pulmonary and systemic circuits in terms of length, pressure, volume, resistance, arterial gas content, and venous gas content.
3. Explain how pressure differences between the atria and ventricles are responsible for atrioventricular valve opening and closing.
4. Explain how pressure differences between the ventricles and the aortic and pulmonary trunks are responsible for valve opening and closing.
5. Identify and describe the heart’s intrinsic cardiac conduction system including the locations and roles of all 5 major parts of the system.
6. Describe the effect of medullary cardiac centers on the activity of the heart.
7. Describe each of the 4 phases of the cardiac cycle. In your discussion describe what is happening to ventricular volume and pressure, whether the atria are in systole or diastole, whether the ventricles are in systole or diastole, whether the atrioventricular valves are open or closed, whether the semilunar valves are open or closed. Also include in your discussion a comparison of the pressures in the left atrium, left ventricle, and aorta.
8. Define end diastolic volume, end systolic volume, stroke volume, heart rate, and cardiac output. Include their mathematical relationships in your discussion.
9. Describe how changes in preload, contractility, and afterload can affect stroke volume.
10. Describe the effect of the following on heart rate: cardioacceleratory activity, norepinephrine, cardioinhibitory activity, acetylcholine, and epinephrine.

Blood Vessels

1. Identify the structural characteristics (composition of tunics) and functions of the 3 major types of blood vessels.
2. Identify the 3 major types of arteries. Describe the structure and function of each.
3. Describe the basic structure and function of all 3 of the major capillary types.
4. Describe capillary beds. Include the following terms in your discussion: true capillaries, vascular shunt, and precapillary sphincters. Identify the triggers for precapillary sphincter contraction and relaxation.

5. Compare veins with arteries in terms of the following: size and composition of the tunics, elasticity, distensibility, pressure, resistance, valves, and volume.

6. Define blood flow, blood pressure, and total peripheral resistance.

7. Explain how each of the following can affect resistance, pressure, and flow: blood viscosity, total blood vessel length, and blood vessel radius.

8. Define systolic pressure and diastolic pressure and explain why arterial pressure is pulsatile and how arterial pressure varies with distance from the heart.

9. Explain how venous return is affected by respiratory and skeletal muscle pumps.

10. Describe the location and function of the vasomotor center.

11. Describe the baroreceptor reflex response to a high rise in arterial BP.

12. Identify the primary adrenal medulla hormones and discuss their site of production, triggers for release, and effect on blood pressure.

13. Describe the relationship between blood volume and blood pressure and explain how the rate of urine production can alter blood volume and blood pressure.

14. Describe the renin-angiotensin system and its effect on BP. Include the following in your discussion: renin, angiotensin II, aldosterone, and antidiuretic hormone.

15. Define tissue perfusion and explain why adequate tissue perfusion is essential.

16. Describe how total cross-sectional area differs in arteries, capillaries, and veins and describe the relationship between blood velocity and total vessel cross-sectional area.

17. Identify and describe the 4 forces that affect the bulk flow of fluid between blood and the interstitial fluid. Explain how those forces affect net filtration pressure and filtration and reabsorption.

**Lymphatic System**

1. Identify the basic components of the lymphatic system and give their functions.

2. Describe the basic function, locations and characteristics of the 4 types of lymphatic vessels.

3. Describe the contents, production, flow and endpoint of lymph.

4. Define lacteals and discuss their location and function.

5. Describe the cellular structure, locations, and functions of diffuse lymphatic tissue and lymphoid follicles.

6. Describe the structure, function, and major locations of lymph nodes.

7. Describe the location, structure, and functions of the spleen.

8. Describe the location, structure, age-related changes, and function of the thymus.

9. Identify the 3 major tonsils and describe their locations and functions.

10. Describe the location, function and structure of MALT, Peyer’s patches, and the appendix.
Immune System

1. Describe the components and characteristics of the innate immune system.
2. Identify the physical characteristics of skin that make it a pathogen barrier.
3. Provide examples of how the mucosae of each of the body’s tracts (digestive, respiratory, urinary, and reproductive) help limit pathogen entry and growth.
4. Describe the mechanism of phagocytosis. Include the following terms in your discussion: adherence, opsonization, phagosome, lysosome, and enzymes.
5. Describe the basic function of natural killer cells.
6. Identify some basic triggers for the inflammatory response and the 4 cardinal signs of inflammation.
7. Describe the production and basic function of interferons and complement proteins.
8. Define fever and pyrogen and identify the benefits of a mild fever.
9. Explain why adaptive immunity is specific, systemic, and exhibits memory. Contrast this with innate immunity.
10. Describe the production and maturation process of T and B lymphocytes.
11. Describe the activation, multiplication, and function of Helper T lymphocytes.
12. Describe the activation, multiplication, and function of B lymphocytes.
13. Describe the basic structure and functions of antibodies.
14. Describe the primary and secondary humoral immune responses. Indicate the typical lengths of the lag time and be able to graphically relate levels of plasma antibodies with time.
15. Define active humoral immunity and differentiate between natural active humoral immunity and artificial active humoral immunity.
16. Define passive humoral immunity and differentiate between natural passive humoral immunity and artificial passive humoral immunity.
17. Describe the activation, multiplication, and function of Killer T lymphocytes.
18. Describe the basic function of Regulatory T cells.

Respiratory System

1. Define pulmonary ventilation, external respiration, internal respiration, and cellular respiration.
2. Explain how the anatomical structure of the nasal cavity and the characteristics of the respiratory mucosa contribute to the filtration, warming, and humidification of inspired air.
3. Describe functions of the paranasal sinuses.
4. Describe the basic function of the pharynx.
5. Describe the basic functions of the larynx.
6. Describe the structure and function of the respiratory membrane. Include the following in your discussion: type I alveolar cells, pulmonary capillaries, basement membranes.
7. Describe the location and function of type II alveolar cells and alveolar macrophages.
8. Describe how the visceral and parietal pleurae and their associated pleural fluid contribute to efficient lung function.
9. Define intrapulmonary pressure and intrapleural pressure. Identify the relationship between intrapleural and intrapulmonary pressure and explain its significance.
10. Describe the relationship between pressure and volume as given by Boyle’s law.
11. Identify the major muscles of quiet inspiration and the effect their contraction has on thoracic volume, lung volume, and intrapulmonary pressure.
12. Identify the relationship between atmospheric pressure, intrapulmonary pressure, and intrapleural pressure during inspiration.
13. Explain how increased motor unit recruitment of the diaphragm and external intercostals coupled with contraction of the sternocleidomastoids, scalenes, pectoralis minor, and erector spinae can contribute to a more vigorous inspiration.
14. Discuss the roles that relaxation of the diaphragm and external intercostals play during quiet expiration. Discuss the effect their relaxation has on thoracic volume, lung volume, and intrapulmonary pressure. Include the role lung elasticity plays in quiet expiration in your discussion.
15. Identify the relationship between atmospheric pressure, intrapulmonary pressure, and intrapleural pressure during expiration.
16. Explain how contraction of the transversus abdominis, external obliques, internal obliques, and internal intercostals can contribute to a more vigorous expiration.
17. Define surface tension and explain why high alveolar surface tension can be problematic. Explain the effect surfactant has on alveolar surface tension.
18. Define compliance and identify the relationship between lung/thoracic compliance and the ease of inspiration.
19. Explain why there is a difference between the composition of alveolar air and atmospheric air with respect to the following gases: \( \text{N}_2, \text{O}_2, \text{CO}_2, \) and \( \text{H}_2\text{O} \).
20. Describe the movement of \( \text{O}_2 \) and \( \text{CO}_2 \) that occurs during internal and external respiration.
21. Provide the \( \text{PO}_2 \) values for the pulmonary arteries, alveoli, and pulmonary veins and explain why they differ in these locations.
22. Provide the \( \text{PCO}_2 \) values for the pulmonary arteries, alveoli, and pulmonary veins and explain why they differ in these locations.
23. Explain how alveolar ventilation and pulmonary perfusion are synchronized.
24. Describe how the thickness and total surface area of the respiratory membrane can affect pulmonary gas exchange.
25. Provide the \( \text{PO}_2 \) values for the systemic arteries, systemic tissues, and systemic veins and explain why they differ in these locations.
26. Provide the \( \text{PCO}_2 \) values for the systemic arteries, systemic tissues, and systemic veins and explain why they differ in these locations.
27. Describe the transport of \( \text{O}_2 \) in the blood. Include the following: oxyhemoglobin, deoxyhemoglobin, and hemoglobin saturation.
28. Explain how hemoglobin’s affinity for \( \text{O}_2 \) is affected by temperature, pH, and \( \text{PCO}_2 \).
29. Describe the 3 ways that CO₂ is carried in the blood. Include the following: carbaminohemoglobin, carbonic acid, carbonic anhydrase, and bicarbonate.
30. Identify the 2 medullary respiratory centers and identify the primary generator of respiratory rhythm.
31. Describe the basic function of VRG inspiratory neurons and expiratory neurons.
32. Identify the function of the dorsal and pontine respiratory groups.
33. Explain how a rise in arterial PCO₂ will cause a decrease in CSF pH.
34. Identify the relationship between CSF pH and respiratory rate.
35. Identify the relationship between arterial pH and respiratory rate and provide examples of respiratory and nonrespiratory changes in arterial pH.

**Digestive System**

1. Identify the 6 major organs of the alimentary canal and the 6 accessory digestive organs.
2. Describe the location and function of the peritoneal membranes, cavity and fluid.
3. Identify the 4 basic layers of the alimentary canal. Describe their basic location, structure, and functions.
4. Describe the structure and functions of the tongue.
5. Describe the location and function of the extrinsic salivary glands and the major functions of saliva.
6. Describe the basic digestive processes that occur in the mouth.
7. Describe the function of the esophagus.
8. Describe the location and function of the cardiac and pyloric sphincters.
9. Describe the basic functions of the stomach.
10. Describe gastric pits and gastric glands and the 4 main types of gastric gland cells. Identify the secretory products of gastric glands and describe their function.
11. Identify and describe the phases of gastric secretion.
12. Describe the function of the small intestine. Include its secretory, digestive, motility and endocrine roles.
13. Identify the digestive function and non-digestive functions of the liver.
14. Describe the structure and function of the liver lobule as well as the basic composition and function of bile.
15. Describe the functions of the gallbladder and control of its activity.
16. Describe the primary exocrine function of the pancreas.
17. Define pancreatic islets and describe their primary function.
18. Describe the function of secretin and cholecystokinin as well as the trigger for their release.
19. Identify the primary functions of the large intestine.
20. Discuss how the histology of the large intestine differs from that of the small intestine and how it relates to their respective functions.
21. Describe the motility of the large intestine.

**Urinary System**

1. Identify the function of the kidneys.
2. Describe the path of blood flow through the kidney. Include the following terms in your discussion: renal artery, segmental artery, interlobar artery, cortical radiate artery, afferent arteriole, glomerulus, efferent arteriole, peritubular capillaries, vasa recta, cortical radiate vein, arcuate vein, interlobar vein, and renal vein.

3. Describe the types and functions of nephrons and describe each of the 5 components of a nephron.

4. Describe the structure and function of glomerular capillaries.

5. Describe the structure, and function of the peritubular capillaries and vasa recta.

6. Define glomerular filtration rate and identify the major factors affecting GFR including myogenic and tubuloglomerular regulation.

7. Explain how the renin-angiotensin mechanism affects GFR and BP.

8. Define tubular reabsorption and explain where it occurs and why it is necessary. Include the mechanism of sodium reabsorption and the process of obligatory water reabsorption.

9. Explain how hormones can affect reabsorption in the distal convoluted tubule.

10. Explain how ADH affects water reabsorption in the collecting duct.

11. Define tubular secretion and identify the major portion of the nephron where it occurs and explain why tubular secretion is necessary.

12. Describe the normal chemical composition of urine in terms of solvent, nitrogenous wastes, and other solutes.

13. Describe the structure and function of the ureters.

14. Describe the structure, and function of the urinary bladder.

15. Describe the structure and functions of the urethra.

16. Define micturition and describe the micturition reflex.

**Male Reproductive System**

1. Describe the structure and basic functions of the male gonads.

2. Describe the function of the seminiferous tubules and interstitial cells.

3. Describe the characteristic and advantage of the vascular supply to the testis.

4. Describe the structure and function of the epididymides.

5. Describe the structure, and function of the ductus deferentia.

6. Describe the structure, and function of the seminal vesicles.

7. Describe the structure, and function of the prostate gland.

8. Describe the function of the bulbourethral glands.

9. Identify the approximate percentage of semen contributed by the testes, seminal vesicles, and prostate gland.

10. Describe the physiological mechanism of erection.

11. Describe the physiological mechanism of ejaculation.

12. Discuss the process of spermatogonium formation.

13. Describe the process of meiosis in males.

14. Explain the process of spermiogenesis and describe the morphological changes that occur as a spermatid becomes a spermatozoon.

15. Describe the role that sustentacular cells play in spermatogenesis.

16. Describe the brain-testicular axis. Include the following terms in your discussion: hypothalamus, gonadotropin-releasing hormone, follicle-stimulating hormone,
luteinizing hormone, anterior pituitary gland, sustentacular cells, androgen binding protein, interstitial cells, and testosterone.
17. Describe the mechanism regulating sperm and testosterone production.
18. Describe the somatic effects of testosterone and its influence on male secondary sexual characteristics.

Female Reproductive System

1. Identify the female principal sex organs and give their primary functions.
2. Describe the basic structure and function of an ovarian follicle and identify and differentiate the 4 basic types of ovarian follicles.
3. Define ovulation and corpus luteum.
4. Describe the structure and function of the uterine tubes.
5. Describe the structure and function of the uterus.
6. Describe the structure and function of the vagina.
7. Define oogenesis and describe its stages, mechanism, and timing.
8. Compare and contrast oogenesis with spermatogenesis.
9. Define ovarian cycle and identify its 2 phases.
10. Describe the follicular phase of the ovarian cycle.
11. Describe the act of ovulation. Include its timing and its trigger in your discussion.
12. Describe the luteal phase of the ovarian cycle.
13. Describe the hormonal control of the ovarian cycle. Include the following terms in your discussion: hypothalamus, gonadotropin-releasing hormone, anterior pituitary gland, follicle-stimulating hormone, luteinizing hormone, ovarian follicles, estrogen, corpus luteum, and progesterone.
14. Identify the 3 events triggered by the mid-cycle surge in LH.
15. Describe the fate of the corpus luteum if pregnancy does not occur.
16. Describe the fate of the corpus luteum if pregnancy does occur. Include the role of human chorionic gonadotropin in your discussion.
17. Define the uterine cycle and identify its 3 phases.
18. Describe the events and causes of the menstrual phase of the uterine cycle.
19. Describe the events and causes of the proliferative phase of the uterine cycle.
20. Describe the events and causes of the secretory phase of the uterine cycle.