BIO-2341: ANATOMY AND PHYSIOLOGY II

Cuyahoga Community College

Viewing: BIO-2341 : Anatomy and Physiology II

Board of Trustees:
2015-05-28

Academic Term:
2015-08-24

Subject Code
BIO - Biology

Course Number:
2341

Title:
Anatomy and Physiology II

Catalog Description:
Structure and function of cells, tissues, and organs of the human cardiovascular, lymphatic/immune, respiratory, urinary, digestive, and reproductive systems. Cellular division, embryological and fetal development, classical genetics and genetic technology considered. Laboratory may include demonstrations, microscopic observations, anatomical models, and videos.

Credit Hour(s):
4

Lecture Hour(s):
3

Lab Hour(s):
3

Requisites

Prerequisite and Corequisite
BIO-2331 Anatomy and Physiology I.

I. ACADEMIC CREDIT

Academic Credit According to the Ohio Department of Higher Education, one (1) semester hour of college credit will be awarded for each lecture hour. Students will be expected to work on out-of-class assignments on a regular basis which, over the length of the course, would normally average two hours of out-of-class study for each hour of formal class activity. For laboratory hours, one (1) credit shall be awarded for a minimum of three laboratory hours in a standard week for which little or no out-of-class study is required since three hours will be in the lab (i.e. Laboratory 03 hours). Whereas, one (1) credit shall be awarded for a minimum of two laboratory hours in a standard week, if supplemented by out-of-class assignments which would normally average one hour of out-of-class study preparing for or following up the laboratory experience (i.e. Laboratory 02 hours). Credit is also awarded for other hours such as directed practice, practicum, cooperative work experience, and field experience. The number of hours required to receive credit is listed under Other Hours on the syllabus. The number of credit hours for lecture, lab and other hours are listed at the beginning of the syllabus. Make sure you can prioritize your time accordingly. Proper planning, prioritization and dedication will enhance your success in this course.

The standard expectation for an online course is that you will spend 3 hours per week for each credit hour.

II. ACCESSIBILITY STATEMENT

If you need any special course adaptations or accommodations because of a documented disability, please notify your instructor within a reasonable length of time, preferably the first week of the term with formal notice of that need (i.e. an official letter from the Student Accessibility Services (SAS) office). Accommodations will not be made retroactively.

For specific information pertaining to ADA accommodation, please contact your campus SAS office or visit online at http://www.tri-c.edu/accessprograms/. Blackboard accessibility information is available at http://access.blackboard.com.

Eastern (216) 987-2052 - Voice
III. ATTENDANCE TRACKING

Regular class attendance is expected. Tri-C is required by law to verify the enrollment of students who participate in federal Title IV student aid programs and/or who receive educational benefits through other funding sources. Eligibility for federal student financial aid is based in part on enrollment status.

Students who do not attend classes for the entire term are required to withdraw from the course(s). Additionally, students who withdraw from a course or stop attending class without officially withdrawing may be required to return all or a portion of their financial aid based on the date of last attendance. Students who do not attend the full session are responsible for withdrawing from the course(s).

Tri-C is responsible for identifying students who have not attended a course before financial aid funds can be applied to students’ accounts.

Therefore, attendance is recorded in the following ways:

- For in-person and blended-learning courses, students are required to attend the course by the 15th day of the semester (or equivalent for terms shorter than five weeks) to be considered attending. Students who have not met all attendance requirements for in-person and blended courses, as described herein, within the first two weeks or equivalent, will be considered not attending.
- For online courses, students are required to login at least two times per week and submit one assignment per week for the first two weeks of the semester, or equivalent to the 15th day of the term. Students who have not met all attendance requirements for online courses, as described herein, within the first two weeks or equivalent, will be considered not attending.

At the conclusion of the first two weeks of a semester or equivalent, instructors report any registered students who have “Never Attended” a course. Those students will be administratively withdrawn from that course. However, after the time period in the previous paragraphs, if a student stops attending a class or wants or needs to withdraw, for any reason, it is the student’s responsibility to take action to withdraw from the course. Students must complete and submit the appropriate Tri-C form by the established withdrawal deadline.

Tri-C is required to ensure that students receive financial aid only for courses that they attend and complete. Students reported for not attending at least one of their registered courses will have all financial aid funds held until confirmation of attendance in registered courses has been verified. Students who fail to complete at least one course may be required to repay all or a portion of their federal financial aid funds and may be ineligible to receive future federal financial aid awards. Students who withdraw from classes prior to completing more than 60 percent of their enrolled class time may be subject to the required federal refund policy.

If illness or emergency should necessitate a brief absence from class, students should confer with instructors upon their return. Students having problems with coursework due to a prolonged absence should confer with the instructor or a counselor.

IV. LEARNING OUTCOMES ASSESSMENT

Occasionally, in addition to submitting assignments to their instructors for evaluation and a grade, students will also be asked to submit completed assignments, called ‘artifacts,’ for assessment of course and program outcomes and the College’s Essential Learning Outcomes (ELOs). The artifacts will be submitted in Blackboard or a similar technology. The level of mastery of the outcome demonstrated by the artifact DOES NOT affect the student’s grade or academic record in any way. However, some instructors require that students submit their artifact before receiving their final grade. Some artifacts will be randomly selected for assessment, which will help determine improvements and support needed to further student success. If you have any questions, please feel free to speak with your instructor or contact the Learning Outcomes Assessment office.

V. CONCEALED CARRY STATEMENT

College policy prohibits the possession of weapons on college property by students, faculty and staff, unless specifically approved in advance as a job-related requirement (i.e., Tri-C campus police officers) or, in accordance with Ohio law, secured in a parked vehicle in a designated parking area only by an individual in possession of a valid conceal carry permit.

As a Tri-C student, your behavior on campus must comply with the student code of conduct which is available on page 29 within the Tri-C student handbook, available athttp://www.tri-c.edu/student-resources/documents/studenthandbook.pdf You must also comply with the College’s Zero Tolerance for Violence on College Property available athttp://www.tri-c.edu/policies-and-procedures/documents/3354-1-20-10-zero-tolerance-for-violence-policy.pdf

Outcomes

Course Outcome(s):

Describe and differentiate between the gross and microscopic anatomy of the organs, tissues, and cells of the cardiovascular, lymphatic/immune, respiratory, urinary, digestive and reproductive systems and relate anatomical structures to physiological functions.

Objective(s):

1. Explain the location of the heart and its major blood vessels.
2. Describe the structures of the pericardium, heart wall, and cardiac valves, and relate these structures to the functions of the heart.
3. Describe the external and internal anatomy of the chambers of the heart, including the attached blood vessels and associated valves, and relate these structures to the functions of the heart.
4. Outline the flow of blood through the heart and systemic and pulmonary circulation naming the correct chambers, valves, and vessels in correct order.
5. Describe the location of coronary arteries and veins and name their functions.
6. Relate the structural characteristics of cardiac muscle cells to their functions.
7. Compare and contrast the structure of muscular arteries, elastic arteries, arterioles, veins, venules, and capillaries and relate their structure to their functions.
8. Compare and contrast continuous, fenestrated, and sinusoidal capillaries and relate their structure to their functions.
9. Identify major arteries and veins of the upper limb, lower limb, thorax, abdomen, and brain and describe their functions.
10. Describe the structure of lymphatic capillaries, vessels, trunks, and ducts and relate their structure to their function.
11. Identify lymphatic vessels, trunks, and ducts and name their functions.
12. Describe the location, structure, and function of primary immune tissues (red bone marrow and thymus).
13. Describe the location, structure, and function of secondary immune tissues and organs including tonsils, lymph nodes, spleen, Peyer's Patches, appendix, and mucosal-associated lymphoid tissue (MALT).
14. Describe the cellular characteristics, biological functions, and life cycle of red blood cells, granulocytes (basophils, eosinophils, and neutrophils), agranulocytes (lymphocytes and monocytes), and platelets.
15. Describe the location, structure, and function of the components of the respiratory system, beginning at the nose and ending at the alveoli.
16. Describe the gross and microscopic anatomy of the lungs, including their blood and lymphatic supply.
17. Describe the location, structure, and functions of the components of the gastrointestinal tract, beginning at the mouth and ending at the anus.
18. Describe the histology of the gastrointestinal tract and name a function of each layer.
19. Describe the location, structure, and functions of the accessory organs of the digestive system, including salivary glands, liver, gallbladder, and pancreas.
20. Describe the location, structure, and function of the peritoneum.
21. Describe the location, structure, and functions of the components of the urinary system, beginning at the kidney and ending at the urethra.
22. Explain the location, structure, and functions of each region of a nephron.
23. Explain the blood supply to and from the kidney, including the microscopic structure of the glomerulus.
24. Compare and contrast the location, structures, and functions of the components of the male and female reproductive systems.
25. Discuss the structure and development of mammary glands and the endocrine system's control during lactation.

Course Outcome(s):
Describe the events of parturition and the control of lactation.

Objective(s):
1. Discuss the structure and development of mammary glands and the endocrine system's control during lactation.
2. Describe major events that occur during the three stages of parturition.
3. Explain changes in maternal and fetal hormones that occur at birth.
4. Describe respiratory, cardiovascular, and digestive changes that occur in the newborn.
5. Describe the physiological events of lactation and the role of hormones in milk production and release.

Course Outcome(s):
Discuss the principles of classical and contemporary genetics.

Objective(s):
1. Describe the central dogma of biology, the structure of DNA, RNA, and protein molecules, and the transmission of information from DNA to protein.
2. Calculate probabilities of inheritance of dominant/recessive, incomplete dominant, co-dominant, and sex-linked traits and diseases.
3. Create and interpret simple pedigrees illustrating dominant/recessive, incomplete dominant, co-dominant, and sex-linked traits and diseases.
4. Explain basic ideas of biotechnology such as gene "knock-out," genome mapping, gene sequencing, and cloning.

Course Outcome(s):
Apply fundamental knowledge of the cardiovascular system to explain homeostasis and to predict outcomes of disrupted structure and/or function in order to succeed in preparatory coursework for health professions, biomedical research, and advanced scientific study.

Objective(s):
1. List the functions of blood.
2. Explain the location of the heart and its major blood vessels.
3. Describe the structures of the pericardium, heart wall, and cardiac valves, and relate these structures to the functions of the heart.
4. Describe the external and internal anatomy of the chambers of the heart, including the attached blood vessels and associated valves, and relate these structures to the functions of the heart.
5. Outline the flow of blood through the heart and systemic and pulmonary circulation naming the correct chambers, valves, and vessels in correct order.
6. Describe the location of coronary arteries and veins and name their functions.
7. Explain the structures and functions of the cardiac conducting pathway.
8. Describe the electrical events that occur during the waves and intervals of a normal electrocardiogram (ECG).
9. Describe the pressure and volume changes that occur during a cardiac cycle.
10. Explain common heart sounds and relate their timing to ECG events and changes in pressure during a cardiac cycle.
11. Describe the composition of whole blood.
12. Relate the electrical and mechanical events of cardiac cycle to heart anatomy.
13. Define cardiac output, stroke volume, and heart rate, and describe extrinsic and intrinsic factors that affect these values.
14. Describe the functions of the circulatory system.
15. Compare and contrast the structure of muscular arteries, elastic arteries, arterioles, veins, venules, and capillaries and relate their structure to their functions.
16. Compare and contrast continuous, fenestrated, and sinusoidal capillaries and relate their structure to their functions.
17. Describe the exchange of materials in capillary beds.
18. Identify major arteries and veins of the upper limb, lower limb, thorax, abdomen, and brain and describe their functions.
19. Describe major circulatory routes through the upper limb, lower limb, thorax, abdomen, and brain.
20. Define blood pressure and describe how it is measured.
21. Define pulse and define systolic, diastolic, and pulse pressure.
22. Describe the chemical composition and biological functions of plasma.
23. Define mean arterial pressure and peripheral resistance and explain their relationships to the rate of blood flow, blood vessel diameter, blood viscosity, blood volume, and cardiac output.
24. Explain short- and long-term mechanisms that affect arterial blood pressure, including the cardiovascular center of the medulla oblongata; autonomic nervous system; baroreceptors and chemoreceptors; hormones, and autoregulation.
25. Describe the cellular characteristics, biological functions, and life cycle of red blood cells, granulocytes (basophils, eosinophils, and neutrophils), agranulocytes (lymphocytes and monocytes), and platelets.
26. Define hematopoiesis, describe the origin and production of the different formed elements, and relate factors that influence formed element production.
27. Define hemostasis and describe the mechanisms of actions for vascular spasm, platelet plug formation, and coagulation.
28. Explain hemostatic control mechanisms that limit coagulation.
29. Explain the basis of the ABO and Rh blood grouping systems, transfusion reactions, and hemolytic disease of the newborn.
30. Describe the functions of the heart.

Course Outcome(s):
Apply fundamental knowledge of the lymphatic/immune system to explain homeostasis and to predict outcomes of disrupted structure and/or function in order to succeed in preparatory coursework for health professions, biomedical research, and advanced scientific study.

Objective(s):
1. Describe the functions of the lymphatic system.
2. Describe the structure of lymphatic capillaries, vessels, trunks, and ducts and relate their structure to their function.
3. Identify lymphatic vessels, trunks, and ducts and name their functions.
4. Describe the location, structure, and function of primary immune tissues (red bone marrow and thymus).
5. Describe the location, structure, and function of secondary immune tissues and organs including tonsils, lymph nodes, spleen, Peyer's Patches, appendix, and mucosal-associates lymphoid tissue (MALT).
6. Describe mechanisms of innate immunity including physical barriers, chemical mediators, and cells.
7. Describe the inflammatory response.
8. Describe mechanisms of cell-mediated adaptive immunity, including the cells and molecules necessary.
9. Describe mechanisms of antibody-mediated (humoral) adaptive immunity, including the general structure of antibodies and the functions of the five classes of antibodies.
10. Explain the four ways to acquire adaptive immunity: natural passive, natural active, artificial passive, and artificial active adaptive immunity.

Course Outcome(s):
Apply fundamental knowledge of the respiratory system to explain homeostasis and to predict outcomes of disrupted structure and/or function in order to succeed in preparatory coursework for health professions, biomedical research, and advanced scientific study.

Objective(s):
1. Describe the functions of the respiratory system.
2. Describe the location, structure, and function of the components of the respiratory system, beginning at the nose and ending at the alveoli.
3. Describe the gross and microscopic anatomy of the lungs, including their blood and lymphatic supply.
4. Discuss the different histological components of the respiratory membrane.
5. Define ventilation, external respiration, and internal respiration and describe events involved in each process.
6. Apply gas laws to inspiration and expiration and movement of gases.
7. Define compliance, minute ventilation, and alveolar ventilation.
8. Distinguish between the different types of pulmonary air volumes and capacities and describe how they are measured.
9. Define partial pressure and explain factors that affect movement of oxygen and carbon dioxide in the body.
10. Describe mechanisms and factors that control ventilation, including the medullary respiratory center, pontine respiratory group, central chemoreceptors, peripheral chemoreceptors, and the Hering-Breuer reflex.

Course Outcome(s):
Apply fundamental knowledge of the urinary system to explain homeostasis and to predict outcomes of disrupted structure and/or function in order to succeed in preparatory coursework for health professions, biomedical research, and advanced scientific study.

Objective(s):
1. Describe functions of the urinary system.
2. Describe the location, structure, and functions of the components of the urinary system, beginning at the kidney and ending at the urethra.
3. Explain the location, structure, and functions of each region of a nephron.
4. Explain the blood supply to and from the kidney, including the microscopic structure of the glomerulus.
5. Discuss the process of urine formation, including glomerular filtration, tubular reabsorption, and tubular secretion, and relate each step to kidney anatomy.
6. Relate the structure of the kidney to its mechanisms to concentrate urine.
7. Compare how different hormones affect urine concentration and volume.
8. Define plasma clearance, glomerular filtration rate, tubular load, and tubular maximum, and relate these values to kidney function.
9. Explain the micturition reflex.
10. List the physical characteristics and normal chemical composition of urine and compare it to the normal chemical composition of plasma and filtrate.
11. Discuss the general principles of fluid and electrolyte balance, acid base balance, and homeostasis of body fluids.

Course Outcome(s):
Apply fundamental knowledge of the digestive system to explain homeostasis and to predict outcomes of disrupted structure and/or function in order to succeed in preparatory coursework for health professions, biomedical research, and advanced scientific study.

Objective(s):
1. Describe the functions of the gastrointestinal tract.
2. Describe the location, structure, and functions of the components of the gastrointestinal tract, beginning at the mouth and ending at the anus.
3. Describe the histology of the gastrointestinal tract and name a function of each layer.
4. Describe the location, structure, and functions of the accessory organs of the digestive system, including salivary glands, liver, gallbladder, and pancreas.
5. Describe the location, structure, and function of the peritoneum.
6. Compare and contrast chemical and mechanical digestion.
7. Define a nutrient, describe the functions of the six classes of nutrients, and state the enzyme(s) necessary to digest it, if applicable.
8. Describe the chemical composition and functions of the major secretions of the gastrointestinal tract and accessory organs, including saliva, bile, gastric acid, and pancreatic juices.
9. Define the various movements of the gastrointestinal tract and describe their regulation. Movements include mastication (chewing), swallowing (deglutition), peristalsis, mass movements, segmental contractions, and defecation.
10. Discuss the neurological and hormonal mechanisms that regulate activity of the gastrointestinal tract and its accessory organs.

Course Outcome(s):
Apply fundamental knowledge of the reproductive system to explain homeostasis and to predict outcomes of disrupted structure and/or function in order to succeed in preparatory coursework for health professions, biomedical research and advanced scientific study.

Objective(s):
1. Describe the functions of the male and female reproductive tracts.
2. Compare and contrast the location, structures, and functions of the components of the male and female reproductive systems.
3. Describe the processes of spermatogenesis and oogenesis.
4. Describe the endocrine system’s regulation of the anatomy and physiology of the male reproductive systems, including maturation at puberty, formation of sperm, and sex act.
5. Describe the sex hormones secreted by cells of the male and female reproductive systems, including the source of each hormone, the target cells of each hormone, and their major effects on the body.
6. Describe the events in the ovarian and uterine cycles, including how hormones from the brain control the ovarian cycle and how hormones from the ovaries control the uterine cycle.
7. List the paths of sperm production and release in the male; oocyte production and release in the female; ejaculated sperm in the female; and fertilized oocyte in the female.
8. Discuss the structure and development of mammary glands and the endocrine system's control during lactation.

Course Outcome(s):
Relate the concepts of mitotic and meiotic cell division to cellular repair, gamete formation, and tissue formation.

Objective(s):
1. Describe the processes of spermatogenesis and oogenesis.
2. Discuss the stages, events, and significance of mitosis and meiosis.
3. Describe events that occur during the stages of cell cycle and differentiate between interphase, mitosis, and cytokinesis.

Course Outcome(s):
Describe the stages in the development of the zygote, embryo, and fetus.

Objective(s):
1. Describe major events that occur from fertilization to the blastocyst stage, including the process of implantation.
2. Describe major events in formation of the placenta and three germ layers of the embryo, and describe the fate of each structure.
3. Describe location, structure, functions and fate of the placenta, umbilical cord, and extra-embryonic membranes of early development.
4. Describe major developmental events of fetal and postnatal development and name the time periods during which they occur.

Methods of Evaluation:
1. Quizzes
2. Examinations
3. Laboratory practicals
4. Reviews of scientific journal articles
5. Case history analysis
6. Online activities
7. Class participation

Course Content Outline:
1. Cardiovascular system
   a. Blood
   b. Functions
   c. Composition
   d. Hemopoiesis
   e. Formed elements
      i. Erythrocytes (red blood cells - RBC)
         1. Structure
         2. Hemoglobin
         3. Life span
         4. Numbers
         5. Laboratory values
         6. Disorders
      ii. Leukocytes (white blood cells -WBC)
         1. General characteristics
         2. Granular leukocytes
            a. Neutrophils
            b. Eosinophils
            c. Basophils
         3. Agranular leukocytes
            a. Lymphocytes
            b. Monocytes
         4. Laboratory values
         5. Disorders
      iii. Thrombocytes (platelets)
1. Structure
2. Function: clotting cascade
3. Laboratory values
4. Disorders

f. Plasma
   i. Water
   ii. Solute

g. Blood types
   i. A,B,O groups
   ii. Rh factor
   iii. Compatible/incompatible transfusions
   iv. Maternal/fetal incompatibility

h. Heart
   i. Anatomy
      1. Pericardium
      2. Walls
      3. Chambers
      4. Vessels
      5. Valves
      6. Coronary circulation
   ii. Physiology
      1. Conduction system
      2. Electrocardiogram (EKG)
      3. Cardiac cycle
         a. Atrial diastole
         b. Atrial systole
         c. Ventricular systole
         d. Ventricular diastole
         e. Timing
         f. Sounds
      4. Cardiac output
         a. Formula
         b. End diastolic volume
         c. End systolic volume
         d. Starling’s law
         e. Regulation of the cardiac cycle
         f. Autonomic nervous system (ANS)
         g. Baroreceptors
         h. Chemoreceptors
         i. Chemicals
         j. Temperature

i. Blood vessels
   i. Arteries
      1. Histology
      2. Blood supply
      3. Properties
      4. Anastomoses
      5. Types
   ii. Capillaries
      1. Structure
      2. Function
   iii. Veins
      1. Histology
      2. Function
      3. Compared to arteries

iv. Physiology of circulation
   1. Pressure values
   2. Arterial blood pressure
a. Formula
b. Factors which affect blood pressure
   i. Cardiac output
   ii. Peripheral resistance
3. Control of blood pressure
   a. Vasomotor center (medulla)
   b. Baroreceptors
   c. Chemoreceptors
   d. Chemicals
   e. Autoregulation
v. Circulatory routes
   1. Systemic circulation
   2. Pulmonary circulation
   3. Fetal circulation
2. Lymphatic system
   a. Functions
   b. Anatomy
      i. lymph
      ii. vessels
         1. Lymph capillaries
         2. Lymphatic vessels and trunks
         3. Thoracic duct (left lymphatic)
         4. Right lymphatic duct
         5. Lacteals
      iii. Lymphatic organs and tissues
         1. Primary lymphatic organs
            a. red bone marrow
            b. thymus
         2. Secondary lymphatic organs and tissues
            a. lymph nodes
            b. spleen
            c. lymphatic nodules (follicles)
3. Respiratory system
   a. Functions
   b. Respiratory organs
      i. Nose
      ii. Pharynx
      iii. Larynx
      iv. Trachea
      v. Bronchi
      vi. Lungs
         1. Pleural membrane
         2. Gross anatomy
         3. Lobules
         4. Alveolar/capillary membrane
         5. Alveolar wall
         6. Blood supply
   c. Physiology of respiration
      i. Pulmonary ventilation (breathing)
         1. Inspiration
         2. Expiration
         3. Compliance
         4. Airway resistance
         5. Modified respiratory movements
      ii. Pulmonary air volumes and capacities
         1. Air volumes
         2. Lung capacities
         3. Minute volume
      iii. Gas laws
1. Charles' law
2. Dalton's law
3. Henry's law

iv. External respiration
v. Internal respiration

vi. Transport of respiratory gases
1. Oxygen
2. Carbon dioxide (CO₂)

vii. Control of respiration
1. Nervous system
   a. Medullary rhythmicity center
      i. Inspiratory center
      ii. Expiratory center
   b. Pneumotaxic center
   c. Apneustic center
2. Factors influencing control
   a. Cortical influences
   b. Herring-Breuer reflex
   c. Chemical stimuli
   d. Blood pressure
   e. Temperature

4. Urinary system
   a. Functions
   b. Kidney
      i. Gross anatomy
         1. Cortex
         2. Medulla
         3. Pelvis
      ii. Nephron
         1. Structure
         2. Types
            a. Cortical
            b. Juxtamedullary
         3. Blood flow
         4. Juxtaglomerular apparatus
      c. Physiology of the nephron
         i. Filtration
            1. Adaptation of the corpuscle
            2. Glomerular filtration rate (GFR)
         ii. Tubular reabsorption
         iii. Tubular secretion
         iv. Regulation of urine concentration
            1. Counter current multiplier mechanism
            2. Role of anti-diuretic hormone (ADH)
         v. Renal clearance
   d. Ureters
      i. Anatomy
      ii. Physiology
   e. Urinary bladder
      i. Anatomy
         1. Trigone
         2. Histology
         3. Sphincters
      ii. Micturition
   f. Urethra
   g. Urine
      i. Normal properties
      ii. Urinalysis: tests for urinary function
a. Fluids, electrolytes, acids, and bases
   i. Fluids and electrolytes
      1. Water compartments
      2. Fluid balance
      3. Electrolytes
      4. Movement of body fluids
      5. Starling’s law of capillaries
      6. Imbalances
   ii. Acid/base balance
      1. Buffers
         a. Definition
         b. Important buffers
      2. Respiratory regulation of pH
      3. Urinary control of pH
      4. Acid/base imbalances
         a. Respiratory acidosis
         b. Respiratory alkalosis
         c. Metabolic acidosis
         d. Metabolic alkalosis

5. Digestive system
   a. Introduction
      i. Definitions
         1. Mechanical digestion
         2. Chemical digestion
         3. Digestive end products
      ii. Digestive processes
      iii. Organization
         1. Gastrointestinal (GI) tract
         2. Accessory organs
      iv. Control
         1. Nervous
         2. Hormonal
      v. Histology
         1. Tuncia mucosa
         2. Submucosa
         3. Muscularis
         4. Serosa
      vi. Peritoneum
         1. Arrangement
         2. Extensions
      vii. Sphincters
         1. Action
         2. Control
         3. Types
   b. Mouth
      i. Anatomy
      ii. Salivary glands
         1. Names and location
         2. Composition of saliva
         3. Functions of saliva
         4. Control of secretion of saliva (parasympathetic)
      iii. Teeth
         1. Anatomy
         2. Dentitions: deciduous versus permanent
      iv. Digestion in the mouth
         1. Mechanical
         2. Chemical
   c. Esophagus
      i. Anatomy
      ii. Physiology
d. Stomach
   i. Anatomy
   ii. Histology
      1. Rugae
      2. Gastric pits
      3. Muscularis
   iii. Digestion
      1. Mechanical
      2. Chemical
   iv. Regulation of gastric secretion
      1. Stimulation
      2. Inhibition
   v. Regulation of gastric emptying (peristalsis)
      1. Stimulation
      2. Inhibition
      3. Absorption

e. Pancreas (heterocrine organ)
   i. Anatomy
   ii. Histology
      1. Pancreatic islets (islets of Langerhans)
      2. Acini cells
   iii. Pancreatic juice
   iv. Control of secretion of pancreatic juice

f. Liver
   i. Anatomy
   ii. Histology
   iii. Blood supply
      1. Hepatic artery
      2. Hepatic vein
      3. Hepatic portal vein
   iv. Bile
      1. Composition
      2. Function
      3. Regulation of production
   v. Functions
      1. Metabolism
      2. Detoxification and purification
      3. Storage
      4. Bile production
      5. Phagocytosis

g. Small intestine
   i. Anatomy
   ii. Histology
      1. Modifications for absorption
      2. Lymph nodes
   iii. Intestinal juice
      1. Composition
      2. Control of secretion
   iv. Digestion
      1. Mechanical
      2. Chemical
   v. Absorption
      1. Carbohydrates and amino acids
      2. Lipids (lacteals)
         a. Micelles
         b. Chylomicrons
      3. Water and electrolytes
      4. Vitamins

h. Large intestine
i. Anatomy
ii. Histology
   1. Haustra
   2. Epiploic appendages
iii. Physiology
   1. Movement
   2. Chemical digestion - none
   3. Bacterial action
   4. Absorption
   5. Defecation

6. Immunity
   a. Types of immunity
      i. Non-specific immunity
         1. Mechanical factors
         2. Chemical factors
         3. Phagocytosis
         4. Inflammation
         5. Fever
         6. Antimicrobial substances
      ii. Specific immunity
         1. Cellular (humoral) immunity
         2. Antibody mediated immunity
   b. Cellular immunity
      i. Types of T cells
      ii. Mechanism of selecting, activating, and cloning T cells
      iii. Importance of helper T cells
   c. Antibody mediated immunity
      i. Antigens
      ii. Antibodies
         1. Heavy and light chains
         2. Variable and constant regions
         3. Classes of antibodies
         4. mechanism of selecting, activating, and cloning B cells
   d. Immunologic memory
   e. Immune disorders
      i. Autoimmune deficiency syndrome (AIDS)
      ii. Immuno-deficiency
      iii. Autoimmune diseases
      iv. Hypersensitivity (allergy)
      v. Tissue rejection
      vi. Aging and immunity

7. Types of cell division
   a. Mitosis
      i. Definitions
      ii. Reasons for mitosis
      iii. Cell cycle
         1. Interphase - phases
         2. Mitosis - phases
   b. Meiosis
      i. Definitions
      ii. Reasons for meiosis
      iii. Steps in meiosis
         1. Meiosis I
         2. Meiosis II
      iv. Spermatogenesis
      v. Oogenesis
      vi. Mitosis vs. meiosis
      vii. Spermatogenesis vs. oogenesis

8. Male reproductive system
a. Chromosomal basis of sex
b. Embryonic differentiation of male and female reproductive systems
c. Male reproductive organs
   i. Testes
      1. Structure
         a. Seminiferous tubules
         b. Interstitial cells
      2. Functions
         a. Hormone secretion
         b. Spermatogenesis
   ii. Epididymis
   iii. Vas deferens
   iv. Prostate gland
   v. Seminal vesicles
   vi. Ejaculatory duct
   vii. Bulbourethral gland
   viii. Urethra
   ix. Penis
      1. Structure
      2. Physiology
         a. Erection
         b. Ejaculation
   x. Semen
      1. contributing organs
      2. Composition
d. Male hormones
   i. Follicle stimulating hormone (FSH)
   ii. Leutinizing hormone (LH), interstitial cell stimulating hormone (ICSH)
   iii. Testosterone
   iv. Inhibin
9. Female reproductive system
   a. Female reproductive organs
      i. Ovaries
         1. Structure and location
         2. Follicle development
         3. Ovulation - mechanism
         4. Hormone secretion - estrogen and progesterone
      ii. Fallopian tubes
      iii. Uterus
         1. Structure and location
         2. Histology
         3. Cyclic changes in the endometrium
      iv. Vagina
   v. External genitalia (vulva)
   vi. Mammary glands
   vii. Menstrual cycle
   viii. Ovarian cycle
   ix. Uterine cycle
   x. Endocrine control and feedback cycles
   xi. Menstrual irregularities
   xii. Menarche
b. Menopause
   i. Hormonal changes
   ii. Anatomic changes
   iii. Physiological changes
   iv. Medical implications and therapies
c. Female hormones
   i. FSH
   ii. LH
iii. Estrogen
iv. Progesterone
v. Inhibin
d. Birth control
   i. Surgical methods
   ii. Chemical methods
   iii. Barrier methods

10. Fertilization and early embryological development
    a. Male gametes
       i. Structure
       ii. Viability
    b. Female gamete
       i. Structure
       ii. Viability
    c. Fertilization
       i. Completion of meiosis II by female gametes
       ii. Union of male and female nuclei
       iii. Zygote formation
d. Cleavage
e. Morula
f. Blastocyst
g. Implantation
h. Embryonic stage
   i. Gastrulation
   ii. Neural tube formation
   iii. Summary of changes
i. Extraembryonic membranes
   i. Yolk sac
   ii. Amnion
   iii. Allantois
j. Placenta
   i. Components
      1. Decidua
      2. Chorion
      3. Umbilical cord
   ii. Functions
      1. Organ of exchange
      2. Hormonal secretion
   iii. Placental abnormalities

11. Fetal development and parturition
    a. Gestation
    b. Fetal development - summary of changes
    c. Trimesters
d. Maternal adaptations to pregnancy
e. Pregnancy risk factors
f. Parturition and labor
   i. Physiology of labor induction (theories)
   ii. Fetal presentation
   iii. Stages of labor
g. Cardiovascular adaptations of the newborn
h. Lactation
   i. Hormonal control
      1. Milk secretion
      2. Milk letdown and ejection
   ii. Effects of breast feeding
12. Genetics
    a. Molecular genetics
       i. Structure of deoxyribonucleic acid (DNA) and ribonucleic acid (RNA)
       ii. Function of DNA and RNA
1. Replication
2. Protein synthesis

b. Classical genetics
   i. Vocabulary
   ii. Genetic problems
      1. Monohybrid cross
      2. Incomplete and codominance
      3. Sex-linked genes. karyotyping
      4. Normal karyotype
      5. Autosomal abnormalities
      6. Sex chromosome abnormalities

c. Genetic technology

Resources
