

KINGSBOROUGH COMMUNITY COLLEGE
The City University of New York

CURRICULUM TRANSMITTAL COVER PAGE

Department: _____ Date: _____

Title Of Course/Degree/Concentration/Certificate: _____

Change(s) Initiated: (Please check)

- | | |
|---|---|
| <input type="checkbox"/> Closing of Degree | <input type="checkbox"/> Change in Degree or Certificate |
| <input type="checkbox"/> Closing of Certificate | <input type="checkbox"/> Change in Degree: Adding Concentration |
| <input type="checkbox"/> New Certificate Proposal | <input type="checkbox"/> Change in Degree: Deleting Concentration |
| <input type="checkbox"/> New Degree Proposal | <input type="checkbox"/> Change in Prerequisite, Corequisite, and/or Pre/Co-requisite |
| <input type="checkbox"/> New Course | <input type="checkbox"/> Change in Course Designation |
| <input type="checkbox"/> New 82 Course (Pilot Course) | <input type="checkbox"/> Change in Course Description |
| <input type="checkbox"/> Deletion of Course(s) | <input type="checkbox"/> Change in Course Title, Number, Credits and/or Hours |
| | <input type="checkbox"/> Change in Academic Policy |
| | <input type="checkbox"/> Pathways Submission: |
| | <input type="checkbox"/> Life and Physical Science |
| | <input type="checkbox"/> Math and Quantitative Reasoning |
| | <input type="checkbox"/> A. World Cultures and Global Issues |
| | <input type="checkbox"/> B. U.S. Experience in its Diversity |
| | <input type="checkbox"/> C. Creative Expression |
| | <input type="checkbox"/> D. Individual and Society |
| | <input type="checkbox"/> E. Scientific World |
- Change in Program Learning Outcomes
- Other (please describe): _____

PLEASE ATTACH MATERIAL TO ILLUSTRATE AND EXPLAIN ALL CHANGES

DEPARTMENTAL ACTION

Action by Department and/or Departmental Committee, if required:

Date Approved: _____ Signature, Committee Chairperson: _____

If submitted Curriculum Action affects another Department, signature of the affected Department(s) is required:

Date Approved: _____ Signature, Department Chairperson: _____

Date Approved: _____ Signature, Department Chairperson: _____

I have reviewed the attached material/proposal

Signature, Department Chairperson: _____

Kingsborough Community College
The City University of New York

Modifications in Credits/Hours for an Existing Course Form

1. Course Number and Title: **BIO 1200- HUMAN ANATOMY AND PHYSIOLOGY II**

2. This Course is **currently** listed as:

4 Credits

7 Hours (include break-down of lecture, lab, or gym)

3. **Proposed** Change in Credits/Hours (Please check **ONE** appropriate box below based on credits):

It is recommended that you refer to the “College Credits Assigned for Instructional Hours” PDF at <http://kingsborough.edu/aa/Pages/forms.aspx>

Hours are hours per week in a typical 12-week semester

1-credit:	<input type="checkbox"/> 1 hour lecture
	<input type="checkbox"/> 2 hours lab/field/gym

2-credits:	<input type="checkbox"/> 2 hours lecture
	<input type="checkbox"/> 1 hour lecture, 2 hours lab/field
	<input type="checkbox"/> 4 hours lab/field

3-credits:	<input type="checkbox"/> 3 hours lecture
	<input type="checkbox"/> 2 hours lecture, 2 hours lab/field
	<input type="checkbox"/> 1 hour lecture, 4 hours lab/field
	<input type="checkbox"/> 6 hours lab/field

4-credits:	<input type="checkbox"/> 4 hours lecture
	<input type="checkbox"/> 3 hours lecture, 2 hours lab/field
	<input checked="" type="checkbox"/> 2 hours lecture, 4 hours lab/field
	<input type="checkbox"/> 1 hour lecture, 6 hours lab/field
	<input type="checkbox"/> 8 hours lab/field

More than 4-credits:	<input type="checkbox"/> Number of credits: ____ (explain mix lecture/lab below)
	____ Lecture ____ Lab
Explanation:	_____

4. Rationale/Justification for the change in credits/hours for this course:

BIO 12 is currently offered as a 4 credit course with 7 student contact hours. The current contact hours are 3 for lecture and 4 for lab, resulting in a disparity between the number of credits and contact hours (which should be 1 credit/contact hour for lecture and ½ credit/contact hour for lab). This is out of compliance with Middle States, New State Department of Education, and CUNY guidelines and is also a disservice to our students. The proposed changes will adjust the number of contact hours to 2 for lecture and 4 for lab for a total of 6 contact hours and the correct number of credits.

5. Include the **Current** Syllabus/Topical Course Outline and the **Proposed** Syllabus/Topical Course Outline for the course. **Highlight** areas that have been modified and serve as the justification for the proposed change in credits/hours for the course.

Please see attached two documents

ORIGINAL BIOLOGY 12 SYLLABUS

Human Anatomy and Physiology

(4 credits and 7 hours)

Spring 2020 / Summer 2020

SYLLABUS AND COURSE INFORMATION

COURSE CO-COORDINATORS FOR BIOLOGY 11 & 12

Dr. Sherrye Glaser	S222	368-5748
Dr. Anna Rozenboym	S132	368-6703

Required textbook and Laboratory manual:

Textbook for Biology 11 and Biology 12:

There is no separate textbook to be purchased. The ebook is supplied for this course at no cost on Blackboard.

Laboratory Manual for Biology 11 and 12:

Elaine N. Marieb, and Lori A. Smith. Human Anatomy and Physiology Laboratory Manual (Pig version, Thirteenth edition), 2018. Pearson Publishing.

Biology 12 – Human Anatomy and Physiology

Course goals for Bio 12

1. Explain the unique biochemistry of the digestive system and its relationship to energizing and providing basic structural molecules for life-sustaining activities in all body systems.
2. Recognize and explain the interrelationships within and between anatomical and physiological aspects of the digestive, cardiovascular, respiratory, lymphatic/immune, urinary and reproductive systems, and of the interrelations between these systems as they maintain homeostasis.
3. Develop the ability to analyze the relationship between structure and function within the digestive, cardiovascular, respiratory, lymphatic/immune, urinary and reproductive systems.
4. Continue to develop proficiency in the use of basic laboratory instruments including the microscope, triple beam balance, pipettes, and glassware, and basic tools for analysis of physiological signs, including relevant computer-based equipment and software.
5. Demonstrate the ability to make a connection between knowledge of anatomy and physiology and real-world situations, including healthy lifestyle decisions and homeostatic imbalances.
6. Explain fluid, electrolyte and acid-base balance in the body, the relationship to homeostasis, and discuss the interrelationship between the various body systems in maintaining this balance.
7. Explain the anatomy and physiology of the human reproduction system, and its role in the processes of gametogenesis, fertilization, embryogenesis and development.

Statement to the Students

Course Prerequisites

*Students must meet the following prerequisites: **Successful completion of Biology 11***

Course Description

Biology 12 is the second semester of a one-year course in Human Anatomy and Physiology. Both Biology 11 and Biology 12 are designed to provide students with a thorough understanding of the basic principles inherent in the study of human anatomy and physiology, and is intended for students majoring in the allied-health professions, e.g. nursing, pre-physical therapy, pre-physician, assistant, etc. The emphasis of this course will be concerned with understanding the structural and functional relationships of the major organ systems of the human body. A special effort will be made to understand the concept of homeostasis and how the individual organ systems of the body interact with each other in the maintenance of the normal functioning of the entire organism.

Biology 12 combines both lecture and laboratory experiences over a twelve week period. Each week, the class meets for a two-hour lecture session, a one-hour recitation and a three-hour laboratory session. Attendance at these sessions is mandatory, and absences will not be permitted.

There will be two writing assignments during the semester, based on a journal, or some other scientific reference suggested, and approved by your instructor. A typed one-page summary must be submitted for each of the readings. The topic for **each** of the readings is to correspond to a topic in any two of the course units. **Your instructor may substitute alternative writing assignments.**

The assignments are to be submitted type written, double-spaced on 8 1/2 x 11 typing paper, and must include a complete bibliographic reference to the source of the original article from which the abstract was prepared. **A Xerox copy of the original article must be submitted with your summary.** The grades for these assignments will be incorporated into your laboratory grade for the semester. Your instructor will provide additional information concerning this assignment.

Plagiarism is the intentional use of another's intellectual creations without attribution (giving credit to the author). This is theft of materials from another author, and is prohibited. Determination and penalty- ranging from grade reduction to course failure - is at the discretion of individual faculty members.

Required Materials

Textbook for Biology 11 and Biology 12:

No textbook must be purchased. An ebook is integrated into Blackboard at no cost.

Laboratory Manual for Biology 11 and 12:

Elaine N. Marieb, and Lori A. Smith. Human Anatomy and Physiology Laboratory Manual (**Pig version**, Thirteenth edition), 2018. Pearson Publishing.

Following materials are required for lab:

1. Dissecting Kit for laboratory dissections
2. Full length Laboratory Coat
3. Disposable Non-Latex Gloves
4. Goggles
5. No open-toed shoes in lab

Learning Objectives

You will note that each of the chapters in your textbook and the laboratory exercises in your laboratory manual begins with a list of clearly defined objectives. These objectives are not questions, rather they identify the goals that should be achieved if you have carefully read and understood the assigned readings. It is strongly suggested that you read the list of objectives prior to each assignment and then again after you have completed your readings. If you have successfully mastered the goals represented by these objectives, you can be assured that you have been successful in your readings.

At the end of this packet you will also find lists of learning objectives that refer to goals that should be mastered for each of the basic units. These objectives should serve as a guide and are not to be considered representative of all of the information that you will be required to master. One way to help ensure success on the unit examinations as well as other tests that you will be taking is to be sure that you have mastered the goals listed in these objectives.

Reading Assignments:

To obtain the maximum advantage from the required readings, you should complete the readings **before** coming to class for the week in which the assignments are given. The lecture syllabus lists the reading assignments that will prepare you for the lectures and laboratory exercises for that particular week and refers to reading assignments in your textbook. The sequence of laboratory exercises lists reading assignments in the laboratory manual. It is very important for you to be familiar with the laboratory exercises before performing the experiments or procedures described in the manual. The benefits that you will derive by completing the readings for lecture and laboratory **prior** to the week for which they are assigned are as follows:

1. You will find that it is easier to understand the lecture and laboratory material because you already have some background regarding the topics that are to be covered.
2. The reading assignments for lecture and laboratory are directly related to the topics that will be covered. If you are already familiar with these topics, you will find that you will be able to take fewer and better notes and pay more attention to what the lecturer is saying.
3. Prior reading of the assignments can help you to pinpoint areas which may be giving you some difficulty. You then can pay very special attention to what the lecturer is saying when discussing these same topics.
4. Reading the assigned material for the laboratory in both the textbook and laboratory manual **prior** to coming to laboratory will help you to get most from your laboratory experiences. Having relevant background information will significantly help you to better understand the laboratory exercises.

Grade Determination:

1. **Laboratory:** The laboratory portion of Biology 12 represents 50% of the course grade. The grade for laboratory will be based on your quiz grades, the writing assignments, and other factors that will be explained to you by your laboratory instructor.
2. **Lecture:** There will be three unit exams that will be administered during the semester (consult the syllabus as to the exact weeks). Each of the unit examinations will represent 10% of your grade. The final examination will account for 20% of your grade.

3. Summary of the grading procedures

Laboratory quizzes, summaries, class participation etc.	= 50%
First unit examination	= 10%
Second unit examination	= 10%
Third unit examination	= 10%
Final examination	= 20%
Total	= 100%

Biology 12 – Human Anatomy and Physiology

Lecture outline

(Follow modules from the ebook on Blackboard)

Week # Lecture Topics and Reading Assignments

1. Introduction to Course, Course Organization

Endocrine system

- A. Overview of the endocrine system
- B. Hormones
- C. Glands
- D. Other Endocrine organs and tissues

Lecture Reading Assignment: Module 1: Endocrine system

2. Digestive system.

- A. Overview of the digestive system
- B. Functional anatomy of the digestive system
- C. Physiology of digestion and absorption

Lecture Reading Assignment: Module 2: Digestive system

3. Cardiovascular System: Blood

- A. Overview: Blood composition and function.
- B. Blood plasma
- C. Formed elements
- D. Hemostasis
- E. Transfusion

Lecture Reading Assignment: Module 3: The Cardiovascular System: Blood

4. Cardiovascular System: Heart

- A. The pulmonary and systemic circuits
- B. Heart anatomy
- C. Cardiac muscle fibers
- D. Heart physiology

Lecture Reading Assignment: Module 4: The Cardiovascular System: Heart

5. Cardiovascular System: Blood vessels

- A. Blood Vessel structure and function
- B. Physiology of circulation

Lecture Reading Assignments: Module 5: The Cardiovascular System: Blood Vessels & Circulation

6. Lymphatic System

- A. Lymphatic system.
- B. Lymphoid cells and tissues
- C. Lymph nodes
- D. Lymphoid organs.

Lecture Reading Assignments: Module 6: The Lymphatic and Immune Systems

7. Immune System

- A. Innate Defenses
- B. Adaptive Defenses

Lecture Reading Assignments: ***Module 6: The Lymphatic and Immune Systems***

8. Respiratory System

- A. Functional anatomy of respiratory system
- B. Mechanics of breathing.
- C. Gas exchange between the blood, lungs and tissues.
- D. Transport of respiratory gases by blood
- E. Control of respiration.

Lecture reading assignment: ***Module 7: The Respiratory System***

9. Urinary System

- A. Kidney anatomy
- B. Kidney physiology: mechanisms of urine formation
- C. Urine transport, storage and elimination

Lecture reading assignment: ***Module 9: The Urinary System***

10. Fluids and Electrolytes

- A. Body fluids
- B. Water Balance
- C. Electrolyte Balance
- D. The Acid Base Balance

Lecture Reading Assignment: ***Module 10: Fluid, Electrolyte, and Acid-Base Balance***

11. Reproductive System

- A. Anatomy of the male reproductive system
- B. Physiology of the male reproductive system
- C. Anatomy of the female reproductive system
- D. Physiology of the female reproductive system

Lecture Reading Assignment: ***Module 11: The Reproductive system***

12. Pregnancy and Human Development

- A. From egg to zygote
- B. Events of embryonic development: zygote to blastocyst implantation
- C. Events of embryonic development: gastrula to fetus
- D. Events of fetal development
- E. Adjustment of the infant to extra uterine life
- F. Parturition (birth)
- G. Lactation

Lecture Reading Assignment: ***Module 12: Development and Inheritance***

Laboratory Exercises

Week #	Laboratory Topics	Lab Manual Exercise No.
1.	Introduction and lab safety	
	Endocrine system Gross and microscopic anatomy	Exercise 27.
	Digestive system	Exercise 38.
	1. Organ system overview Using models	
	2. Gross anatomy of digestive system	
	3. Microscopic anatomy	
2.	Digestive system Dissection of fetal pig digestive system and endocrine system	Exercise 38.
	Chemical digestion:	Diss. Ex. 6 p. 743 and Ex. 3 p.725 39. Activity 3 p. 604
3.	Circulatory System: Properties of blood	Exercise 29
	1. Formed elements-Wright's stain	
	2. Hematocrit	
	3. Hemoglobin-Tallquist method	
	4. Coagulation time	
4.	Circulatory System: Heart and Vessels	Exercise 30
	1. Anatomy of the Heart	
	a. organization, gross anatomy	
	b. dissection of sheep heart	
5.	Circulatory System: Cardiovascular Physiology	
	1. Conduction system of the heart	Exercise 31 Act 1B Biopac –
	Electrocardiography	
	2. Cardiac Cycle and Heart Sounds	Exercise 33
	3. Blood pressure measurements	
	4. Effect of exercise and other factors on B.P. and heart rate.	
	5. Biopac – Measuring Pulse	
6.	Circulatory System: Circulatory Pathways	
	1. Gross Anatomical Organization: Organization of blood vessels-histology	Exercise 32 Act 1 p. 473
	Circulatory pathways	
	a. cardiopulmonary	
	b. systemic pathways	
	c. hepatic portal circulation	
	d. fetal circulation	
	2. Fetal pig Dissection	Diss. Ex. 4, p. 729

- 7. Lymphatics and Immunity** **Exercise 29 Act 7 p. 436**
1. Blood typing
 2. Review. Organ identification. Histology **Exercise 35 Act. 1 and 2**
 3. Dissection: Fetal pig lymphatic system **Diss. Ex. 4 p. 729**
- 8. Respiratory System**
1. Organization, gross and microscopic anatomy **Exercise 36**
 2. Fetal pig dissection: respiratory system **Diss. Ex. 5 p. 739**
 3. Mechanics of breathing, respiratory volumes, respiratory sounds **Exercise 37 Act. 5 Biopac p. 563**
 4. Biopac computer exercise.
- 9. Urinary System** **Exercise 40**
1. Organization, gross and microscopic anatomy,
 2. Diffusion and osmosis review
 3. Dissection; Sheep kidney
 4. Dissection: Fetal pig urinary system **Diss. ex. 7 p. 749**
- 10. Urinary System** **Exercise 41**
1. Composition of urine/Urineanalysis
 2. Analysis of components of normal and abnormal urine
 3. Acids, Bases and Buffers **Exercise 37(act. 7-8)**
- 11. Reproduction**
1. Organization, gross and microscopic anatomy of male and female reproductive systems **Exercise 42**
 2. Fetal pig dissection **Diss. ex. 8 p. 753**
 3. Mitosis **Exercise 4 pp. 44 -48**
 4. Meiosis, gametogenesis **Exercise 43**
 5. Ovarian cycle
 6. Principles of heredity **Exercise 45**
- 12. Embryonic Development** **Exercise 44**
1. Sea Urchin embryology
 2. Stages of human development
 3. Fetal structures
 4. Placental structures

LEARNING OBJECTIVES

Note to the Student

On page 2 of your course outline you will find a brief discussion of the importance of mastering the learning objectives for Biology 12. The list of learning objectives that follows is intended to provide you with a guide as to the minimum amount of basic material that you are expected to master upon completion of each unit of the course. Your individual course instructor may wish to modify this list by either deleting or adding additional objectives at his/her discretion.

Each objective, whether from the textbook, laboratory manual or the list below, represents a statement of a knowledge, technique, or skill, that you are expected to acquire from your assigned readings, laboratory experiences, lectures or other learning activities. The mastery of these learning objectives is directly related to your success in the course. Success can be obtained only if you take the **time and effort** to test yourself as a means of determining whether or not you have met the required objectives. You may find it necessary to read a paragraph or section in the assigned readings a number of times before you are satisfied that you have clearly understood what you have read. This is to be expected in a science course, and you must not allow yourself to become easily frustrated.

A. Endocrine System

1. Compare and contrast the general functions and mechanisms of action of the endocrine system and the nervous system.
2. Distinguish between exocrine and endocrine glands.
3. List and describe the endocrine glands
4. Explain the relationship between the pituitary gland and the hypothalamus.
5. Describe the chemical classes of hormones, and provide an example for each.
6. Differentiate between direct and indirect mechanisms of hormone action.
7. List and describe the target action of hormones from each of the following endocrine glands: the anterior pituitary, the posterior pituitary, the pineal, the thymus, the thyroid, the parathyroid, the pancreas, the adrenals and the gonads.
8. Describe how hormone secretions are regulated by negative feedback processes. Describe a specific example.

B. Digestive system

1. State the general function of the digestive system
2. List in order the organs of the alimentary canal
3. Describe the types of movements that occur in the digestive system
3. Distinguish between physical and chemical digestion
4. Describe the anatomy of the mouth and throat
5. Explain the dental formula and differentiate between deciduous and permanent teeth
6. Describe the composition and functions of saliva

7. Describe the swallowing reflex, including the esophagus
8. List the regions of the digestive tract and the accessory organs of the digestive system
8. Describe the gross and micro anatomy of the stomach.
9. Describe the composition of gastric juice and name the cell types responsible for secreting each component
10. Describe the phases of gastric function and how gastric activity is regulated
11. Describe the microscopic and gross anatomy of the small intestine
12. Describe the gross and microscopic anatomy of the liver, gallbladder, bile duct system and pancreas
13. Describe the digestive system secretions and functions of the liver, gallbladder and pancreas
14. Describe the chemical digestive processes of the small intestine
15. Describe the process of absorption in the small intestine
16. Describe the gross and microscopic anatomy of the large intestine
17. List the major functions of the large intestine, and describe the regulation of defecation
18. State the physiological significance of the intestinal bacteria
19. Describe the neural and hormonal regulation of digestion

C. Cardiovascular System

Blood

1. List and define the functions and general characteristics of blood
2. List, draw and describe the functions of the formed elements of blood and know what percentage of blood each formed element constitutes
3. Define the role of plasma, what percentage of whole blood plasma represents, and describe the functions of the different solutes found in plasma
4. Diagram and describe hematopoiesis (erythropoiesis, leukopoiesis, and platelet formation)
5. Describe factors that influence hematopoiesis
6. Describe what useful information can be obtained from a differential blood count
7. Describe the life cycle of a red blood cell and the fate of bilirubin
8. Explain the homeostatic imbalances related to blood count (polycythemia vera, anemia, leukemia, leukopenia)
9. Describe the chemical composition of hemoglobin and its function in the red blood cell
10. Describe A,B,O, and Rh typing. Define and explain the following terms as they relate to blood typing: antigen, antibody, agglutinin and agglutinogens
11. Define hemostasis; describe the intrinsic and extrinsic pathway
12. Define hemophilia, hematoma, thrombosis, embolus and infarction

13. Explain the role of blood as a diagnostic tool

Heart

1. Given a model or diagram of the human heart, or a dissected sheep heart, identify all of the major chambers, valves, blood vessels and other anatomical structures
2. Briefly describe the functions of each of the structures listed above
3. Trace a blood cell from the inferior vena cava to the aorta. Be able to list every vessel, chamber and valve it encounters
4. Describe the cardiac conduction system
5. Define systole, diastole
6. Describe the physical events of the cardiac cycle
7. Relate the cardiac conduction system to the filling and contraction of the heart chambers, and the heart sounds
8. Define cardiac output, stroke volume. Describe factors that modify cardiac output
9. Explain what determines the heart rate. Describe how it can be altered by the autonomic nervous system

Blood vessels

1. Compare the structure of arteries, arterioles, capillaries and veins
2. Define blood pressure
3. Explain the difference between systolic pressure and diastolic pressure
4. Explain what a pulse is
5. Explain blood pressure as it relates to blood viscosity, and the length and radius of blood vessels
6. Briefly describe the procedure used to measure a patient's blood pressure
7. Explain how blood pressure changes as the distance from the heart increases. Relate this to the mechanisms that aid in return of venous blood to the heart
8. Describe the three mechanisms that maintain homeostasis of blood pressure
9. Describe the factors involved in the movements of fluids across the capillaries
10. List and explain three main factors contributing to edema
11. Differentiate between atherosclerosis and arteriosclerosis and describe the role each plays in heart and vascular disease
12. Define thrombus, embolus, and aneurysm

D. Lymphatics and Immunity

1. Describe the distribution and functions of lymphatic system
2. Name the components of the lymphatic system and state the function of each
3. Compare and contrast the anatomy of lymphatic vessels with that of blood vessels
4. Describe the composition of lymph fluid as compared to blood

5. Relate the distribution of lymph nodes to lymphatic function
6. State the role of lacteals in the process of absorption in the digestive system
7. Describe the role of respiratory forces in the movement of lymph fluid
8. Define the functions of the immune system
9. Describe the function of the spleen, thymus, tonsils and lymph nodes
11. Differentiate between specific and non-specific resistance
12. Describe the mechanisms of the following: mechanical barriers, inflammation, cells, fever, complement protein and interferon
13. Review the terms: antigen, antibody, agglutinogens
14. Describe the development and maturation of T lymphocytes compared to B lymphocytes
15. State the function of antigen presenting cells (APCs) and MHC proteins
16. Define cell mediated and humoral immunity
17. Compare and contrast the role of the complement system in cell mediated and humoral immunity
18. Compare primary and secondary immune system responses
19. Compare passive and active immunity
20. Define and provide an example of autoimmunity
21. Define the following: autografts, isografts, heterografts, xenografts

E. Respiratory System

1. Distinguish between ventilation, gas exchange and cellular respiration
2. Trace the sequence of anatomical structures from the nose to the pulmonary alveoli
3. Explain the following terms: upper respiratory tract, lower respiratory tract
4. Relate the function of any portion of the respiratory tract to its gross and microscopic anatomy
5. Define the gas laws and relate them to respiratory physiology: Boyle's Law, Charles Law, Dalton's Law, and Henry's Law
6. Explain how pressure gradients cause air to flow into and out of the lungs
7. Explain how the respiratory muscles produce the above mentioned pressure gradients
8. Explain the relevance of pulmonary compliance and elasticity to ventilation
9. Explain why the alveoli do not collapse when one exhales
10. Define the following measurements of ventilation: respiratory volumes, tidal volume, inspiratory reserve volume, expiratory reserve volume, and residual volume
11. Explain the following respiratory capacities and how they are obtained: vital capacity, inspiratory capacity, functional residual capacity, total lung capacity, forced expiratory volume and peak flow

12. Explain how the brain stem regulates respiration
13. Contrast the neural pathways for voluntary and autonomic control of the respiratory muscles
14. Describe the chemical stimuli and the peripheral chemoreceptors that modify the respiratory rhythm
15. Define partial pressure and discuss its relationship to air
16. Contrast the composition of inspired and expired air
17. Describe how partial pressure affects gas transport across a respiratory membrane
18. Describe the mechanism of transporting CO₂ and O₂
19. Describe the factors that govern gas exchange in the lungs and systemic capillaries
20. Relate the Bohr and Haldane Effects to gas exchange in the lungs and tissues
21. Explain how gas exchange is adjusted to the metabolic needs of different tissues

F. Urinary System

1. Name and state the anatomical location of the organs of the urinary system
2. List the functions of the kidneys (including non-urinary system functions)
3. Name the major metabolic nitrogenous wastes and identify their sources
4. Define excretion and identify the systems that excrete wastes
5. Name and locate the microscopic and macroscopic structures of the kidney
6. Describe the microscopic structure of a nephron
7. Trace the flow of fluid/ blood through the renal tubules and the kidney
8. Describe the glomerular filtration membrane and how it excludes blood cells and proteins from the filtrate
9. Describe the process of filtration and relate it to net filtration pressure
10. Describe how the renal tubules reabsorb useful solutes from the glomerular filtrate and return them to the blood
11. Describe the nerve supply to the kidney
12. Describe how the nervous system, hormones, and the kidney regulate glomerular filtration
13. Describe how the nephron regulates water excretion
14. Explain the role of aldosterone and of atrial natriuretic factor in sodium and water balance
15. Describe the mechanism that maintains the medullary osmotic gradient
16. Describe the composition and properties of urine
17. Describe the functional anatomy of ureters, urinary bladder, and male and female urethra
18. Explain micturition reflex and describe how it controls the voiding of urine

G. Fluids and Electrolytes

1. List the water content of males, females, and infants, and the factors contributing to differences in water content among these groups
2. Name the fluid compartments and sub-compartments of the body, and the relative amount of body fluid in each
3. Differentiate between electrolytes and nonelectrolytes, and discuss the relative osmotic power of each
4. Compare the relative solute concentration of specific solutes in the intracellular and extracellular compartments
5. Describe the mechanisms of fluid movement between fluid compartments
6. Identify the routes of water intake and output to and from the body
7. Explain the thirst mechanism and mechanism of cessation of thirst
8. Indicate how shifts in water output by the body occur, and how the body compensates for such shifts
9. Discuss the activity of antidiuretic hormone (ADH)
10. Describe imbalances of fluid homeostasis and their consequences
11. Explain how salt is balanced in the body
12. Describe how sodium regulates fluid and electrolyte balance
13. Identify the mechanisms regulating sodium balance of the body fluids
14. Examine the mechanisms regulating potassium, calcium, and phosphate balance of the body fluids
15. Discuss the mechanism regulating anions in the body fluids

H. pH and Acid Base Balance

1. Explain the pH concept and include the numerical meaning of a change in pH of [one, two, one-half, and one-tenth] pH unit
2. List the approximate pH range of the following naturally occurring substances: intracellular fluid, arterial blood, urine, saliva, gastric juice, and sweat
3. Define "electrolyte" and list the major ones, including the hydrogen and hydroxyl ions, by name and ionic symbol found in human body fluids
4. Explain the functions of the hydrogen ion concentrations found in the skin, stomach, blood, urine, and mitochondria
5. Indicate the acid produced from normal metabolism occurring in each of the following body regions: aerobic respiration of cardiocytes, anaerobic respiration of erythrocytes, hydrolysis of phospholipids, degradation of sulfur amino acids, and the normal functioning of the stomach's parietal cells
6. Explain why the body naturally tends to enter a state of acidosis during the course of any time period
7. Define the following terms in the context of the chemical structure of a buffering system:

strong acid, weak acid, strong base, weak base, and salt

8. Explain why the body requires the continuous action of chemical buffering systems
9. Explain the relative strength, location and effectiveness of each of the following buffering systems: hemoglobin buffer, protein buffer, phosphate buffer, and the protein buffer
10. Utilize the components of each of the four major chemical buffering systems to show how they would work to neutralize excess acid or base
11. Describe the interaction of the bicarbonate buffer with the respiratory and urinary systems to help regulate the body's acid-base balance.
12. Indicate the normal range of values for the pCO₂ (partial pressure of carbon dioxide) and the bicarbonate ion concentration (HCO₃⁻, also called alkali reserve) in maintaining an arterial pH range of 7.35-7.45.
13. Explain the relationship between each of the following pairs of terms: chronic obstructive pulmonary disease (COPD) and respiratory acidosis, hyperventilation and respiratory alkalosis, diarrhea or uncontrolled diabetes mellitus and metabolic acidosis, and the ingestion of alkaline drugs for stomach ulcer and metabolic alkalosis.
14. For each acid-base disturbance in objective 13, indicate the body's compensations to maintain the arterial pH in the normal range of 7.35-7.45

I. Reproductive System

1. Explain the structure and function of the testes
2. Describe the structure and function of the penis
3. List and discuss the location, structure, and function of the male accessory ducts and glands
4. Define the male sexual response
5. Describe the process of spermatogenesis
6. Identify the hormonal regulation of the male reproductive function
7. Name male and female secondary sex characteristics and explain the role of hormones in their formation
8. Indicate the structure and function of the ovaries
9. Describe the structure, function, and location of the female reproductive duct system
10. Identify the structures of the female external genitalia
11. Discuss the mammary glands and breast cancer
12. Explain the process of oogenesis
13. Discuss the ovarian cycle including its three phases and their major events
14. Indicate the hormonal interactions of the ovarian cycle
15. Describe the uterine cycle
16. Identify the effects of estrogen and progesterone on the development of structures and physiological processes other than the ovarian cycle

17. Identify what determines sex
18. Discuss the process of sexual differentiation as it occurs in the developing embryo
19. Explain the descent of the gonads
20. Define and discuss puberty and menopause.

J. Pregnancy and Human Development

1. Define fertilization and discuss the limits of timing on its occurrence
2. Describe the process of sperm capacitation and its importance
3. Explain the need for blocks to polyspermy and how this is accomplished
4. Identify cleavage divisions, and the cellular and embryonic products of cleavage divisions
5. Discuss the events of implantation, and the role of human chorionic gonadotropin (hCG)
6. Explain the process of placentation
7. Describe the development and function of the embryonic membranes
8. Define gastrulation and list the layers formed
9. Identify organogenesis, and discuss the specialization that occurs within each germ layer
10. Explain the development of the specialized structures of the fetal circulation, and the function of each
11. Discuss the events of fetal development
12. Describe the anatomical, metabolic, and physiological changes experienced by the mother during pregnancy
13. Explain the triggers that initiate labor and discuss the three stages of labor
14. List the factors considered in the Apgar score, and describe how the score is used to assess the newborn
15. Describe the changes that occur to specialized fetal circulatory structures after birth
16. Define lactation, and describe the mechanism of hormones and neural stimuli involved

UPDATED BIOLOGY 12 SYLLABUS

Human Anatomy and Physiology

(4 credits and 6 hours)

Spring 2020 / Summer 2020

SYLLABUS AND COURSE INFORMATION

COURSE CO-COORDINATORS FOR BIOLOGY 11 & 12

Dr. Sherrye Glaser	S222	368-5748
Dr. Anna Rozenboym	S132	368-6703

Required textbook and Laboratory manual:

Textbook for Biology 11 and Biology 12:

There is no separate textbook to be purchased. The ebook is supplied for this course at no cost on Blackboard.

Laboratory Manual for Biology 11 and 12:

Elaine N. Marieb, and Lori A. Smith. Human Anatomy and Physiology Laboratory Manual (Pig version, Thirteenth edition), 2018. Pearson Publishing.

Biology 12 – Human Anatomy and Physiology

Course goals for Bio 12

1. Explain the unique biochemistry of the digestive system and its relationship to energizing and providing basic structural molecules for life-sustaining activities in all body systems.
2. Recognize and explain the interrelationships within and between anatomical and physiological aspects of the digestive, cardiovascular, respiratory, lymphatic/immune, urinary and reproductive systems, and of the interrelations between these systems as they maintain homeostasis.
3. Develop the ability to analyze the relationship between structure and function within the digestive, cardiovascular, respiratory, lymphatic/immune, urinary and reproductive systems.
4. Continue to develop proficiency in the use of basic laboratory instruments including the microscope, triple beam balance, pipettes, and glassware, and basic tools for analysis of physiological signs, including relevant computer-based equipment and software.
5. Demonstrate the ability to make a connection between knowledge of anatomy and physiology and real-world situations, including healthy lifestyle decisions and homeostatic imbalances.
6. Explain fluid, electrolyte and acid-base balance in the body, the relationship to homeostasis, and discuss the interrelationship between the various body systems in maintaining this balance.
7. Explain the anatomy and physiology of the human reproduction system, and its role in the processes of gametogenesis, fertilization, embryogenesis and development.

Statement to the Students

Course Prerequisites

*Students must meet the following prerequisites: **Successful completion of Biology 11***

Course Description

Biology 12 is the second semester of a one-year course in Human Anatomy and Physiology. Both Biology 11 and Biology 12 are designed to provide students with a thorough understanding of the basic principles inherent in the study of human anatomy and physiology, and is intended for students majoring in the allied-health professions, e.g. nursing, pre-physical therapy, pre-physician, assistant, etc. The emphasis of this course will be concerned with understanding the structural and functional relationships of the major organ systems of the human body. A special effort will be made to understand the concept of homeostasis and how the individual organ systems of the body interact with each other in the maintenance of the normal functioning of the entire organism.

Biology 12 combines both lecture and laboratory experiences over a twelve week period. Each week, the class meets **for a two-hour lecture session, and a four-hour laboratory session**. Attendance at these sessions is mandatory, and absences will not be permitted.

There will be two writing assignments during the semester, based on a journal, or some other scientific reference suggested, and approved by your instructor. A typed one-page summary must be submitted for each of the readings. The topic for **each** of the readings is to correspond to a topic in any two of the course units. **Your instructor may substitute alternative writing assignments.**

The assignments are to be submitted type written, double-spaced on 8 1/2 x 11 typing paper, and must include a complete bibliographic reference to the source of the original article from which the abstract was prepared. **A Xerox copy of the original article must be submitted with your summary.** The grades for these assignments will be incorporated into your laboratory grade for the semester. Your instructor will provide additional information concerning this assignment.

Plagiarism is the intentional use of another's intellectual creations without attribution (giving credit to the author). This is theft of materials from another author, and is prohibited. Determination and penalty- ranging from grade reduction to course failure - is at the discretion of individual faculty members.

Required Materials

Textbook for Biology 11 and Biology 12:

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Laboratory Manual for Biology 11 and 12:

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Following materials are required for lab:

1. Dissecting Kit for laboratory dissections
2. Full length Laboratory Coat
3. Disposable Non-Latex Gloves
4. Goggles
5. No open-toed shoes in lab

Learning Objectives

You will note that each of the chapters in your textbook and the laboratory exercises in your laboratory manual begins with a list of clearly defined objectives. These objectives are not questions, rather they identify the goals that should be achieved if you have carefully read and understood the assigned readings. It is strongly suggested that you read the list of objectives prior to each assignment and then again after you have completed your readings. If you have successfully mastered the goals represented by these objectives, you can be assured that you have been successful in your readings.

At the end of this packet you will also find lists of learning objectives that refer to goals that should be mastered for each of the basic units. These objectives should serve as a guide and are not to be considered representative of all of the information that you will be required to master. One way to help ensure success on the unit examinations as well as other tests that you will be taking is to be sure that you have mastered the goals listed in these objectives.

Reading Assignments:

To obtain the maximum advantage from the required readings, you should complete the readings **before** coming to class for the week in which the assignments are given. The lecture syllabus lists the reading assignments that will prepare you for the lectures and laboratory exercises for that particular week and refers to reading assignments in your textbook. The sequence of laboratory exercises lists reading assignments in the laboratory manual. It is very important for you to be familiar with the laboratory exercises before performing the experiments or procedures described in the manual. The benefits that you will derive by completing the readings for lecture and laboratory **prior** to the week for which they are assigned are as follows:

1. You will find that it is easier to understand the lecture and laboratory material because you already have some background regarding the topics that are to be covered.
2. The reading assignments for lecture and laboratory are directly related to the topics that will be covered. If you are already familiar with these topics, you will find that you will be able to take fewer and better notes and pay more attention to what the lecturer is saying.
3. Prior reading of the assignments can help you to pinpoint areas which may be giving you some difficulty. You then can pay very special attention to what the lecturer is saying when discussing these same topics.
4. Reading the assigned material for the laboratory in both the textbook and laboratory manual **prior** to coming to laboratory will help you to get most from your laboratory experiences. Having relevant background information will significantly help you to better understand the laboratory exercises.

Grade Determination:

1. **Laboratory:** The laboratory portion of Biology 12 represents 50% of the course grade. The grade for laboratory will be based on your quiz grades, the writing assignments, and other factors that will be explained to you by your laboratory instructor.
2. **Lecture:** There will be three unit exams that will be administered during the semester (consult the syllabus as to the exact weeks). Each of the unit examinations will represent 10% of your grade. The final examination will account for 20% of your grade.

3. Summary of the grading procedures

Laboratory quizzes, summaries, class participation etc.	= 50%
First unit examination	= 10%
Second unit examination	= 10%
Third unit examination	= 10%
Final examination	= 20%
Total	= 100%

Biology 12 – Human Anatomy and Physiology

Lecture outline

(Follow modules from the ebook on Blackboard)

Week # Lecture Topics and Reading Assignments

1. Introduction to Course, Course Organization

Endocrine system

- A. Overview of the endocrine system
- B. Hormones
- C. Glands
- D. Other Endocrine organs and tissues

Lecture Reading Assignment: Module 1: Endocrine system

2. Digestive system.

- A. Overview of the digestive system
- B. Functional anatomy of the digestive system
- C. Physiology of digestion and absorption

Lecture Reading Assignment: Module 2: Digestive system

3. Cardiovascular System: Blood

- A. Overview: Blood composition and function.
- B. Blood plasma
- C. Formed elements
- D. Hemostasis
- E. Transfusion

Lecture Reading Assignment: Module 3: The Cardiovascular System: Blood

4. Cardiovascular System: Heart

- A. The pulmonary and systemic circuits
- B. Heart anatomy
- C. Cardiac muscle fibers
- D. Heart physiology

Lecture Reading Assignment: Module 4: The Cardiovascular System: Heart

5. Cardiovascular System: Blood vessels

- A. Blood Vessel structure and function
- B. Physiology of circulation

Lecture Reading Assignments: Module 5: The Cardiovascular System: Blood Vessels & Circulation

6. Lymphatic System

- A. Lymphatic system.
- B. Lymphoid cells and tissues
- C. Lymph nodes
- D. Lymphoid organs.

Lecture Reading Assignments: Module 6: The Lymphatic and Immune Systems

7. Immune System

- A. Innate Defenses
- B. Adaptive Defenses

Lecture Reading Assignments: *Module 6: The Lymphatic and Immune Systems*

8. Respiratory System

- A. Functional anatomy of respiratory system
- B. Mechanics of breathing.
- C. Gas exchange between the blood, lungs and tissues.
- D. Transport of respiratory gases by blood
- E. Control of respiration.

Lecture reading assignment: *Module 7: The Respiratory System*

9. Urinary System

- A. Kidney anatomy
- B. Kidney physiology: mechanisms of urine formation
- C. Urine transport, storage and elimination

Lecture reading assignment: *Module 9: The Urinary System*

10. Fluids and Electrolytes

- A. Body fluids
- B. Water Balance
- C. Electrolyte Balance
- D. The Acid Base Balance

Lecture Reading Assignment: *Module 10: Fluid, Electrolyte, and Acid-Base Balance*

11. Reproductive System

- A. Anatomy of the male reproductive system
- B. Physiology of the male reproductive system
- C. Anatomy of the female reproductive system
- D. Physiology of the female reproductive system

Lecture Reading Assignment: *Module 11: The Reproductive system*

12. Pregnancy and Human Development

- A. From egg to zygote
- B. Events of embryonic development: zygote to blastocyst implantation
- C. Events of embryonic development: gastrula to fetus
- D. Events of fetal development
- E. Adjustment of the infant to extra uterine life
- F. Parturition (birth)
- G. Lactation

Lecture Reading Assignment: *Module 12: Development and Inheritance*

Laboratory Exercises

Week #	Laboratory Topics	Lab Manual Exercise No.
1.	Introduction and lab safety	
	Endocrine system Gross and microscopic anatomy	Exercise 27.
	Digestive system 1. Organ system overview Using models 2. Gross anatomy of digestive system 3. Microscopic anatomy	Exercise 38.
2.	Digestive system Dissection of fetal pig digestive system and endocrine system	Exercise 38.
	Chemical digestion:	Diss. Ex. 6 p. 743 and Ex. 3 p.725 39. Activity 3 p. 604
3.	Circulatory System: Properties of blood	Exercise 29
	1. Formed elements-Wright's stain	
	2. Hematocrit	
	3. Hemoglobin-Tallquist method	
4. Coagulation time		
4.	Circulatory System: Heart and Vessels	Exercise 30
	1. Anatomy of the Heart a. organization, gross anatomy b. dissection of sheep heart	
5.	Circulatory System: Cardiovascular Physiology	
	1. Conduction system of the heart	Exercise 31 Act 1B Biopac –
	Electrocardiography	
	2. Cardiac Cycle and Heart Sounds	Exercise 33
	3. Blood pressure measurements	
4. Effect of exercise and other factors on B.P. and heart rate.		
5. Biopac – Measuring Pulse		
6.	Circulatory System: Circulatory Pathways	
	1. Gross Anatomical Organization: Organization of blood vessels-histology	Exercise 32 Act 1 p. 473
	Circulatory pathways	
	a. cardiopulmonary	
	b. systemic pathways	
	c. hepatic portal circulation	
	d. fetal circulation	
2.	Fetal pig Dissection	Diss. Ex. 4, p. 729

- 7. Lymphatics and Immunity** **Exercise 29 Act 7 p. 436**
1. Blood typing
 2. Review. Organ identification. Histology **Exercise 35 Act. 1 and 2**
 3. Dissection: Fetal pig lymphatic system **Diss. Ex. 4 p. 729**
- 8. Respiratory System**
1. Organization, gross and microscopic anatomy **Exercise 36**
 2. Fetal pig dissection: respiratory system **Diss. Ex. 5 p. 739**
 3. Mechanics of breathing, respiratory volumes, respiratory sounds **Exercise 37 Act. 5 Biopac p. 563**
 4. Biopac computer exercise.
- 9. Urinary System** **Exercise 40**
1. Organization, gross and microscopic anatomy,
 2. Diffusion and osmosis review
 3. Dissection; Sheep kidney
 4. Dissection: Fetal pig urinary system **Diss. ex. 7 p. 749**
- 10. Urinary System** **Exercise 41**
1. Composition of urine/Urineanalysis
 2. Analysis of components of normal and abnormal urine
 3. Acids, Bases and Buffers **Exercise 37(act. 7-8)**
- 11. Reproduction**
1. Organization, gross and microscopic anatomy of male and female reproductive systems **Exercise 42**
 2. Fetal pig dissection **Diss. ex. 8 p. 753**
 3. Mitosis **Exercise 4 pp. 44 -48**
 4. Meiosis, gametogenesis **Exercise 43**
 5. Ovarian cycle
 6. Principles of heredity **Exercise 45**
- 12. Embryonic Development** **Exercise 44**
1. Sea Urchin embryology
 2. Stages of human development
 3. Fetal structures
 4. Placental structures

LEARNING OBJECTIVES

Note to the Student

On page 2 of your course outline you will find a brief discussion of the importance of mastering the learning objectives for Biology 12. The list of learning objectives that follows is intended to provide you with a guide as to the minimum amount of basic material that you are expected to master upon completion of each unit of the course. Your individual course instructor may wish to modify this list by either deleting or adding additional objectives at his/her discretion.

Each objective, whether from the textbook, laboratory manual or the list below, represents a statement of a knowledge, technique, or skill, that you are expected to acquire from your assigned readings, laboratory experiences, lectures or other learning activities. The mastery of these learning objectives is directly related to your success in the course. Success can be obtained only if you take the **time and effort** to test yourself as a means of determining whether or not you have met the required objectives. You may find it necessary to read a paragraph or section in the assigned readings a number of times before you are satisfied that you have clearly understood what you have read. This is to be expected in a science course, and you must not allow yourself to become easily frustrated.

A. Endocrine System

1. Compare and contrast the general functions and mechanisms of action of the endocrine system and the nervous system.
2. Distinguish between exocrine and endocrine glands.
3. List and describe the endocrine glands
4. Explain the relationship between the pituitary gland and the hypothalamus.
5. Describe the chemical classes of hormones, and provide an example for each.
6. Differentiate between direct and indirect mechanisms of hormone action.
7. List and describe the target action of hormones from each of the following endocrine glands: the anterior pituitary, the posterior pituitary, the pineal, the thymus, the thyroid, the parathyroid, the pancreas, the adrenals and the gonads.
8. Describe how hormone secretions are regulated by negative feedback processes. Describe a specific example.

B. Digestive system

1. State the general function of the digestive system
2. List in order the organs of the alimentary canal
3. Describe the types of movements that occur in the digestive system
3. Distinguish between physical and chemical digestion
4. Describe the anatomy of the mouth and throat
5. Explain the dental formula and differentiate between deciduous and permanent teeth
6. Describe the composition and functions of saliva

7. Describe the swallowing reflex, including the esophagus
8. List the regions of the digestive tract and the accessory organs of the digestive system
8. Describe the gross and micro anatomy of the stomach.
9. Describe the composition of gastric juice and name the cell types responsible for secreting each component
10. Describe the phases of gastric function and how gastric activity is regulated
11. Describe the microscopic and gross anatomy of the small intestine
12. Describe the gross and microscopic anatomy of the liver, gallbladder, bile duct system and pancreas
13. Describe the digestive system secretions and functions of the liver, gallbladder and pancreas
14. Describe the chemical digestive processes of the small intestine
15. Describe the process of absorption in the small intestine
16. Describe the gross and microscopic anatomy of the large intestine
17. List the major functions of the large intestine, and describe the regulation of defecation
18. State the physiological significance of the intestinal bacteria
19. Describe the neural and hormonal regulation of digestion

C. Cardiovascular System

Blood

1. List and define the functions and general characteristics of blood
2. List, draw and describe the functions of the formed elements of blood and know what percentage of blood each formed element constitutes
3. Define the role of plasma, what percentage of whole blood plasma represents, and describe the functions of the different solutes found in plasma
4. Diagram and describe hematopoiesis (erythropoiesis, leukopoiesis, and platelet formation)
5. Describe factors that influence hematopoiesis
6. Describe what useful information can be obtained from a differential blood count
7. Describe the life cycle of a red blood cell and the fate of bilirubin
8. Explain the homeostatic imbalances related to blood count (polycythemia vera, anemia, leukemia, leukopenia)
9. Describe the chemical composition of hemoglobin and its function in the red blood cell
10. Describe A,B,O, and Rh typing. Define and explain the following terms as they relate to blood typing: antigen, antibody, agglutinin and agglutinogens
11. Define hemostasis; describe the intrinsic and extrinsic pathway
12. Define hemophilia, hematoma, thrombosis, embolus and infarction

13. Explain the role of blood as a diagnostic tool

Heart

1. Given a model or diagram of the human heart, or a dissected sheep heart, identify all of the major chambers, valves, blood vessels and other anatomical structures
2. Briefly describe the functions of each of the structures listed above
3. Trace a blood cell from the inferior vena cava to the aorta. Be able to list every vessel, chamber and valve it encounters
4. Describe the cardiac conduction system
5. Define systole, diastole
6. Describe the physical events of the cardiac cycle
7. Relate the cardiac conduction system to the filling and contraction of the heart chambers, and the heart sounds
8. Define cardiac output, stroke volume. Describe factors that modify cardiac output
9. Explain what determines the heart rate. Describe how it can be altered by the autonomic nervous system

Blood vessels

1. Compare the structure of arteries, arterioles, capillaries and veins
2. Define blood pressure
3. Explain the difference between systolic pressure and diastolic pressure
4. Explain what a pulse is
5. Explain blood pressure as it relates to blood viscosity, and the length and radius of blood vessels
6. Briefly describe the procedure used to measure a patient's blood pressure
7. Explain how blood pressure changes as the distance from the heart increases. Relate this to the mechanisms that aid in return of venous blood to the heart
8. Describe the three mechanisms that maintain homeostasis of blood pressure
9. Describe the factors involved in the movements of fluids across the capillaries
10. List and explain three main factors contributing to edema
11. Differentiate between atherosclerosis and arteriosclerosis and describe the role each plays in heart and vascular disease
12. Define thrombus, embolus, and aneurysm

D. Lymphatics and Immunity

1. Describe the distribution and functions of lymphatic system
2. Name the components of the lymphatic system and state the function of each
3. Compare and contrast the anatomy of lymphatic vessels with that of blood vessels
4. Describe the composition of lymph fluid as compared to blood

5. Relate the distribution of lymph nodes to lymphatic function
6. State the role of lacteals in the process of absorption in the digestive system
7. Describe the role of respiratory forces in the movement of lymph fluid
8. Define the functions of the immune system
9. Describe the function of the spleen, thymus, tonsils and lymph nodes
11. Differentiate between specific and non-specific resistance
12. Describe the mechanisms of the following: mechanical barriers, inflammation, cells, fever, complement protein and interferon
13. Review the terms: antigen, antibody, agglutinogens
14. Describe the development and maturation of T lymphocytes compared to B lymphocytes
15. State the function of antigen presenting cells (APCs) and MHC proteins
16. Define cell mediated and humoral immunity
17. Compare and contrast the role of the complement system in cell mediated and humoral immunity
18. Compare primary and secondary immune system responses
19. Compare passive and active immunity
20. Define and provide an example of autoimmunity
21. Define the following: autografts, isografts, heterografts, xenografts

E. Respiratory System

1. Distinguish between ventilation, gas exchange and cellular respiration
2. Trace the sequence of anatomical structures from the nose to the pulmonary alveoli
3. Explain the following terms: upper respiratory tract, lower respiratory tract
4. Relate the function of any portion of the respiratory tract to its gross and microscopic anatomy
5. Define the gas laws and relate them to respiratory physiology: Boyle's Law, Charles Law, Dalton's Law, and Henry's Law
6. Explain how pressure gradients cause air to flow into and out of the lungs
7. Explain how the respiratory muscles produce the above mentioned pressure gradients
8. Explain the relevance of pulmonary compliance and elasticity to ventilation
9. Explain why the alveoli do not collapse when one exhales
10. Define the following measurements of ventilation: respiratory volumes, tidal volume, inspiratory reserve volume, expiratory reserve volume, and residual volume
11. Explain the following respiratory capacities and how they are obtained: vital capacity, inspiratory capacity, functional residual capacity, total lung capacity, forced expiratory volume and peak flow

12. Explain how the brain stem regulates respiration
13. Contrast the neural pathways for voluntary and autonomic control of the respiratory muscles
14. Describe the chemical stimuli and the peripheral chemoreceptors that modify the respiratory rhythm
15. Define partial pressure and discuss its relationship to air
16. Contrast the composition of inspired and expired air
17. Describe how partial pressure affects gas transport across a respiratory membrane
18. Describe the mechanism of transporting CO₂ and O₂
19. Describe the factors that govern gas exchange in the lungs and systemic capillaries
20. Relate the Bohr and Haldane Effects to gas exchange in the lungs and tissues
21. Explain how gas exchange is adjusted to the metabolic needs of different tissues

F. Urinary System

1. Name and state the anatomical location of the organs of the urinary system
2. List the functions of the kidneys (including non-urinary system functions)
3. Name the major metabolic nitrogenous wastes and identify their sources
4. Define excretion and identify the systems that excrete wastes
5. Name and locate the microscopic and macroscopic structures of the kidney
6. Describe the microscopic structure of a nephron
7. Trace the flow of fluid/ blood through the renal tubules and the kidney
8. Describe the glomerular filtration membrane and how it excludes blood cells and proteins from the filtrate
9. Describe the process of filtration and relate it to net filtration pressure
10. Describe how the renal tubules reabsorb useful solutes from the glomerular filtrate and return them to the blood
11. Describe the nerve supply to the kidney
12. Describe how the nervous system, hormones, and the kidney regulate glomerular filtration
13. Describe how the nephron regulates water excretion
14. Explain the role of aldosterone and of atrial natriuretic factor in sodium and water balance
15. Describe the mechanism that maintains the medullary osmotic gradient
16. Describe the composition and properties of urine
17. Describe the functional anatomy of ureters, urinary bladder, and male and female urethra
18. Explain micturition reflex and describe how it controls the voiding of urine

G. Fluids and Electrolytes

1. List the water content of males, females, and infants, and the factors contributing to differences in water content among these groups
2. Name the fluid compartments and sub-compartments of the body, and the relative amount of body fluid in each
3. Differentiate between electrolytes and nonelectrolytes, and discuss the relative osmotic power of each
4. Compare the relative solute concentration of specific solutes in the intracellular and extracellular compartments
5. Describe the mechanisms of fluid movement between fluid compartments
6. Identify the routes of water intake and output to and from the body
7. Explain the thirst mechanism and mechanism of cessation of thirst
8. Indicate how shifts in water output by the body occur, and how the body compensates for such shifts
9. Discuss the activity of antidiuretic hormone (ADH)
10. Describe imbalances of fluid homeostasis and their consequences
11. Explain how salt is balanced in the body
12. Describe how sodium regulates fluid and electrolyte balance
13. Identify the mechanisms regulating sodium balance of the body fluids
14. Examine the mechanisms regulating potassium, calcium, and phosphate balance of the body fluids
15. Discuss the mechanism regulating anions in the body fluids

H. pH and Acid Base Balance

1. Explain the pH concept and include the numerical meaning of a change in pH of [one, two, one-half, and one-tenth] pH unit
2. List the approximate pH range of the following naturally occurring substances: intracellular fluid, arterial blood, urine, saliva, gastric juice, and sweat
3. Define "electrolyte" and list the major ones, including the hydrogen and hydroxyl ions, by name and ionic symbol found in human body fluids
4. Explain the functions of the hydrogen ion concentrations found in the skin, stomach, blood, urine, and mitochondria
5. Indicate the acid produced from normal metabolism occurring in each of the following body regions: aerobic respiration of cardiocytes, anaerobic respiration of erythrocytes, hydrolysis of phospholipids, degradation of sulfur amino acids, and the normal functioning of the stomach's parietal cells
6. Explain why the body naturally tends to enter a state of acidosis during the course of any time period
7. Define the following terms in the context of the chemical structure of a buffering system:

strong acid, weak acid, strong base, weak base, and salt

8. Explain why the body requires the continuous action of chemical buffering systems
9. Explain the relative strength, location and effectiveness of each of the following buffering systems: hemoglobin buffer, protein buffer, phosphate buffer, and the protein buffer
10. Utilize the components of each of the four major chemical buffering systems to show how they would work to neutralize excess acid or base
11. Describe the interaction of the bicarbonate buffer with the respiratory and urinary systems to help regulate the body's acid-base balance.
12. Indicate the normal range of values for the pCO₂ (partial pressure of carbon dioxide) and the bicarbonate ion concentration (HCO₃⁻, also called alkali reserve) in maintaining an arterial pH range of 7.35-7.45.
13. Explain the relationship between each of the following pairs of terms: chronic obstructive pulmonary disease (COPD) and respiratory acidosis, hyperventilation and respiratory alkalosis, diarrhea or uncontrolled diabetes mellitus and metabolic acidosis, and the ingestion of alkaline drugs for stomach ulcer and metabolic alkalosis.
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2. Describe the structure and function of the penis
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5. Describe the process of spermatogenesis
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7. Name male and female secondary sex characteristics and explain the role of hormones in their formation
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12. Describe the anatomical, metabolic, and physiological changes experienced by the mother during pregnancy
13. Explain the triggers that initiate labor and discuss the three stages of labor
14. List the factors considered in the Apgar score, and describe how the score is used to assess the newborn
15. Describe the changes that occur to specialized fetal circulatory structures after birth
16. Define lactation, and describe the mechanism of hormones and neural stimuli involved