COURSE OUTLINE

Anatomy and Physiology

Rutherford High School
Rutherford, New Jersey
I. BASIC PHILOSOPHY
Recognizing that a student’s attitude about anatomy and physiology is just as important in the long run as his or her acquisition of specific scientific concepts, it is our goal to instill in our students the belief that anatomy and physiology is an exciting, relevant, human activity that can be enjoyable to study. To this end, the extensive use of laboratory experimentation, demonstrations, and other hands-on activities are an integral part of this course.

II. METHODS EMPLOYED
- direct teacher instruction
- demonstrations
- laboratory experiments
- mini-activities (e.g. simulations) and laboratories
- computer-assisted instruction
- cooperative learning - problem solving
- filmstrips and videos
- library research
- problem and question & answer sessions

III. TEXT
To be determined at a later date

IV. SUPPLEMENTAL MATERIALS

V. BEHAVIORAL OBJECTIVES
These objectives are correlated in the left column to Part VI - Course Outline.

At the completion of this course, students should be able to:
1-1 1. define the terms anatomy and physiology.
2. list and discuss in order of increasing complexity the levels of organization of the body.
1-2 3. define the term anatomical position
4. discuss and contrast the axial and appendicular subdivisions of the body. Identify a number of specific anatomical regions in each area.

5. list the nine abdominal regions and the abdominal quadrants.

6. list and define the principal directional terms and sections (planes) used in describing the body and the relationship of body parts to one another.

7. list the major cavities of the body and the subdivisions of each.

8. explain the meaning of the term **homeostasis** and give an example of a typical homeostatic mechanism.

9. identify and discuss the basic structure and function of the three major components of a cell.

10. list and briefly discuss the functions of the primary cellular organelles.

11. compare the major passive and active transport processes that act to move substances through cell membranes.

12. compare and discuss DNA and RNA and their function in protein synthesis.

13. discuss the stages of mitosis and explain the importance of cellular reproduction.

14. explain how epithelial tissue is grouped according to shape and arrangement of cells.

15. list and briefly discuss the major types of connective and muscle tissue.

16. list the three structural components of a neuron.

17. define and contrast the terms **organ** and **organ system**.

18. list the 11 major organ systems of the body.

19. identify and locate the major organs of each major organ system.

20. briefly describe the major functions of each major organ system.

21. identify and discuss the major subdivisions of the reproductive system.

22. classify, compare the structure of, and give examples of each type of body membrane.

23. describe the structure and function of the epidermis
and dermis
24. list and briefly describe each accessory organ of the skin.
25. list and discuss the three primary functions of the integumentary system.
26. classify burns and describe how to estimate the extent of a burn injury.
27. explain how bones are formed, how they grow, and how they are remodeled.
28. discuss the microscopic structure of bone and cartilage, including the identification of specific cell types and structural features.
29. identify the major anatomical structures found in a typical long bone and discuss bone formation and growth.
30. list and discuss the generalized functions of the skeletal system.
31. identify the two major subdivisions of the skeleton and list the bones found in each area.
32. list and compare the major types of joints in the body and give an example of each.
33. list, locate in the body, and compare the structure and function of the three major types of muscle tissue.
34. discuss the microscopic structure of a skeletal muscle sarcomere and motor unit.
35. discuss how a muscle is stimulated and compare the major types of skeletal muscle contractions.
36. name, identify on a model or diagram, and give the function of the major muscles of the body discussed in this chapter.
37. list and explain the most common types of movement produced by skeletal muscles.
38. list the organs and divisions of the nervous system and describe the generalized functions of the system as a whole.
39. identify the major types of cells in the nervous system and discuss the functions of each.
40. identify the anatomical and functional components of a three-neuron reflex arc. Compare and contrast the
propagation of a nerve impulse along a nerve fiber and across a synaptic cleft.

41. identify the major anatomical components of the brain and spinal cord and briefly comment on the function of each.

42. identify and discuss the coverings and fluid spaces of the brain and spinal cord.

43. compare and contrast spinal and cranial nerves.

44. discuss the anatomical and functional characteristics of the two divisions of the autonomic nervous system.

45. classify sense organs as special or general and explain the basic differences between the two groups.

46. discuss how a stimulus is converted into a sensation.

47. list the major senses.

48. describe the structure of the eye and the functions of its components.

49. discuss the anatomy of the ear and its sensory function in hearing and equilibrium.

50. discuss the chemical receptors and their functions.

51. discuss the general sense organs and their functions.

52. distinguish between endocrine and exocrine glands and define the terms hormone and prostaglandin.

53. identify and locate the primary endocrine glands and list the major hormones produced by each gland.

54. describe the mechanisms of steroid and protein hormone action.

55. explain how negative and positive feedback mechanisms regulate the secretion of endocrine hormones.

56. identify the principal functions of each major endocrine hormone and describe the conditions that may result from hyposecretion or hypersecretion.

57. define diabetes insipidus, diabetes mellitus, gigantism, goiter, cretinism, glycosuria.

58. describe the primary functions of blood.

59. list the formed elements of blood and identify the most important function of each.

60. discuss anemia in terms of red blood cell numbers and hemoglobin content.

61. explain the steps involved in blood clotting.
62. describe ABO and Rh blood typing.
63. define the following medical terms associated with blood:
   hematocrit, leukocytosis, leukopenia, polycythemia, sickle cell, phagocytosis, acidosis, thrombosis, erythroblastosis fetalis, serum, fibrinogen, Rh factor, anemia.
64. discuss the location, size, and position of the heart in the thoracic cavity and identify the heart chambers, sounds, and valves.
65. trace blood through the heart and compare the functions of the heart chambers on the right and left sides.
66. list the anatomical components of the heart conduction system and discuss the features of a normal electrocardiogram.
67. explain the relationship between blood vessel structure and function.
68. trace the path of blood through the systemic, pulmonary, hepatic portal, and fetal circulations.
69. identify and discuss the primary factors involved in the generation and regulation of blood pressure and explain the relationships between these factors.
70. describe the generalized functions of the lymphatic system and list the primary lymphatic structures.
71. define and compare nonspecific and specific immunity, inherited and acquired immunity, and active and passive immunity.
72. discuss the major types of immune system molecules and indicate how antibodies and complements function.
73. discuss and contrast the development and functions of B and T cells.
74. compare and contrast humoral and cell-mediated immunity.
75. discuss the generalized functions of the respiratory system.
76. list the major organs of the respiratory system and describe the functions of each.
77. compare, contrast, and explain the mechanism responsible for the exchange of gases that occurs
during internal and external respiration.

13-10 78. list and discuss the volumes of air exchanged during pulmonary ventilation.

13-11 79. identify and discuss the mechanisms that regulate respiration.

14-1,2 80. list in sequence each of the component parts or segments of the alimentary canal from the mouth to the anus and identify the accessory organs of digestion.

14-6 81. list and describe the four layers of the wall of the alimentary canal. Compare the lining layer in the esophagus, stomach, small intestine, and large intestine.

14-9 82. discuss the basics of protein, fat, and carbohydrate digestion and give the end products of each process.

14-10,11 83. define and contrast mechanical and chemical digestion.

14-12 84. define: peristalsis, bolus, chyme, jaundice, ulcer, and diarrhea.

14-1 85. define and contrast catabolism and anabolism.

15-2,3 86. describe the metabolic role of carbohydrates, fats, proteins, vitamins, and minerals.

15-4 87. define basal metabolic rate and list some factors that affect it.

15-5 88. discuss the physiological mechanisms that regulate body temperature.

16-1 89. identify the major organs of the urinary system and give the generalized function of each.

16-2 90. name the parts of the nephron and describe the role each component plays in the formation of urine.

16-3 91. explain the importance of filtration, tubular reabsorption, and tubular secretion in urine formation.

16-4 92. discuss the mechanisms that control urine volume.

16-5,6 93. explain how the kidneys act as vital organs in maintaining homeostasis.

17-1 94. list, describe, and compare the body fluid compartments and their subdivisions.

17-2 95. discuss avenues by which water enters and leaves the body and the mechanisms that maintain fluid balance.

96. discuss the nature and importance of electrolytes in body fluids and explain the aldosterone mechanism of extracellular fluid volume control.
97. explain the interaction between capillary blood pressure and blood proteins.
17-3 98. give examples of common fluid imbalances.
18-1 99. discuss the concept of pH and define the phrase acid-base balance.
18-2 100. define the term buffer and buffer pair, and contrast strong and weak acids and bases.
101. contrast the respiratory and urinary mechanisms of pH control.
18-2 102. discuss compensatory mechanisms that may help return blood pH to near-normal levels in case of pH imbalances.
103. compare and contrast metabolic and respiratory types of pH imbalances.
19-1 104. list the essential and accessory organs of the male and female reproductive systems and give the generalized function of each.
19-2 105. describe the gross microscopic structure of the gonads in both sexes and explain the developmental steps in spermatogenesis and oogenesis.
19-3 106. discuss the primary functions of the sex hormones and identify the cell type or structure responsible for their secretion.
107. identify and describe the structures that constitute the external genitals of both sexes.
19-4 108. identify and discuss the phases of the endometrial or menstrual cycle and correlate each phase with its occurrence in a typical 28-day cycle.
20-1 109. discuss the concept of development as a biological process characterized by continuous modification and change.
20-2 110. discuss the major developmental changes characteristic of the prenatal stage of life from fertilization to birth.
20-3 111. discuss the three stages of labor that characterize a normal, vaginal birth.
112. identify the three primary germ layers and several derivatives in the adult body that develop from each layer.
113. list and discuss the major developmental changes
characteristic of the four postnatal periods of life.

20-4 114. discuss the effects of aging on the major body organ systems.

VI. COURSE OUTLINE

1. AN INTRODUCTION TO THE STRUCTURE AND FUNCTION OF THE BODY
   1-1 Structural Levels of Organizing
   1-2 Some Words Used in Describing Body Structures
   1-3 Planes or Body Sections
   1-4 Anatomical Position
   1-5 Body Regions
   1-6 Some Basic Facts About Body Functions

2. CELLS AND TISSUES
   2-1 Cells
   2-2 Movement of Substances Through Cell
   2-3 Cell Reproduction and Heredity
   2-4 Tissues

3. ORGAN SYSTEMS OF THE BODY
   3-1 Organ Systems of the Body

4. THE INTEGUMENTARY SYSTEM AND BODY MEMBRANES
   4-1 Classification of Body Membranes
   4-2 The Skin

5. THE SKELETAL SYSTEM
   5-1 Bone Formation and Growth
   5-2 Microscopic Structure of Bone and Cartilage
   5-3 Types of Bones
   5-4 Structure of Long Bones
   5-5 Functions of Bones
   5-6 Divisions of Skeleton
   5-7 Differences Between a Man’s and a Woman’s Skeleton
   5-8 Joints (Articulations)

6. THE MUSCULAR SYSTEM
   6-1 Muscle Tissue
   6-2 Structure of Skeletal Muscle
   6-3 Functions of Skeletal Muscle
   6-4 Fatigue
   6-5 Role of Other Body Systems in Movement
6-6 Motor Unit
6-7 Muscle Stimulus
6-8 Types of Skeletal Muscle Contraction
6-9 Effects of Exercise on Skeletal Muscle
6-10 Skeletal Muscle Groups
6-11 Movements Produced by Skeletal Muscle

7. THE NERVOUS SYSTEM
   7-1 Organs and Divisions of the Nervous System
   7-2 Cells of the Nervous System
   7-3 Nerves
   7-4 Reflex Arcs
   7-5 Nerve Impulses
   7-6 The Synapse
   7-7 Central Nervous System
   7-8 Peripheral Nervous System
   7-9 Autonomic Nervous System

8. THE SENSES
   8-1 Classification of sense Organs
   8-2 Converting a Stimulus into a Sensation
   8-3 Special Sense Organs
   8-4 General Sense Organs

9. THE ENDOCRINE SYSTEM
   9-1 Mechanisms of Hormone Action
   9-2 Regulation of Hormone Secretion
   9-3 Prostaglandins
   9-4 Pituitary Gland
   9-5 Hypothalamus
   9-6 Thyroid Gland
   9-7 Parathyroid Glands
   9-8 Adrenal Glands
   9-9 Pancreatic Islets
   9-10 Female Sex Glands
   9-11 Male Sex Glands
   9-12 Thymus
   9-13 Placenta
   9-14 Pineal Gland
   9-15 Other Endocrine Structures

10. BLOOD
   10-1 Blood Composition
10-2 Blood Types

11. THE CIRCULATORY SYSTEM
   11-1 Heart
   11-2 Blood Vessels
   11-3 Circulation
   11-4 Blood Pressure
   11-5 Pulse

12. THE LYMPHATIC SYSTEM AND IMMUNITY
   12-1 The Lymphatic System
   12-2 The Immune System
   12-3 Immune System Molecules
   12-4 Immune System Cells

13. THE RESPIRATORY SYSTEM
   13-1 Structural Plan
   13-2 Respiratory Tracts
   13-3 Respiratory Mucosa
   13-4 Nose
   13-5 Pharynx
   13-6 Larynx
   13-7 Trachea
   13-8 Bronchi, Bronchioles, and Alveoli
   13-9 Lungs and Pleura
   13-10 Respiration
   13-11 Regulation of Respiration
   13-12 Types of Breathing

14. THE DIGESTIVE SYSTEM
   14-1 Wall of the Digestive Tract
   14-2 Mouth
   14-3 Teeth
   14-4 Salivary Glands
   14-5 Pharynx
   14-6 Esophagus
   14-7 Stomach
   14-8 Small Intestine
   14-9 Liver and Gallbladder
   14-10 Pancreas
   14-11 Large Intestine
   14-12 Appendix
14-13 Peritoneum
14-14 Digestion
14-15 Absorption

15. NUTRITION AND METABOLISM
   15-1 Role of the Liver
   15-2 Nutrient Metabolism
   15-3 Vitamins and Minerals
   15-4 Metabolic Rates
   15-5 Body Temperature

16. THE URINARY SYSTEM
   16-1 Kidneys
   16-2 Formation of urine
   16-3 Ureters
   16-4 Urinary Bladder
   16-5 Urethra
   16-6 Micturition

17. FLUID AND ELECTROLYTE BALANCE
   17-1 Body Fluids
   17-2 Mechanisms that Maintain Fluid Balance
   17-3 Fluid Imbalance

18. ACID-BASE BALANCE
   18-1 pH of Body Fluids
   18-2 Mechanisms that Control pH of Body Fluids
   18-3 pH Imbalance

19. THE REPRODUCTIVE SYSTEM
   19-1 Common Structural and Functional Characteristics Between the Sexes
   19-2 Male Reproductive System
   19-3 Female Reproductive System
   19-4 Summary of Male and Female Reproductive Systems

20. GROWTH AND DEVELOPMENT
   20-1 Prenatal Period
   20-2 Birth or Parturition
   20-3 Postnatal Period
   20-4 Effects of Aging

VII. SUGGESTED LABORATORY ACTIVITIES
   1. Examine human torso model
2. Dissect fetal pig
3. Review Compound Microscope
4. Observe plant and animal cells under microscope
5. Observe mitosis in onion cell
6. Observe epithelial tissue
7. Observe blood cells
8. Anatomy of the Cell
9. Continue fetal pig dissection to observe body organs
10. Sweat Glands
11. Observe human hair under microscope
12. Examine prepared human skin slide
13. Observe long bone and identify tissues
14. Examine microscope slide of bone tissue
15. Testing bones for calcium
16. How important is calcium for strong bones?
17. Observe movement of various muscles among students
18. Observe prepared slides of muscle cell types
19. Joints and identifying Joints
20. Dissect prepared frog to observe various muscle tissues
21. Naming Muscle Movements
22. Tendons
23. Continue dissection of fetal pig to observe spinal cord
24. Examine prepared slides of neurons and identify components
25. Structure of the Brain
26. Parts and Functions of Frog's Brain
27. Anatomy of a Neuron
28. Investigating Nerve Receptors on Your Skin
29. Observe sweet and salt taste on tongue
30. Observe sense of hearing from various locations
31. Dissect cow or sheep eye to identify components
32. The Four Senses
33. Perception and Ink Blots
34. Examine prepared slide of adrenal gland to observe components
35. Examine prepared slides of blood to observe various diseases
36. Identify “Unknown” Blood type and Rh factor from prepared slides
37. Investigating a Drop of Blood (computer simulation)
38. Red Blood Cells (prepared slides)
39. Dissect sheep or frog heart to observe various components
40. The External Anatomy of the Heart
41. The Internal Anatomy of the Heart
42. The Heart cycle
43. Investigating Cardiac Muscle
44. How Much Blood Does Your Heart Pump in a Minute?
45. The Blood Vessels
46. Calculate blood pressure using a sphygmomanometer and a stethoscope
47. Examine X-rays showing lymph abnormalities
48. White Blood Cells
49. Make an Action Cartoon
50. The Anatomy of a Virus
51. Lymphocytes
52. How the HIV Attacks a T4 Lymphocyte
53. Examine bronchial sounds using a stethoscope
54. Examine prepared slides showing lung abnormalities
55. Anatomy of the Respiratory System
56. Inspiration
57. Testing for Carbon Dioxide During Exhalation
58. Self-examination of teeth
59. Identify sugars and starches
60. Examine prepared slides of stomach and intestine and identify components
61. Anatomy of Digestive System
62. Digestion in the Small Intestine
63. Simulating Steps of Digestion
64. Energy From Food
65. Carbohydrates
66. Test body temperature before and after exercise
67. Excretion
68. Structure and Function of Urinary System
69. Internal Anatomy of Kidney
70. Anatomy of Nephron
71. Making an Action Cartoon: Reabsorption
72. Examine prepared slides of nephrons and ureter walls showing components
73. Keep account of fluid intake and output for 24 hours
74. Observe pH of various substances with pH meter
Examine prepared slide of seminiferous tubules and ovaries

Male Reproductive System

Female Reproductive System

Fertilization and Formation of an Embryo

Examine prepared slides of sea urchin embryological development

VIII. SUGGESTED DISCUSSION TOPICS AND ASSIGNMENTS

1. observe mannequin or torso model
2. cut fruit to examine planes
3. draw body cavities and name organs
4. explain homeostasis
5. identify major elements of body
6. draw and label cell with components
7. demonstrate diffusion with coffee and sugar
8. describe how many systems are involved as you eat lunch
9. list physicians’ specialties from phone book and describe body systems associated with them
10. discuss various problems associated with skin care
11. take fingerprints with an ink pad and observe differences
12. examine skeleton model
13. use a grip tester to examine muscle fatigue
14. list exercises for specific muscles
15. list isometric exercises for specific muscles
16. demonstrate various reflexes
17. why does cold reduce swelling?
18. discuss various health situations and describe the glands involved in each
19. discuss pros and cons of blood doping
20. discuss pros and cons of exercise
21. show on a heart model how structure is related to function
22. discuss how AIDS is transmitted, its affects on the body, and measures to prevent to spread
23. explain various mechanisms the body uses to ward off disease
24. diagram movement of carbon dioxide as it moves through lungs
25. discuss breathing in paper bag
26. listen with stethoscope to water being swallowed
27. explain functions of different types of teeth
28. make chart of pancreatic enzymes relating to digestion
29. identify different types of teeth on a human skull model
30. discuss affects of carbohydrate restricted diet
31. discuss safe dieting plans
32. do minerals and vitamins provide energy?
33. discuss various things that affect metabolic rate
34. make chart of urine components
35. explain how protein deficient diet influences capillary blood pressure
36. how does environment influence amount of fluid needed by body?
37. what are effects of diuretics?
38. diagram and label respiratory and urinary systems
39. list changes in various systems due to aging

IX. SUGGESTED FIELD TRIPS
1. Visit a local hospital radiology department and view various body cavities and organs on X-ray film.
2. Visit local hospital laboratory and observe various procedures.
3. Visit local hospital to observe demonstration of electrocardiogram (ECG)
4. Visit hemodialysis unit at local hospital and make observations.
5. Visit day care center and note different levels of mental and physical development

X. SUGGESTED CLASSROOM SPEAKERS
1. Doctor of radiology to explain advantages, disadvantages, and precautions concerning X-ray.
2. Skin care specialist or dermatologist to discuss skin care
3. Speech specialist to discuss and explain aphasia
4. Exercise physiologist to discuss pros and cons of exercise
5. Cardiologist to show and explain wave pattern on ECG.
6. Exercise physiologist to describe symptoms of heat cramps, heat exhaustion, heatstroke.
7. Exercise physiologist to discuss necessity of maintaining adequate intake of fluid.
8. IV Therapist to speak of importance of maintaining fluid and electrolyte balance.
9. Public Health nurse to speak of health maintenance.
10. Official from state health department to discuss recent information on AIDS.
11. Pediatrician to discuss child development.

XI. SUGGESTED FILMSTRIPS (F), VIDEOS (V), COMPUTER SOFTWARE (C), AND SLIDES (S).

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XII. SUGGESTED REPORTS AND PROJECTS

1. Career Report
2. Scientist Report
3. Construct a model of a human, frog, or rat torso and illustrate body organs and systems
4. Build a model of a bone showing all parts
5. Show movement of blood through circulatory system
XIII. EVALUATION

Student evaluation for this course is in accordance with the Board-approved policy on grading, including the mandatory Homework requirement and Final Exams. Grades are also assigned based upon:

1. tests (teacher-made and/or standardized)
2. quizzes
3. class participation

The following evaluation criteria may also be used:

1. notebooks
2. research reports (oral/written)
3. projects
4. labs
Minimum Proficiencies - Anatomy & Physiology

The course proficiencies listed below represent the minimum requirements in order to receive a passing grade for this course.

1. Students should become acquainted with the structural foundation of the body and its ability to function, with special attention to maintaining homeostasis of the body.
2. Students should demonstrate structural and functional aspects of cell organization.
3. Students should become acquainted with major organs of the body and how they function within each system.
4. Students should have the basic understanding of the integumentary system and its regulatory and protective importance.
5. Students will perform various techniques for identification of the skeletal system and its vital functions of support and protection of the body.
6. Students will describe the general structure and overall function of muscle tissue by dissecting a prepared frog.
7. Students should demonstrate an understanding of the major components of the nervous system, describing structure and function of the neurons and the details of the autonomic nervous system.
8. Students will develop an understanding of the body’s innate ability to sense change in our environment which enables us to maintain a state of homeostasis and continued survival.
9. Students will distinguish endocrine glands from exocrine glands and differentiate between hormones and prostaglandins.
10. Students will understand the function and transport of blood through the body and explain the principal structural features of the heart and its location, size, and position.
11. Students will have a working knowledge of the lymphatic system as a component of the circulatory system, and knowledge of the immune system including antibodies and complement.
12. Students should demonstrate an understanding of the digestive system, nutrition, and metabolism.
13. Students will develop an understanding of the fluid and electrolyte compartments of the body, especially the importance of water to the body, and the critical acid-base balance in the body.

14. Students should have a basic understanding of the essential and accessory organs of the male and female reproductive systems and some important changes that occur during growth and development.

15. Students will compile and update a notebook logically and comprehensively.

16. Students will be required to complete all homework assignments.

17. Students will complete laboratory assignments and prepare laboratory reports.

18. Students will prepare a research report and project according to department guidelines.