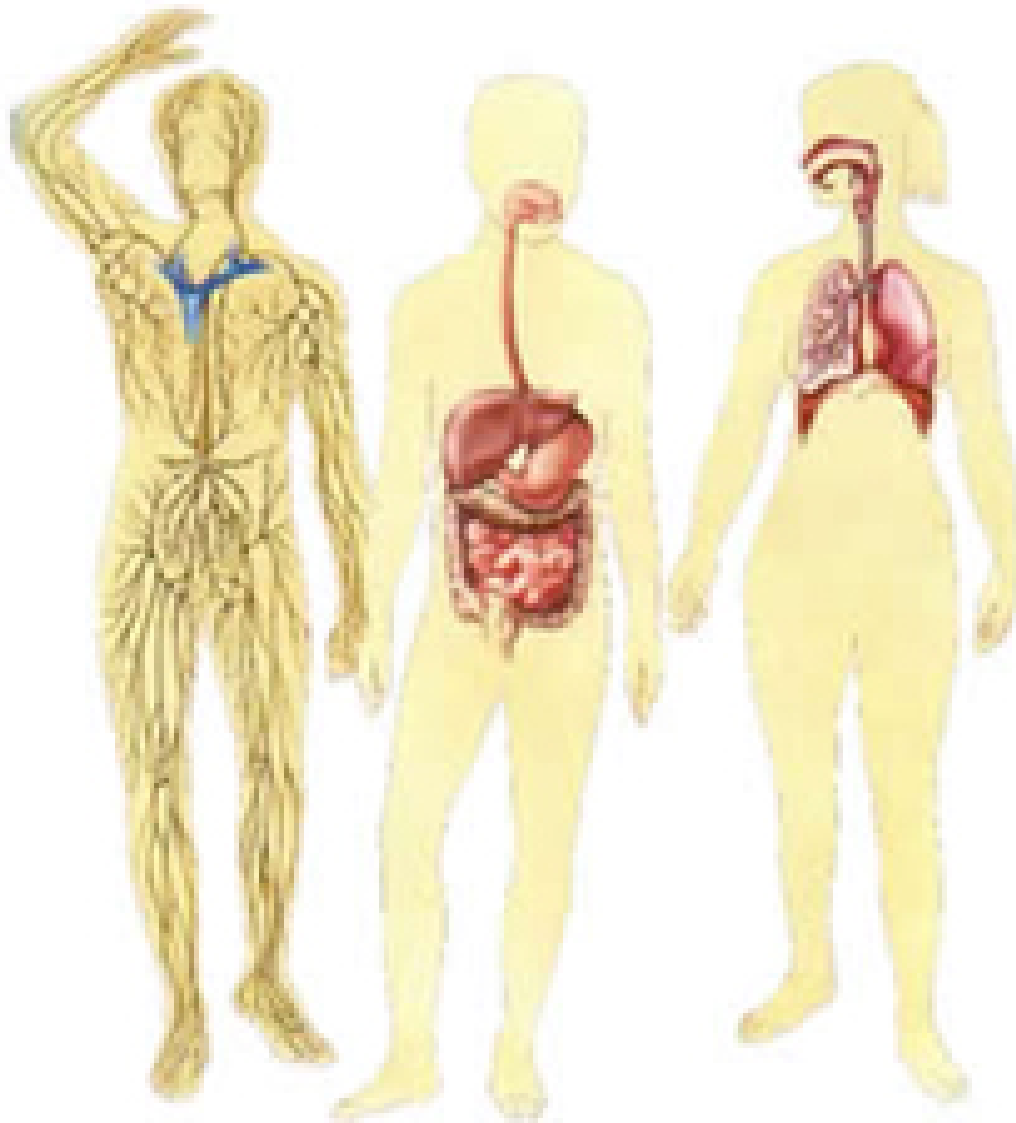


BSC 2086
HUMAN ANATOMY & PHYSIOLOGY
PART 2



A & P 2 - LECTURE SYLLABUS

ANATOMY & PHYSIOLOGY 2 - BSC 2086 LECTURE HOMESTEAD CAMPUS

BSC 2086 Lecture Schedule Spring 2008 (2007-2) MDC Homestead

<u>Ref #</u>	462413
<u>Days:</u>	Monday [M] Wednesday [W]
<u>Time:</u>	8.25 am – 9.40 am
<u>Building/Room:</u>	G-305
<u>Instructor:</u>	Richard Coulson Ph.D.
<u>Phone:</u>	305-510-5887 (cell/mobile)
<u>Mailbox:</u>	Arts & Science Administration Building
<u>E-mail:</u>	rcoulson@mdc.edu or richardocoulson@yahoo.com
<u>Web-site:</u>	http://faculty.mdc.edu/rcoulson
<u>Office:</u>	B-130 Computer room – faculty - Administration Building B
<u>Office Hours:</u>	TBD (usually 10 am – 12 noon Mondays or by appointment)
<u>Textbook:</u>	<i>Fundamentals of Anatomy & Physiology</i> by Frederic H. Martini, Ph.D. - 7 th Edition

Goals and Objectives:

Upon successful completion of this course the student will demonstrate knowledge (including the correct anatomical and medical terminology for the organ systems) of the following organ systems:

- 1) Unit 4 - Cardiovascular
- 2) Unit 4 - Lymphatic & Immune
- 3) Unit 5 - Digestive
- 4) Unit 5 - Respiratory
- 5) Unit 5 - Urinary
- 6) Unit 6 - Reproductive & Development
- 7) Unit 3 - Endocrine

Grading Policy:

Exam 1	25 %
Exam 2	25 %
Exam 3	25 %
Exam 4	25 %

Extra Credit:

A potential extra 10% will be added to the final grade, based upon:

- Successful completion of all homework or other ‘stretch’ assignments and / or short ‘pop’ quizzes
- Maintaining a grade average of at least 50% ($\geq 50\%$)

Grading Scale:

A	100 – 90 %
B	89 – 80 %
C	79 – 70 %
D	69 – 60 %
F	59 – 0 %

Attendance Policy:

Attendance is required. Attendance will be taken at every class meeting. Students are expected to arrive on time and remain in class until the end of the period. Obtaining class notes is your responsibility should you miss class for any reason.

Make-up Policy:

Make-up examinations are NOT given. See your instructor if you have a conflict with this.

Cheating Policy:

Any student caught cheating on an exam will be assigned a final grade of *F*.

Teaching and Learning:

Studying is an integral part of achieving a good grade. Do not wait until the last minute to begin studying for an exam, there will be a lot of information to learn. Keep up with the information covered in class this will make studying easier. A learning resource that some students find helpful is their peers, so you may want to form study groups with your classmates. In addition to reading the chapters in your textbook, the text also brings supplemental material, such as a CD and an internet website. These offer animations that you may find helpful.

Instructor's Educational Philosophy

Congratulations, you have chosen what I hope will be an interesting and informative course. This course may be a demanding course so I will attempt to guide you as best I can. My emphasis will be on the relationships between the concepts and not on simple memorization of details. Therefore, understanding of the underlying processes will be crucial to successful comprehension of this body of knowledge. I will share my knowledge with you in as clear a manner as possible.

In order to be successful in this course, you should become proficient in: studying; organizing time; taking tests; thinking critically; expressing yourself critically; organizing your new knowledge; and, relating your new information to old knowledge. Building these skills will be the foundation of your professional career. These are skills that you must work to develop within yourself - others can only advise you.

As such, I will try to help you develop your skills to further your success. I can advise you on using your best thinking and learning styles, efficient use of time, testing skills and overcoming test anxiety. I can also guide you on how to organize the material so it easier to learn and retain.

My goals are to improve your learning environment and further your academic excellence. Your hard work along with my help will allow both of us to be successful. I am here for you! Please contact me if you need help.

Supplementary Material:

For your guidance I will provide lecture outlines/notes and objectives for each segment of the A&P2 BSC 2086 course. Use these as a summary of the critical information you will need to understand in more depth.

Objectives and a lecture outline (Powerpoint® and Word® documents) will be provided for Units 4, 5, 6, and 3 (Endocrine only) as an addendum to this synopsis.

Also, you have access to my web site at Miami Dade College <http://faculty.mdc.edu/rcoulson> , 'My A&P' and 'The Anatomy & Physiology Place' at: www.myaandp.com

	Date	TENTATIVE BSC 2086 LECTURE TOPIC SCHEDULE	TEXT CHAPTER
1	Jan 09 - Wed	UNIT 4 – FLUIDS & TRANSPORT - Blood	19
2	Jan 14 - Mon	UNIT 4 – FLUIDS & TRANSPORT - Blood	19
3	Jan 16 - Wed	UNIT 4 – FLUIDS & TRANSPORT – Heart	20
	Jan 21 - Mon	Martin Luther King Jr. Day	
4	Jan 23 - Wed	UNIT 4 – FLUIDS & TRANSPORT - Heart	20
5	Jan 28 - Mon	UNIT 4 – FLUIDS & TRANSPORT - Circulation	21
6	Jan 30 - Wed	UNIT 4 – FLUIDS & TRANSPORT - Circulation	21
7	Feb 04 - Mon	UNIT 4 – FLUIDS & TRANSPORT – Lymphatic & Immunity	22
8	Feb 06 - Wed	UNIT 4 – FLUIDS & TRANSPORT – Lymphatic & Immunity	22
9	Feb 11 - Mon	EXAM 1	19-22
10	Feb 13 - Wed	UNIT 5 – ENVIRONMENTAL EXCHANGE – Digestive System	24
11	Feb 18 - Mon	UNIT 5 – ENVIRONMENTAL EXCHANGE – Digestive System	24
12	Feb 20 - Wed	UNIT 5 – ENVIRONMENTAL EXCHANGE – Digestive System	24
13	Feb 25 - Mon	UNIT 5 – ENVIRONMENTAL EXCHANGE – Metabolism & Energetics	25
14	Feb 27 - Wed	UNIT 5 – ENVIRONMENTAL EXCHANGE – Metabolism & Energetics	25
15	Mar 03 - Mon	UNIT 5 – ENVIRONMENTAL EXCHANGE – Metabolism & Energetics	25
16	Mar 05 - Wed	EXAM 2	24-25
17	Mar 10 - Mon	UNIT 5 – ENVIRONMENTAL EXCHANGE – Respiratory System & pH	23
18	Mar 12 - Wed	UNIT 5 – ENVIRONMENTAL EXCHANGE – Respiratory System & pH	23
19	Mar 17 - Mon	UNIT 5 – ENVIRONMENTAL EXCHANGE - Respiratory System & pH	23
20	Mar 19 - Wed	UNIT 5 – ENVIRONMENTAL EXCHANGE – Urinary System	26
21	Mar 24 - Mon	UNIT 5 – ENVIRONMENTAL EXCHANGE – Urinary System	26
22	Mar 26 - Wed	UNIT 5 – ENVIRONMENTAL EXCHANGE – Fluid, Electrolyte, Acid-Base Balance	27
23	Mar 31 - Mon	UNIT 5 – ENVIRONMENTAL EXCHANGE – Fluid, Electrolyte, Acid-Base Balance	27
24	Apr 02 - Wed	EXAM 3	23,26,27
25	Apr 07 - Mon	UNIT 6 – CONTINUITY OF LIFE – Reproductive System	28
26	Apr 09 - Wed	UNIT 6 – CONTINUITY OF LIFE – Reproductive System	28
27	Apr 14 - Mon	UNIT 6 – CONTINUITY OF LIFE – Development, Genetics, Inheritance	29
28	Apr 16 - Wed	UNIT 6 – CONTINUITY OF LIFE – Development, Genetics, Inheritance	29
29	Apr 21 - Mon	UNIT 3 – CONTROL & REGULATION – Endocrine System	18
30	Apr 23 - Wed	UNIT 3 – CONTROL & REGULATION – Endocrine System	18
31	Apr 28 - Mon	Review (Optional Attendance – No Classes – Exam week)	28, 29, 18
32	Apr 30 - Wed	EXAM 4	28, 29, 18

UNIT 4: CIRCULATORY SYSTEM – FLUIDS & TRANSPORT

Blood Lymphatics & Immunity

CHAPTER 19 CHAPTER 22

1. List and explain the general functions of the circulatory system.
2. Explain the compartment concept of body fluids and list the volumes of fluids in normal 70 kg individuals using the following terminology:
 - Intracellular compartment
 - Extracellular compartment
 - Interstitial (intercellular) fluid
 - The vascular compartment
 - Blood plasma
 - Lymph
3. List the 2 major divisions of whole blood. Describe the function of the following:
 - Plasma
 - Water
 - Plasma proteins
 - a. Fibrinogen
 - b. Albumin
 - c. Globulin (*Alpha = α , Beta = β , Gamma = γ*)
 - d. Prothrombin
 - e. Plasminogen
 - Serum
 - Formed elements
 - Erythrocytes (RBCs)
 - Leukocytes (WBCs)
 - a. Granulocytes
 - i. Neutrophils
 - ii. Basophils
 - iii. Eosinophils
 - b. Agranulocytes
 - i. Lymphocytes
 - ii. Monocytes
 - c. Thrombocytes (platelets)
4. Explain hematopoiesis using the following terms:
 - Erythropoiesis
 - Leucopoiesis / leukopoiesis (✓)
 - Myeloid elements
 - Lymphoid elements
 - Anemia
 - Hypoxia
 - Polycythemia
 - Renal erythropoietic factor
 - Vitamin B₁₂
 - Intrinsic factor (stomach)

- Iron
5. Explain the involvement of hemoglobin in gas transport:
 - O₂ transport (oxyhemoglobin)
 - CO₂ transport (carbaminohemoglobin)
 - Reduced hemoglobin (acid hemoglobin)
 - Buffer
 6. Describe the breakdown of hemoglobin using the following:
 - Liver
 - Kupffer cells (macrophages of the liver)
 - Spleen
 - Bile salts
 - Bilirubin
 - Jaundice
 7. Explain blood typing based on the glycoproteins involved. Include the following terms:
 - Antigen
 - ABO complex
 - Rh factor
 - Erythroblastosis fetalis
 - Antibodies
 8. Define homeostasis. Include the events in blood clotting using these terms:
 - Thromboplastin/prothrombin activator
 - Intrinsic & extrinsic pathways
 - Prothrombin
 - Thrombin
 - Fibrinogen
 - Fibrin
 - Clot
 - Thrombus
 - Embolus
 - Calcium ions (Ca²⁺)
 - Vitamin K
 - Antihemophilic factor
 - Anticoagulants
 9. Explain the concept of **'self/nonself' in immunity**:
 - Positive selection
 - Negative selection
 10. Describe the **inflammatory response** including the cells & tissues involved
 11. **Nonspecific immunity** – list and describe the components involved, where they arise, where they acquire competency, and how they are activated:
 - Reticuloendothelial cells (macrophages & histocytes)
 - Neutrophils (microphages)
 - Monocytes (macrophages)
 - Basophils
 - Eosinophils
 - Complement
 12. **Specific immunity** – List and describe the components involved, where they arise, where they acquire competency and how they are activated:

- Lymphocytes
 - B cells
 - T cells
 - Complement
13. Describe the process of successful immunization in terms of:
- Primary response
 - Secondary response (anamnestic response)

Heart

CHAPTER 20

1. Explain the origin and conduction of the cardiac action potential using the following terms:
 - Pacemaker system
 - Sino-atrial (SA) node
 - Atrio-ventricular (AV) node
 - AV bundle (Bundle of His)
 - a. Right and Left bundle branches
 - Purkinje fibers
 - Systole
 - Diastole
 - Intrinsic depolarizing mechanism
 - Plateau of cardiac action potential
2. Describe the cardiac cycle and correlate it with electrocardiogram (EKG) waves:
 - P wave
 - QRS complex
 - T wave
 - Ectopic foci
 - PVCs
 - Heart sounds
3. Describe cardiac output and explain the effect of the following **Extrinsic factors** on its function:
 - Parasympathetic (vagal) stimulation
 - a. Acetylcholine
 - Sympathetic stimulation
 - a. Epinephrine (adrenaline)
 - b. Norepinephrine (noradrenaline)
 - Potassium ions (K^+)
 - Calcium ions (Ca^{2+})
4. Describe the effect of the following **Intrinsic factors** on cardiac output:
 - Stroke volume
 - Heart rate
 - Venous return
 - Frank-Starling Law
 - Hypertrophy of the heart
 - Myocardial infarction

Circulation

CHAPTER 21

1. List the circulatory vessels and describe their histology using these terms:

- Tunica interna (intima)
 - Tunica media
 - Tunica externa (adventitia)
 - Arteries
 - Arterioles
 - Capillaries
 - Precapillary sphincter
 - Arterio-venous shunts
 - Sinusoids
 - Venules
 - Veins
 - Lymph capillaries
 - Lymph veins
 - Lymph ducts
2. Describe arterial function and include these events:
- Arterial pressure
 - a. Systolic
 - b. Diastolic
 - Pulse pressure
 - Pressure regulators
 - a. Arteriolar damping
 - b. Arteriolar diameter
 - Mean arterial pressure
3. Describe the exchange between capillaries and tissue using these terms:
- Plasma
 - a. Hydrostatic pressure
 - b. Osmotic pressure
 - Interstitial fluid
 - a. Hydrostatic pressure (negative)
 - b. Osmotic pressure
4. Describe the functions of veins including:
- Blood reservoir
 - Central venous pressure
 - Venous (muscle) pump
 - Venous return
5. Explain how the following affect systemic blood flow:
- Heart rate
 - Stroke volume
 - Blood viscosity
 - Vessel elasticity
 - Vessel diameter
 - Autoregulation of vessels
 - Peripheral resistance
 - Nervous regulation
 - Humoral regulation
 - a. CO₂
 - b. O₂

- c. Epinephrine/norepinephrine
 - d. Renin/angiotensin/aldosterone
6. Describe blood flow in each of the following:
 - Fetus-placenta
 - Hepatic portal system
 - Circle of Willis
 - Pulmonary circulation
 - Coronary circulation
 7. Explain the role of the lymph system in circulation using the following terms:
 - Lymph formation
 - Lymph transport
 - Lymph organs
 - “Lymph pumps”
 8. Define shock. Differentiate the following types of shock and list the cause of each:
 - Hypovolemic shock
 - Neurogenic shock
 - Anaphylactic shock
 - Septic shock
 - Cardiac shock

The Lymphatic System and Immunity – CHAPTER 22

I. An Overview of the Lymphatic System and Immunity

A. Objective

1. Explain the difference between nonspecific and specific defense, and the role of lymphocytes in the immune response.
 - a. pathogens
 - b. lymphatic system
 - c. immune response
 - d. immunity

II. Organization of the Lymphatic System

A. Objectives

1. Identify the major components of the lymphatic system and explain their functions.
2. Discuss the importance of lymphocytes and describe their distribution in the body.
3. Describe the structure of lymphoid tissues and organs and explain their functions.
 - a. lymph
 - b. lymphatic vessels
 - c. lymphatics
 - d. lymphoid tissues
 - e. lymphoid organs

B. Functions of the Lymphatic System

C. Lymphatic Vessels

1. Lymphatic Capillaries
2. Small Lymphatic Vessels
3. Major Lymph-Collecting Vessels
 - a. superficial lymphatics
 - b. deep lymphatics
 - c. thoracic duct
 - d. cisterna chily
 - e. right lymphatic duct
 - f. lymphedema

D. Lymphocytes

1. Types of Lymphocytes

- a. T cells
 - b. B cells
 - c. NK cells
 - d. plasma cells
 - e. antigens
 - f. large granular lymphocytes
- 2. Life Span and Circulation of Lymphocytes
- 3. Lymphocyte Production
 - a. lymphopoiesis
 - b. stromal cells
 - c. blood-thymus barrier
- E. Lymphoid Tissues
 - a. lymphoid tissues
 - b. lymphoid nodule
 - c. germinal center
- 1. MALT
 - a. mucosa-associated lymphoid tissue (**MALT**)
 - b. aggregated lymphoid nodules
- 2. Tonsils
 - a. tonsils
 - b. palatine tonsils
 - c. pharyngeal tonsil
 - d. lingual tonsils
 - e. tonsillitis
- F. Lymphoid Organs
 - 1. Lymph Nodes
 - i. lymph nodes
 - ii. trabeculae
 - iii. hilus
 - iv. afferent lymphatics
 - v. efferent lymphatics
 - a. Lymph Flow
 - i. dendritic cells
 - ii. outer cortex
 - iii. deep cortex
 - iv. medulla
 - v. medullary cords
 - b. Lymph Node Function
 - i. lymphadenopathy
- 2. The Thymus
 - i. thymus
 - ii. thymic lobes
 - iii. septa
 - iv. lobules
 - v. cortex
 - vi. medulla
 - vii. reticular epithelial cells
 - viii. Hassall's corpuscles
- a. Hormones of the Thymus
- 3. The Spleen
 - a. Anatomy of the Spleen
 - i. gastrosplenic ligament
 - ii. hilus
 - b. Histology of the Spleen
 - i. pulp
 - ii. red pulp
 - iii. white pulp
 - iv. trabecular arteries
 - v. trabecular veins

vi. splenectomy

G. The Lymphatic System and Body Defenses

- a. nonspecific resistance
- b. specific resistance

III. Nonspecific Defenses

A. Objectives

1. List the body's nonspecific defenses and explain the function of each.
2. Describe the components and mechanisms of each nonspecific defense.

B. Physical Barriers

C. Phagocytes

1. Microphages
2. Macrophages
 - i. macrophages
 - ii. monocyte-macrophage system
- a. Fixed Macrophages
 - i. fixed macrophages
 - ii. microglia
 - iii. Kupffer cells
- b. Free Macrophages
 - i. free macrophages
 - ii. alveolar macrophages
3. Movement and Phagocytosis
 - i. chemotaxis
 - ii. adhesion

D. Immunological Surveillance

1. NK Cell Activation
 - a. perforins
 - b. tumor-specific antigens
 - c. immunological escape

E. Interferons

- a. interferons
- b. antiviral proteins
- c. alpha-interferons
- d. beta-interferons
- e. gamma-interferons
- f. cytokines

F. Complement

- a. complement (C) proteins
- b. complement system
1. Complement Activation: The Classical Pathway
 - a. classical pathway
2. Complement Activation: The Alternative Pathway
 - a. alternative pathway
 - b. properdin
3. Effects of Complement Activation
 - a. opsonins
 - b. opsonization
 - c. membrane attack complex (MAC)

G. Inflammation

1. The Response to Injury
 - a. necrosis
 - b. pus
 - c. abscess

H. Fever

- a. fever
- b. pyrogens
- c. endogenous pyrogen
- d. interleukin-1

IV. Specific Defenses: An Overview of the Immune Response

A. Objectives

1. Define specific resistance and identify the forms and properties of immunity.
2. Distinguish between cell-mediated (cellular) immunity and antibody-mediated (humoral) immunity and identify the cells responsible for each.
 - a. mediated immunity
 - b. antibody-mediated immunity

B. Forms of Immunity

- a. innate immunity
- b. acquired immunity
- c. active immunity
- d. naturally acquired active immunity
- e. induced active immunity
- f. vaccine
- g. passive immunity
- h. naturally acquired passive immunity
- i. induced passive immunity

C. Properties of Immunity

1. Specificity
2. Versatility
 - a. versatility
 - b. clone
3. Memory
4. Tolerance

D. An Introduction to the Immune Response

V. T Cells and Cell-Mediated Immunity

A. Objectives

1. Discuss the types of T cells and the role played by each in the immune response.
2. Describe the mechanisms of T cell activation and the differentiation of the major classes of T cells.

B. Antigen Presentation

- a. antigen presentation
- b. major histocompatibility complex (MHC)
- c. MHC proteins
- d. class I
- e. class II
- f. antigen-presenting cells (APCs)
- g. antigen processing

C. Antigen Recognition

- a. antigen recognition
- b. CD markers
- c. CD3 receptor complex
- d. CD8
- e. CD4

1. Costimulation

D. Activation of CD8 T Cells

1. Cytotoxic T Cells
 - a. lymphotoxin
2. Memory T_C cells
3. Suppressor T Cells

E. Activation of CD4 T Cells

- a. memory T_H cells

1. Graft Rejection and Immunosuppression
 - a. graft rejection

VI. B Cells and Antibody-Mediated Immunity

A. Objectives

1. Describe the mechanisms of B cell activation and the differentiation of plasma cells and memory B cells.
2. Describe the structure of an antibody and discuss the types of antibodies in body fluids and secretions.
3. Explain the functions of antibodies and how they perform those functions.
4. Discuss the primary and secondary responses to antigen exposure.

- B. B Cell Sensitization and Activation
 - a. sensitization
 - b. memory B cells
- C. Antibody Structure
 - a. heavy chains
 - b. light chains
 - c. antigen binding sites
- 1. The Antigen-Antibody Complex
 - a. antigen-antibody complex
 - b. antigenic determinant sites
 - c. complete antigen
- 2. Classes and Actions of Antibodies
 - a. immunoglobulins (Igs)
 - b. neutralization
 - c. immune complex
 - d. precipitation
 - e. agglutination
- D. Primary and Secondary Responses to Antigen Exposure
 - a. primary response
 - b. secondary response
- 1. The Primary Response
 - a. antibody titer
- 2. The Secondary Response
- E. Summary of the Immune Response

VII. Normal and Abnormal Resistance

- A. Objectives
 - 1. Describe the origin, development, activation, and regulation of normal resistance to disease.
 - 2. Explain the origin of autoimmune disorders, immunodeficiency diseases, and allergies and list important examples of each type of disorder.
 - 3. Discuss the effects of stress on the immune function.
 - a. immunological competence
- B. The Development of Immunological Competence
- C. Immune Disorders
 - i. autoimmune disorders
 - ii. immunodeficiency disease
 - iii. allergies
- 1. Autoimmune Disorders
 - i. autoantibodies
- 2. Immunodeficiency Diseases
 - i. severe combined immunodeficiency disease (SCID)
 - ii. immunosuppressive drugs
- 3. Allergies
 - i. allergens
- a. Immediate Hypersensitivity
 - i. immediate hypersensitivity
 - ii. anaphylaxis
 - iii. anaphylactic shock
 - iv. antihistamines

- D. Stress and the Immune Response

VIII. Aging and the Immune Response

- A. Objective
 - 1. Describe the effects of aging on the lymphatic system and the immune response.

IX. Integration with Other Systems

- A. Clinical Patterns

-EXAM 1-

UNIT 5: ENVIRONMENTAL EXCHANGE

Digestive System

CHAPTER 24

1. Define digestion & absorption, describe the functions of the mouth, stomach, small intestine, pancreas, liver, and gall bladder
2. List and describe the functions of major tissues in each of the following layers of gastrointestinal (GI) tract:
 - Mucosa
 - Epithelium
 - Lamina propria
 - Muscularis mucosa
 - Submucosa
 - Muscularis
 - Circular
 - Longitudinal
 - Serosa (visceral peritoneum) or adventitia
3. List and describe the functions of the salivary glands and describe the composition and functions of saliva using the following terms:
 - Water
 - Mucus
 - Salivary amylase (ptyalin)
 - Substrate
 - Products
 - Stimulation for salivation
 - Bolus
4. List the origin and function of each of the following gastric secretions:
 - HCl
 - Pepsinogen/pepsin
 - Substrate
 - Products
 - Mucus
 - Intrinsic factor
5. Explain the regulation of gastric function in terms of:
 - Cephalic phase
 - Gastric phase
 - Gastrin
 - Chyme
 - Intestinal phase
 - Secretin
 - Gastric inhibitory peptide (GIP)
 - Cholecystikinin (CCK)
6. Explain the role of the pancreas and liver in digestion. Diagram how they are connected to the duodenum. Include in your account the function(s) of the following:
 - Gall bladder
 - a. Bile
 - i. Emulsifying action

- ii. Cystic & hepatic ducts
 - iii. Common bile ducts
- Pancreas
 - a. Acinar secretions (*exocrine*)
 - i. Trypsin
 - ii. Chymotrypsin
 - iii. Carboxypeptidases
 - iv. Lipase
 - v. Amylase
 - b. Pancreatic ducts
 - i. Main (*Duct of Wirsung*)
 - ii. Accessory (*Duct of Santorini*)
 - c. Islets of Langerhans (*endocrine*)
 - i. Alpha (α) cells
 - Glucagon
 - ii. Beta (β) cells
 - Insulin
 - iii. Delta (δ) cells
 - Somatostatin
- Duodenum
 - Greater duodenal papilla (*Ampulla of Vater*)
 - Hepatopancreatic ampullar sphincter (*Sphincter of Oddi*)

7. Explain the absorptive and digestive functions of the small intestine using the following terms:

- Intestinal mucosa
- Plicae circularis
- Facilitated diffusion & active transport
- Lacteal – chylomicrons
- Capillaries
- Amino acids
- Monosaccharides
- Glycerol & fatty acids
- Cell-bound hydrolytic enzymes
- Maltase
- Lactase
- Sucrase
- Peptidase(s)
- **Chyme**
 - **Chyme** is the liquid substance found in the [stomach](#) before passing through the [pyloric valve](#) and entering the [duodenum](#). It results from the mechanical and chemical breakdown of a bolus and consists of partially digested food, water, [hydrochloric acid](#), and various [digestive enzymes](#). Chyme slowly passes through the pyloric [sphincter](#) and into the duodenum, where the extraction of nutrients begins. Depending on the quantity and contents of the meal, the stomach will digest the food into chyme anywhere between 40 minutes and a few hours. With a [pH](#) of around 2, chyme emerging from the stomach is very acidic. To raise its pH, the [duodenum](#) secretes a [hormone](#), [cholecystinin](#) (CCK), which causes the [gall bladder](#) to contract, releasing alkaline [bile](#) into the duodenum. The duodenum also produces the hormone [secretin](#) to stimulate the pancreatic secretion of large amounts of [sodium bicarbonate](#), which raises the chyme's pH to 7 before it reaches the [ileum](#). As it is protected by a thick layer of [mucus](#) and utilises the neutralizing actions of the sodium bicarbonate and bile, the duodenum is not as sensitive to highly acidic chyme as the rest of the small intestine.
 - **Note do not confuse CHYME with Chyle** - is a milky [fluid \(bodily fluid\)](#) consisting of [lymph](#) and emulsified [fats](#), or free fatty acids (FFAs). It is formed in the [small intestine](#) during digestion of ingested fatty foods and taken

up by lymph vessels specifically known as [lacteals](#), unlike other components of digested food that are conveyed by [veins](#). The lacteals are much better suited for the transport of FFAs away from the [gastrointestinal](#) tract.

8. Describe the:

- Site of production
- Stimulus
- Function

For each of the following digestive hormones:

- Gastrin
- Secretin
- Cholecystokinin (CCK)
- Gastric inhibitory peptide (GIP)

9. List specific examples for each of the following general hepatic functions:

- Excretory activities
- Synthetic reactions (*including plasma proteins*)
- Metabolic reactions
- Hematopoietic activity (*fetus*)
- Reticulendothelial activity
- Storage

10. List the functions of the large intestine using the terms:

- Absorptive functions
 - a. Water
 - b. Minerals
 - c. Vitamins (bacterial production)
 - d. Storage of feces
 - e. Defecation

Metabolism

CHAPTER 25

1. Define the following:

- Metabolism
- Anabolism
- Catabolism
- Metabolic rates
- Calorie – large & small
- **SDA** – *specific dynamic action* of food on metabolic rate

2. Briefly list the anabolism and catabolism of carbohydrates, proteins, and lipids, and the energy each food group produces per gram. Include the following terms:

- Glycogen
- Gluconeogenesis
- Monosaccharides
- Amino acids
- Deamination
 - Urea and amino group
- Fat
- Glycerol
- Fatty acids
- Beta (β) oxidation

- Ketone bodies
 - Acetyl coenzyme A (**acetyl CoA**)
 - Acetoacetic acid
 - Acetone
 - Beta (β) –hydroxybutyric acid

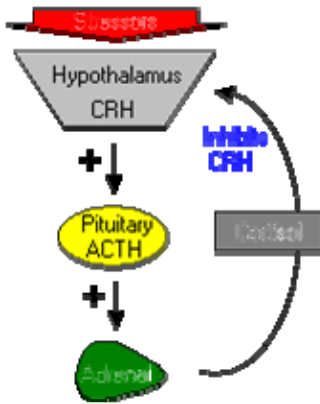
- Ketosis

3. Describe how glucose enters and is used within the cell using the following terms:
 - Glucose-6-phosphate (**G6P**)
 - a. Effect of epinephrine on glycogen
 - Glycogenesis
 - Glycogen
 - Glycogenolysis
 - Phosphorylase
 - Gluconeogenesis
 - Hexokinase(s)
 - Insulin receptor / facilitated diffusion
4. Describe glycolysis in terms of the following parameters:
 - Glucose degradation (oxidation) to pyruvic acid
 - Location of glycolytic activity in the cell
 - Use & production of ATP
 - Production of protons (H^+) to be used in oxidative phosphorylation (**OP**)
5. Discuss the Krebs cycle (Citric acid cycle, Tricarboxylic acid cycle (**TCA**)) in terms of the following:
 - The bridge between pyruvic acid and acetyl CoA
 - Location of Krebs cycle activity in the cell
 - Degradation (oxidation) of the ‘*acetyl*’ portion of acetyl CoA
 - Production of protons (H^+) to be used in oxidative phosphorylation (**OP**)
6. Describe oxidative phosphorylation (**OP**, cytochrome system, or the electron transfer system) with respect to:
 - Location of this metabolic activity
 - Production of ATP
 - a. Production of protons (H^+) from glycolysis
 - b. Production of protons (H^+) from Krebs’s cycle
 - Role of oxygen (**O₂**)
7. Differentiate among the following:
 - Diabetes mellitus
 - Diabetes insipidus
 - Diabetic coma
 - Insulin shock
 - Absorptive state
 - Post-absorptive state
8. Describe the metabolic effect of each hormone listed below:
 - Insulin
 - Glucagons
 - Thyroxine (**T₄**) or 3:5,3':5' tetraiodothyronine) is the major hormone secreted by the follicular cells of the thyroid gland.
 - **TSH or Thyrotropin:** A [hormone](#) produced by the [pituitary gland](#) at the base of the brain in response to signals from the [hypothalamus](#) gland in the brain. Thyrotropin has an affinity for the thyroid. Thyrotropin is known also as thyroid stimulating hormone (TSH). Thyrotropin (or, if you

prefer, TSH) promotes the growth of the [thyroid gland](#) in the neck and stimulates it to produce more [thyroid hormones](#). When there is an excessive amount of thyroid hormones, the pituitary gland stops producing TSH, reducing thyroid hormone production. This mechanism maintains a relatively constant level of thyroid hormones circulating in the blood.

- ACTH ('corticoids')

Adrenocorticotrophic Hormone (ACTH, corticotropin)



Adrenocorticotrophic hormone, as its name implies, stimulates the adrenal cortex. More specifically, it stimulates secretion of glucocorticoids such as cortisol, and has little control over secretion of aldosterone, the other major steroid hormone from the adrenal cortex.

ACTH is secreted from the anterior pituitary in response to corticotropin-releasing hormone from the hypothalamus. Corticotropin-releasing hormone is secreted in response to many types of stress, which makes sense in view of the "stress management" functions of glucocorticoids. Corticotropin-releasing hormone itself is inhibited by glucocorticoids, making it part of a classical [negative feedback loop](#).

- Growth hormone (GH) or somatotropin
- Testosterone

-EXAM 2-

UNIT 5: ENVIRONMENTAL EXCHANGE

Respiratory System & pH

CHAPTER 23

1. Outline the basic anatomy and relevant histology of the respiratory system using these terms:

- Conductive portion
 - Nasal cavity, conchae, nasopharynx, nares
 - Trachea
 - Bronchi – primary, secondary (lobar), tertiary (segmental)
 - Bronchioles
 - Terminal bronchioles
- Respiratory portion
 - Respiratory bronchioles
 - Alveolar ducts
 - Alveoli
 - Surfactant
- Lungs
 - Lobes & fissures
 - Bronchopulmonary segments

c. Visceral pleura

d. Parietal pleura

2. Describe the respiratory functions of the following membranes and structures:
 - Mucous membranes – nasal cavity
 - Paranasal sinuses
 - Conchae – nasal cavity
 - Hyaline cartilage rings – trachea
 - Pseudostratified ciliated columnar epithelium & goblet cells, trachea, bronchi
 - Smooth muscle – bronchioles
 - Simple squamous epithelium – alveoli & capillaries
3. Describe the movements of the rib cage, diaphragm, and lungs in ventilation (*inspiration & expiration*). Include the following terms:
 - Negative air pressure
 - Positive air pressure
 - Intrapleural & intrathoracic pressures
 - Intraalveolar (intrapulmonic) pressure
 - Atmospheric pressure
4. Define the pulmonary capacities and list volumes typical of each:
 - Residual volume
 - a. Importance to continued diffusion of gases
 - Tidal volume
 - Vital capacity
 - Total lung volume
 - Inspiratory reserve volume
 - Expiratory reserve volume
 - Dead space (physiological and anatomical)
5. Define partial pressure, show how it is calculated and explain its significance in respiration. Include the following:
 - pO₂
 - pCO₂
 - pN₂
 - pH₂O
 - Concentration gradients & diffusion
6. Compare the partial pressure of O₂, CO₂ in the following:
 - Atmospheric air
 - Alveolar air
 - Pulmonary arteries
 - Pulmonary veins
 - Systemic tissues
 - Expired air
7. Describe the relevance of the following to O₂ transport:
 - Oxyhemoglobin
 - Dissociation curve
 - Bohr effect
8. Describe the mechanisms of CO₂ transport showing the relative importance of the following:
 - Carbonic acid (H₂CO₃)
 - Bicarbonate ion (HCO₃⁻)

- a. Carbonic anhydrase
 - b. Chloride shift
 - Carbaminohemoglobin (carboxyhemoglobin)
 - Plasma (dissolved)
 - Acid hemoglobin
9. Describe the role of the following in reflex control of ventilation:
- Glossopharyngeal and vagal afferent pathways
 - Respiratory centers in the medulla oblongata (MO)
 - a. Inspiratory Center
 - b. Expiratory Center
 - c. Phrenic and intercostals nerves
 - d. Herring-Breuer reflex
 - e. Stretch receptors in lungs
 - Respiratory centers in pons
 - a. Apneustic center
 - b. Pneumotaxic center
10. Explain how the following affect the ventilation rate:
- O₂ level in blood
 - CO₂ level in blood and CSF fluid
 - Central receptors (in medulla oblongata)
 - Peripheral receptors (in carotid, aortic bodies)

Fluid, Electrolyte, Acid-base Balance - CHAPTER 27

1. REVIEW IONIZATION & DISSOCIATION:

- E.g.: $\text{HCl} \rightarrow \text{H}^+ + \text{Cl}^-$

2. ACIDS, BASES

- A. Acid – any substance that donates H⁺ or accepts OH⁻
 Base – any substance that accepts H⁺ or donates OH⁻
 Salt – composed of any cation except H⁺ and any anion except OH⁻. Thus, it is neither acid nor base, but is a compound that results from acid-base interaction, e.g.: HCl (acid) + NaOH (base) = NaCl (salt) + HOH (water)
- B. A strong acid, such as hydrochloric acid, dissociates completely:
 $\text{HCl} \rightarrow \text{H}^+ + \text{Cl}^-$
- In an HCl solution there will be few or no HCl molecules, only H⁺ ions and Cl⁻ ions
- C. A weak acid, such as carbonic acid, does not dissociate completely:
 $\text{H}_2\text{CO}_3 \leftrightarrow \text{H}^+ + \text{HCO}_3^-$
 The double arrow (↔) demonstrates a reversible reaction that takes place. In a carbonic acid solution, there will be acid molecules re-forming as well as dissociating into hydrogen ions (H⁺) and bicarbonate ions (HCO₃⁻)
- In a carbonic acid solution there will H₂CO₃ molecules as well as H⁺ ions and HCO₃⁻ ions.
- D. Major sources of acids in the human body:
- i. Sulfur (S) & phosphorus (P) from proteins, nucleic acids, etc.
 - $\text{H}_2\text{PO}_4 \rightarrow \text{H}^+ + \text{HPO}_4^-$
 - $\text{H}_2\text{SO}_4 \rightarrow 2\text{H}^+ + \text{SO}_4^-$

- ii. Fatty acids and lactic acid
- iii. CO₂ gas

In the red blood cells, the enzyme carbonic anhydrase catalyzes the following reaction:



In these reactions the hydrogen ions (H⁺) are formed in blood flowing in the tissues (*arrow to the right* →). When blood flows through the lungs, CO₂ is formed and gets ‘blown off’ (*arrow to the left* ←)

- E. pH = negative logarithm of hydrogen ion concentration [H⁺]. The pH system is a way of noting the concentration of acid in a substance, liquid, tissue, etc.

For example: pH 7.0 = neutral: [H⁺] = [OH⁻]

[X] = concentration of X

pH 1-7 = acid: [H⁺] > [OH⁻]

> = greater than

pH 7-14 = alkaline: [H⁺] < [OH⁻]

< = less than

➤ **The lower the pH**, the more acid the solution.

➤ **The higher the pH**, the more alkaline the solution.

‘**Acidosis**’ a condition where the pH of blood is 6.8-7.3

- death – caused by a pH lower than 6.8 (more & fatally acidic)

‘**Alkalosis**’ a condition where the pH of blood is 7.5-8.0

- death – caused by a pH greater than 8.0 (more & fatally alkalotic)

Average pH venous blood = 7.35

Average pH arterial blood = 7.45

Normal pH range for blood = 7.35 – 7.45

COMPARE the pH of arterial and venous blood

- Which is the more acidic?
- Which is the more basic (alkaline)?

3. **BUFFERS** - Buffers are substances that resist changes in the acid-base balance of a solution. Which is to say: *buffers resist changes in pH*

- **Buffer Pairs - Usually buffers consist of 2 substances (buffer pairs):**

i. **Alkaline member** of the pair - One substance minimizes the effect of acids on pH – this is the alkaline member

ii. **Acid member** of the pair – The other substance minimizes the effect of bases on pH – this is the acid member

○ **RESIST CHANGE IN pH:**

- ***Generally this is done by replacing a stronger acid with a weaker one, or replacing a stronger base with a weaker one***

- **Some Important Buffer Pairs are:**

○ Bicarbonate:

- NaHCO₃ sodium bicarbonate

- Exists as KHCO₃ inside cells – WHY?

- H₂CO₃ carbonic acid

○ Phosphate:

- Na₂HPO₄ alkaline phosphate

- NaH₂PO₄ acid phosphate

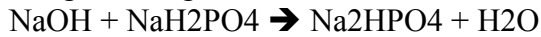
○ Hemoglobin (Hb):

- KHb alkaline hemoglobin
 - HHb acid hemoglobin
 - Proteins:
 - Na proteinate alkaline protein
 - Protein acid protein
- **The Bicarbonate System:**
 - Most important system in plasma and the one able to respond the fastest to pH changes
 - Requires 20:1 ratio to maintain perfect acid/base balance
 - E.g. 20 units NaHCO₃: 1 unit H₂CO₃
 - Changes in ratio that permit existence of tolerable pH - e.g.:
 - 40 units NaHCO₃ : 2 units H₂CO₃ = compensated alkalosis
 - 20:1 ratio = maintain acceptable pH range
 - 10 units NaHCO₃ : 0.5 units = compensated alkalosis
 - Changes beyond 40/2 or 10/0.5 lead to unacceptable pHs and are termed, respectively:
 - Uncompensated alkalosis
 - Uncompensated acidosis
 - With strong acid (HCl):
 - HCl + NaHCO₃ → NaCl + H₂CO₃ (carbonic acid)
 - Carbonic acid is weaker than HCl, contributes fewer hydrogen ions (H⁺), thus less of a threat to existing pH
 - Carbonic acid in venous blood, when it gets to the lungs (via pulmonary artery) it reacts:
 - H₂CO₃ → H₂O + CO₂ → CO₂ is 'blown off' in expired air
 - With strong base (NaOH):
 - NaOH + H₂CO₃ → NaHCO₃ + H₂O
 - Sodium bicarbonate (NaHCO₃) is less alkaline than sodium hydroxide (NaOH) and therefore causes smaller changes in pH
- **Respiratory Control**
 - CO₂ is a major source of acid – *Note: low pH of carbonated drinks!*
 - The control of CO₂ concentration is one of the functions of the respiratory system.
 - CO₂ + H₂O ↔ H₂CO₃ ↔ H⁺ + HCO₃⁻
 - Note that venous blood will have higher concentrations of H₂CO₃ and thus a lower pH (7.35) than arterial blood (7.45)
 - Hemoglobin (Hb) buffers are active in red blood cells (RBCs), thus indirectly assist in controlling the hydrogen ion concentration [H⁺] of the plasma
 - Buffer pair:
 - KHb basic / alkaline hemoglobin
 - HHb acid hemoglobin
 - H₂CO₃ + KHb → KHCO₃ + HHb
 - Acid Hb (HHb) is a weaker acid than carbonic acid (H₂CO₃)
 - Respiratory control of blood pH:
 - Excess H⁺ → lower pH (*more acid*) → stimulates respiratory centers → increased ventilation rate → 'blow off' CO₂ → increases pH (*more alkaline*) → normal pH
- **Urinary Control**
 - Phosphate buffers are active in the kidney
 - Buffer pair: **Na₂HPO₄** **sodium alkaline phosphate**
 NaH₂PO₄ **sodium acid phosphate**
 - Add a strong acid, e.g. HCl



The Na^+ is reabsorbed, acid phosphate (H_2PO_4^-) is excreted by kidney

- Add a strong base, e.g. NaOH



The alkaline phosphate (Na_2HPO_4) is less alkaline than sodium hydroxide (NaOH) and is excreted

- Explain the mechanism of tubular secretion of hydrogen ions (H^+)
 - Note: the role of carbonic anhydrase and the tubular secretion of H^+ ions (blood $\text{H}^+ \rightarrow$ urine H^+) results in the movement of more NaHCO_3 into the blood to further buffer the plasma
- Explain the mechanism for tubular secretion of ammonia (NH_3 or NH_4^+ ammonium ion)
 - Note again: that the tubular secretion of ammonia as ammonium chloride (NH_4Cl) results in more NaHCO_3 reabsorbed into the blood

▪ **Proteins**

- Proteins are important and widespread buffers in the plasma and within cells. Protein molecules help to neutralize excessive alkaline or acid solutions by releasing or accepting H^+ ions. Thus, they act as acids in alkaline environments, and as bases in acid environments. Such compounds are said to be '*amphoteric*' – they can go either way. In addition, proteins can act as buffers in the same fashion as the other buffer pairs (listed above).
- Proteins:

Na proteinate	alkaline protein
Protein	acid protein

4. METABOLIC DISTURBANCES

- **Metabolic acidosis**
 - Loss of bicarbonate, mostly due to depletion of bicarbonate by neutralizing acids produced in disease, such as diabetes – pH goes down
- **Metabolic alkalosis**
 - Increase in bicarbonate by ingestion of too much sodium bicarbonate, or by excessive vomiting = loss of HCl acid from stomach = relative increase in bicarbonate (alkaline, base) – pH goes up
- **Respiratory acidosis**
 - Increase in carbonic acid by retention of excessive CO_2 , e.g. inadequate ventilation – pH goes down
- **Respiratory alkalosis**
 - Decrease in carbonic acid by removing too much CO_2 , e.g. excessive (hyper) ventilation

Urinary System

CHAPTER 26

1. List the excretory role of the following organ systems:
 - Skin
 - Digestive system
 - Respiratory system
 - Urinary system
2. Describe the following nephron components:
 - Bowman's capsule
 - Glomerular capillaries

- Proximal convoluted tubules (PCT)
 - Loop of Henle
 - Distal convoluted tubule (DCT)
 - Collecting tubule (duct) – (CT)
3. Define these major nephron processes:
- Glomerular filtration
 - Tubular reabsorption
 - Tubular secretion
4. Describe the following events for each of the major nephron processes:
- Glomerular filtration
 - Effective filtration pressure
 - Glomerular filtrate
 - Materials filtered
 - Tubular reabsorption
 - Facultative & obligatory water reabsorption
 - Active transport of nutrients, Na⁺
 - Threshold concept & carrier saturation
 - Pinocytosis
 - Tubular secretion
 - Role in acid-base balance
 - Active & passive transport
5. Explain the kidney's role in water balance by including the following:
- ADH (antidiuretic hormone, vasopressin)
 - Aldosterone
 - Posterior pituitary
 - Adrenal cortex
 - Relative permeability of DCT and collecting ducts to water
6. Describe the structure & function of the juxtaglomerular apparatus (JGA) using these terms:
- Distal convoluted tubule (DCT)
 - Macula densa
 - Renin-angiotensin
 - Arterial blood pressure (ABP)
7. Describe the characteristics of urine using the following terms:
- Water concentration
 - Solute concentration (specific gravity (SG))
 - Glucose
 - Other organic materials
 - pH
 - Glycosuria
 - Polyuria
 - Oliguria
8. Outline the mechanics of the bladder reflex

-EXAM 3-

UNIT 6 – CONTINUITY OF LIFE

Reproductive System CHAPTER 28

1. Write the definitions and functions of the male (♂) & female (♀) primary and secondary sexual organs and features
2. Explain the differences between diploid and haploid cells using the following terms:
 - Mitosis
 - Meiosis
 - Gametogenesis
 - Spermatogenesis (♂)
 - Oogenesis (♀)
3. Diagram a human life cycle which includes these terms:
 - Immature male (♂) and female (♀) - *adolescence*
4. Discuss the production and action of gonadotropins in males (♂) and females (♀). Include:
 - Hypothalamus
 - Anterior pituitary gland
 - Portal system
 - Releasing factor
5. Explain the hormone mechanism for the production and maintenance of gametes and secondary sexual features in males (♂) :
 - Interstitial cells
 - FSH (follicle stimulating hormone), LH (luteneizing hormone)
 - Releasing factor
 - Testosterone
6. Explain the hormone mechanism for the production of gametes and maintenance of pregnancy in females (♀):
 - Primary and Graafian follicles
 - Estrogen
 - Progesterone
 - Corpus luteum
 - Chorionic gonadotropin
 - Menses
 - FSH
 - LH
7. Explain the function of the following male structures:
 - Testis
 - Seminiferous tubules – interstitial cells
 - Epididymis
 - Vas deferens (ductus deferens)
 - Seminal vesicles
 - Ejaculatory ducts
 - Prostate gland
 - Urethra
 - Bulbourethral gland (*Cowper's gland*)
 - Penis

➤ Erectile tissue

➤ Urethra

8. Explain the function of the following female structures:

- Ovaries & ovarian cycle
 - Immature follicle
 - Graafian follicle
 - Corpus hemorrhagicum
 - Corpus luteum
 - Corpus albicans
 - Ovulation
- Fallopian tubes (oviducts, uterine tubes)
- Uterus
 - Perimetrium
 - Myometrium
 - Smooth muscle
 - Endometrium
 - Proliferation phase
 - Secretory phase
 - Menstrual phase

9. Explain the changing hormone levels as they relate to the events in a female cycle:

- Menses
- Endometrial cycle
 - Proliferative
 - Secretory
 - Menstrual
- Fertilization
- Implantation
- Viable ovum

10. Describe these events in early pregnancy:

- Site of fertilization
- Maximum ovum fertility (*first 10-15 hours after ovulation*)
- Implantation
- Role of trophoblast in implantation (*release of chorionic gonadotrophin*)
- Function of human chorionic gonadotrophin (*hCG*)
 - Peptide hormone made by embryonic cells of placenta soon after conception
 - Maintains corpus luteum
 - Used as diagnostic test for pregnancy
- Hormonal functions of placenta

11. Explain the role of the following in lactation and milk ejection:

- Estrogens
 - Ductile system in mammary glands
- Progesterone
 - Development of secretory apparatus
- Colostrum
- Loss of placental hormones at parturition
 - Oxytocin
- Nursing

- Hypothalamus
- Pituitary hormones
 - Oxytocin
 - Prolactin
- Suckling stimulus

12. Discuss the various current contraceptive methods and their mechanism of action (MOA)

Development and Inheritance

CHAPTER 29

I. An Overview of Topics in Development

A. Objective

1. Explain the relationship between differentiation and development, and specify the various stages of development.
 - a. development
 - b. differentiation
 - c. fertilization
 - d. conception
 - e. embryological development
 - f. embryology
 - g. fetal development
 - h. prenatal development
 - i. postnatal development
 - j. maturity
 - k. inheritance
 - l. genetics

II. Fertilization

A. Objectives

1. Describe the process of fertilization.
2. Explain how developmental processes are regulated.

B. The Oocyte at Ovulation

- a. hyaluronidase
- b. acrosin

C. Oocyte Activation

- a. oocyte activation
- b. polyspermy
- c. female pronucleus
- d. male pronucleus

III. The Stages of Prenatal Development

A. Objective

1. List the three prenatal periods and describe the major events associated with each.
 - a. gestation
 - b. trimesters
 - c. first trimester
 - d. second trimester
 - e. third trimester

IV. The First Trimester

A. Objectives

1. Explain how the three germ layers participate in the formation of extraembryonic membranes.
2. Discuss the importance of the placenta as an endocrine organ.
 - a. cleavage
 - b. pre-embryo
 - c. implantation
 - d. placentation
 - e. placenta
 - f. embryogenesis

B. Cleavage and Blastocyst Formation

- a. blastomeres
- b. morula
- c. blastocyst
- d. blastocoele
- e. trophoblast
- f. inner cell mass

C. Implantation

- i. cellular trophoblast
- ii. syncytial trophoblast
- iii. ectopic pregnancy
- iv. lacunae
- v. villi
- 1. Formation of the Amniotic Cavity
 - i. amniotic cavity
- 2. Gastrulation and Germ Layer Formation
 - i. gastrulation
 - ii. primitive streak
 - iii. ectoderm
 - iv. endoderm
 - v. mesoderm
 - vi. germ layers
 - vii. embryonic disc
- 3. Formation of the Extraembryonic Membranes
 - i. extraembryonic membranes
 - a. The Yolk Sac
 - b. The Amnion
 - i. amnion
 - ii. amniotic fluid
 - c. The Allantois
 - d. The Chorion
 - i. chorion
 - ii. chorionic villi

D. Placentation

- i. body stalk
- ii. yolk stalk
- iii. deciduas capsularis
- iv. deciduas basalis
- v. deciduas parietalis
- vi. umbilical cord
- 1. Placental Circulation
 - i. umbilical arteries
 - ii. umbilical vein
- 2. The Endocrine Placenta
 - a. Human Chorionic Gonadotropin
 - i. human chorionic gonadotropin (hCG)
- 3. Human Placental Lactogen and Placental Prolactin
 - i. human placental lactogen (hPL)
 - ii. placental prolactin
- a. Relaxin
- b. Progesterone and Estrogens

E. Embryogenesis

- a. embryogenesis
- b. head fold
- c. tail fold
- d. organogenesis

V. The Second and Third Trimesters

A. Objectives

1. Describe the interplay between the maternal organ systems and the developing fetus.

2. Discuss the structural and functional changes in the uterus during gestation.
- B. Pregnancy and Maternal Systems
- C. Structural and Functional Changes in the Uterus
- a. false labor
 - b. true labor
 - c. labor contractions

VI. Labor and Delivery

- A. Objective
1. List and discuss the events that occur during labor and delivery.
 - a. parturition
- B. Stages of Labor
1. The Dilation Stage
 2. The Expulsion Stage
 - a. expulsion stage
 - b. delivery
 - c. episiotomy
 - d. cesarean section
 3. The Placental Stage
- C. Premature Labor
- a. premature labor
 - b. immature delivery
 - c. premature delivery
- D. Difficult Deliveries
- a. breech births
- E. Multiple Births
- a. dizygotic
 - b. monozygotic
 - c. conjoined twins

VII. Postnatal Development

- A. Objective
1. Identify the features and functions associated with the various life stages.
 - a. life stages
- B. The Neonatal Period, Infancy, and Childhood
- i. neonatal period
 - ii. infancy
 - iii. childhood
 - iv. adolescence
 - v. pediatrics
1. The Neonatal Period
 - i. neonate
 - a. Lactation and the Mammary Glands
 - i. colostrums
 - ii. milk let-down reflex
2. Infancy and Childhood
- C. Adolescence and Maturity
- a. puberty
- D. Senescence
- a. senescence
 - b. geriatrics
 - c. geriatricians

VIII. Genetics, Development, and Inheritance

- A. Objective
1. Relate basic principles of genetics to the inheritance of human traits.
- B. Genes and Chromosomes
- a. genotype
 - b. phenotype
- C. Patterns of Inheritance

- a. homologous
- b. chromosomes
- c. autosomal chromosomes
- d. sex chromosomes
- e. karyotype
- f. locus
- g. alleles
- h. homozygous
- i. simple inheritance
- 1. Interactions between Alleles
 - a. heterozygous
 - b. strict dominance
 - c. dominant
 - d. recessive
 - e. incomplete dominance
 - f. codominance
- 2. Penetrance and Expressivity
 - a. penetrance
 - b. expressivity
 - c. teratogens
- 3. Predicting Inheritance
 - a. Punnett square
 - b. polygenic inheritance
- D. Sources of Individual Variation
 - 1. Genetic Recombination
 - a. genetic recombination
 - b. crossing over
 - c. translocation
 - d. genomic imprinting
 - e. chromosomal abnormalities
 - 2. Mutation
 - a. spontaneous mutations
 - b. carriers
- E. Sex-Linked Inheritance
 - a. X chromosome
 - b. Y chromosome
 - c. X-linked
- F. The Human Genome Project
 - a. Human Genome Project
 - b. genome
 - c. karyotyping

Endocrine System

CHAPTER 18

OBJECTIVES:

1. Describe the differences between endocrine and exocrine glands / secretions
2. Compare the effect of the endocrine system on body tissues with that of the nervous system using the following terms:
 - Speed of tissue response
 - Duration of tissue response
3. Describe how steroid and polypeptide hormones work. Include the concepts of:
 - Target cell
 - Receptors
 - First messenger
 - Second messenger

- Adenyl cyclase
 - Cyclic AMP
 - Gene activation
4. Give examples of each of the following types of hormone activation and their role in homeostasis:
- Neurohumors produced by nervous system
 - Control endocrine secretions
 - Feedback control
 - Negative feedback
 - Positive feedback
5. List the precise anatomical locations of each of the seven (7) glands with respect to surrounding organs. Identify the target tissues and their physiological effect exerted by each hormone:
- 1a- Anterior pituitary gland (adenohypophysis)
 - ACTH
 - TSH
 - FSH
 - LH / ICSH
 - LTH
 - Luteotrophic hormone
 - Secreted by pituitary gland after ovulation
 - Maintains corpus luteum
 - GH
 - Prolactin
 - 1b- Posterior pituitary gland (neurohypophysis)
 - ADH
 - Oxytocin
 - 2a- Adrenal cortex
 - Mineralocorticoids
 - Glucocorticoids
 - Androgens / estrogens
 - 2b- Adrenal medulla
 - Catecholamines
 - Epinephrine (**E**, adrenaline)
 - Norepinephrine (**NE**, noradrenaline)
 - 3- Thyroid gland
 - Thyroxine (**T4**)
 - Calcitonin
 - 4- Parathyroid gland
 - PTH (parathyroid hormone, parathormone)
 - 5- Pancreas
 - Insulin
 - Diabetes mellitus
 - Glucagon
 - 6- Testes
 - Testosterone
 - 7- Ovaries
 - Estrogens

Endocrine Summary:

I. Intercellular (cell-to-cell) Communication

A. Objectives

1. Explain the importance of intercellular communication.
2. Describe the mechanisms involved.
3. Compare the modes of intercellular communication used by the endocrine and nervous systems.
4. Discuss the functional significance of the differences between the two systems.
 - a. direct communication
 - b. paracrine communication
 - c. hormones
 - d. target cells
 - e. endocrine communication
 - f. synaptic communication

II. An Overview of the Endocrine System

A. Objectives

1. Compare the cellular components of the endocrine system with those of other tissues and systems.
2. Compare the major structural classes of hormones.
3. Explain the general mechanisms of hormonal action.
4. Describe how endocrine organs are controlled.
 - a. endocrine system

B. Classes of Hormones

1. Amino Acid Derivatives
2. Peptide Hormones
3. Lipid Derivatives
 - a. Eicosanoids
 - i. eicosanoids
 - ii. leukotrienes
 - iii. prostaglandins
 - iv. thromboxanes
 - v. prostacyclins
 - b. Steroid Hormones

C. Secretion and Distribution of Hormones

D. Mechanisms of Hormone Action

1. Hormones and Cell Membrane Receptors
 - a. First and Second Messengers
 - i. first messenger
 - ii. second messenger
 - iii. down-regulation
 - iv. up-regulation
 - v. G protein
 - b. G Proteins and cAMP
 - i. adenylate cyclase
 - ii. phosphodiesterase (PDE)
 - c. G Proteins and Calcium Ions
 - i. diacylglycerol (DAG)
 - ii. inositol triphosphate (IP₃)
 - iii. protein kinase C (PKC)
 - iv. calmodulin
2. Hormones and Intracellular Receptors

E. Control of Endocrine Activity

- a. endocrine reflexes

1. Endocrine Reflexes
 - a. regulatory hormones

III. The Pituitary Gland

A. Objectives

1. Describe the location and structure of the pituitary gland and explain its structural and functional relationships with the hypothalamus.
2. Identify the hormones produced by the anterior and posterior lobes of the pituitary gland and specify the functions of those hormones.
3. Discuss the results of abnormal levels of pituitary hormone production.
 - a. hypophysis
 - b. infundibulum

B. The Anterior Lobe

- i. anterior lobe
 - ii. adenohypophysis
 - iii. pars distalis
 - iv. pars tuberalis
 - v. pars intermedia
1. The Hypophyseal Portal System
 - i. fenestrated capillaries
 - ii. portal vessels
 - iii. portal system
 - iv. hypophyseal portal system
 2. Hypothalamic Control of the Anterior Lobe
 - i. releasing hormone (RH)
 - ii. inhibiting hormone (IH)
 3. Hormones of the Anterior Lobe
 - a. Thyroid-Stimulating Hormone (TSH)
 - b. Adrenocorticotrophic Hormone
 - i. adrenocorticotrophic hormone (ACTH)
 - ii. corticotropin-releasing hormone (CRH)
 - c. The Gonadotropins
 - i. gonadotropins
 - ii. hypogonadism
 - iii. follicle-stimulating hormone (FSH)
 - iv. luteinizing hormone (LH)
 - v. androgens
 - d. Prolactin
 - i. prolactin (PRL)
 - ii. prolactin-inhibiting hormone (PIH)
 - e. Growth Hormone
 - i. growth hormone (GH)
 - ii. somatotropin
 - iii. somatomedins
 - iv. insulin-like growth factors (IGFs)
 - v. glucose-sparing effect
 - vi. diabetogenic effect
 - vii. growth hormone-releasing hormone (GH-RH)
 - viii. growth hormone-inhibiting hormone (GH-IH)
 - f. Melanocyte-Stimulating Hormone (MSH)

C. The Posterior Lobe (vocabulary)

- a. posterior lobe
- b. neurohypophysis

- c. supraoptic nuclei
 - d. paraventricular nuclei
 - 1. Antidiuretic Hormone (ADH)
 - 2. Oxytocin (OT)
- D. Summary: The Hormones of the Pituitary Gland

IV. The Thyroid Gland

A. Objectives

1. Describe the location and structure of the thyroid gland.
2. Identify the hormones produced by the thyroid gland, specify the functions of those hormones, and discuss the results of abnormal levels of thyroid hormones.

- a. thyroid gland
- b. lobes
- c. isthmus

B. Thyroid Follicles and Thyroid Hormones

- a. thyroid follicles
- b. follicle cavity
- c. thyroglobulin
- d. thyroxine
- e. T₄
- f. triiodothyronine
- g. T₃
- h. thyroid-binding globulins (TBGs)
- i. tranthyretin

C. Functions of Thyroid Hormones

- a. calorogenic effect

1. Iodine and Thyroid Hormones

D. The C Cells of the Thyroid Gland and Calcitonin

- a. C (clear) cells
- b. calcitonin (CT)

V. The Parathyroid Glands

A. Objective

1. Describe the location of the parathyroid glands, the functions of the hormone they produce, and the effects of abnormal levels of parathyroid hormone production.

- a. parathyroid glands
- b. chief cells
- c. parathyroid hormone (PTH)

VI. The Adrenal Glands

A. Objectives

1. Describe the location, structure, and general functions of the adrenal glands.
2. Identify the hormones produced by the adrenal cortex and medulla and specify the functions of each hormone.
3. Discuss the results of abnormal levels of adrenal hormone production.

- a. adrenal gland
- b. adrenal cortex
- c. adrenal medulla

B. The Adrenal Cortex

- i. adrenocortical steroids
- ii. corticosteroids

1. The Zona Glomerulosa

- i. zona glomerulosa
- ii. mineralocorticoids

- iii. aldosterone
 - a. Aldosterone
 - 2. The Zona Fasciculata
 - i. zona fasciculate
 - ii. glucocorticoids
 - a. The Glucocorticoids
 - i. cortisol
 - ii. corticosterone
 - iii. cortisone
 - b. Effects of Glucocorticoids
 - i. anti-inflammatory
 - 3. The Zona Reticularis
- C. The Adrenal Medulla
- 1. Epinephrine and Norepinephrine

VII. The Pineal Gland

A. Objective

- 1. Describe the location of the pineal gland and the functions of the hormone that it produces.
 - a. pineal gland
 - b. pinealocytes
 - c. melatonin

VIII. The Pancreas

A. Objectives

- 1. Describe the location and structure of the pancreas.
- 2. Identify the hormones produced by the pancreas, and specify the functions of those hormones.
- 3. Discuss the results of abnormal levels of pancreatic hormone production.
 - a. pancreas
 - b. exocrine pancreas
 - c. endocrine pancreas
 - d. pancreatic islets

B. The Pancreatic Islets

- a. alpha cells
- b. beta cells
- c. delta cells
- d. F cells
- e. pancreatic polypeptide (PP)

C. Insulin

D. Glucagon

IX. The Endocrine Tissues of Other Systems

A. Objective

- 1. Describe the functions of the hormones produced by the kidneys, heart, thymus, testes, ovaries, and adipose tissue.

B. The Intestines

C. The Kidneys

- 1. Calcitriol
- 2. Erythropoietin
 - a. erythropoietin
 - b. EPO
- 3. Renin (renin-angiotensin system or 'RAS' – *yes another one!*)
 - a. renin = angiotensinogenase = an enzyme produced by renal JGA
 - b. angiotensinogen
 - c. angiotensinogen I

- d. angiotensinogen II
- D. The Heart
 - a. natriuretic peptides
- E. The Thymus
 - a. thymus
 - b. thymosin
- F. The Gonads
 - a. interstitial cells
 - b. testosterone
 - c. sustentacular cells
 - d. inhibin
 - e. estrogens
 - f. estradiol
 - g. progestins
 - h. progesterone
- G. Adipose Tissue
 - a. leptin
 - b. resistin

X. Patterns of Hormonal Interaction

A. Objectives

1. Explain how hormones interact to produce coordinated physiological responses.
2. Identify the hormones of special importance to normal growth and discuss their roles.
3. Define the general adaptation syndrome and compare homeostatic responses with stress responses.
4. Describe the effects of hormones on behavior.
 - a. antagonistic effects
 - b. synergistic effect
 - c. permissive effect
 - d. integrative effects

B. Role of Hormones in Growth

C. The Hormonal Responses to Stress

- a. stress
 - b. general adaptation syndrome (GAS)
 - c. stress response
1. The Alarm Phase
 2. The Resistance Phase
 3. The Exhaustion Phase

D. The Effects of Hormones on Behavior

XI. Aging and Hormone Production

XII. Integration with Other Systems

A. Clinical Patterns

-EXAM 4-
