

Anatomy & Physiology 1-2

Approved by the
BOARD OF TRUSTEES
March 8, 2012

I. Course Description

- A. UC/CSU “a-g” Subject Areas:** “d”
- B. Rationale for Course:** Anatomy & Physiology 1-2 is a one-year advanced biology program. It is designed to provide students an in-depth, enriched study of the structure and function of the human body. As an upper division course, it is designed to prepare students for postsecondary study in science by providing students an opportunity to study these topics in greater depth and breadth than is possible in the core science curriculum.
- C. Grade Level:** 10th-12th
- D. Credits:** 10.0
- E. Pre-Requisites:** University of California “d” credit (lab science) requires completion or concurrent enrollment in Algebra 1-2. We recommend completion of Biology 1-2 with a B or better and completion/concurrent enrollment of Chemistry with a B or better.
- F. Brief Course Description:** The course builds upon the scientific foundations developed in Biology 1-2 and Chemistry 1-2 by spiraling and integrating topics and key themes in the context of the human body. The course is an excellent compliment to topics addressed in other upper division science electives, especially AP Biology. The course content is primarily organized around the organ systems of the vertebrate body-skeletal, muscular, cardiovascular, respiratory, and so on-and their interaction in maintaining a functioning, homeostatic organism. The course is laboratory-based, drawing equally on experimental and observational studies as the major instructional methodologies. The course is based on California Science *Content Standards for Biology/Life Sciences* and the California Common Core State Standards for Literacy in History/Social Studies, Science, and Technical subjects as outlined below.

II. Course Purpose: Goals and Student Outcomes

- Students will understand the relationship between structure and function and how organ systems are interrelated in working to maintain homeostasis. (Biology 9)
- Students will understand basic cell structures and their functions, as well as cellular energy metabolism. (Biology 1)
- Students will understand the pathway to protein synthesis from DNA to functional protein. (Biology 4)
- Students will understand how the human body has several mechanisms with which it can defend itself and the impact impairment of those mechanisms can have. (Biology 10)
- Students will understand the importance of sexual reproduction for variation and where the gamete production takes place in the body (Biology 2)

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- Students will know the general structure of DNA, RNA, and proteins and how their structure affects their structure. (Biology 5)
- Students will demonstrate scientific literacy by actively participating in the process of science through analyzing current research topics in physiology and through forming hypotheses, designing research, collecting/analyzing data and drawing conclusions regarding specific laboratory experiments related to the structure and function of the human body. (Investigation and Experimentation) (RSLSTS and WSLHSSSTS)
- Students will understand how chemical bonds impact the behavior of various organic molecules. (Chemistry 2)
- Students will understand how diffusion affects the movement of particles into and out of systems. (Chemistry 4)
- Students will understand the effects of pH on the conformation of macromolecules and why and how the human body regulates it with buffers. (Biology 9, Chemistry 5)
- Students will understand that biochemistry is wet and the importance of a solution's composition and concentration. (Chemistry 6)
- Students will understand the thermodynamics of the various catabolic and anabolic processes taking place at the cellular level (Chemistry 7).
- Students will understand what factors influence chemical reaction rates including enzymes, concentrations of reactants, and temperature. (Chemistry 8)
- Students will understand how chemical equilibrium is reached when the rates of the forward and reverse process are equal. (Chemistry 9)
- Students will understand the how the carbon skeleton allows for a diverse array of molecules, and how macromolecules that are polymers are assembled from a set of subunits. (Chemistry 10)

III. Course Outline:

*Essential Standards are underlined

Fall Semester

I. Introduction to Physiology

- Three Themes of Physiology: Structure and Function, Homeostasis, and Interrelatedness of Systems (Biology 9a, 9b, 9c)
- Characteristics of Life
- Necessary life functions
- Levels of organization
- Anatomical Terms
- Homeostatic Mechanism Diagrams
- Homeostasis Lab Design (Investigation and Experimentation 1a)

II. Biochemistry

- Water and solutions chemistry (Chemistry 2a, 2b, 2c, 2d, 2h, 6a, 6c)
- Acids and Bases (Chemistry 5a, 5b, 5d, 5f)
- Macromolecules (Chemistry 10a, 10b, 10c and Biology 1h)

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- Hydrolysis and dehydration synthesis (Chemistry 10a)
- Protein Structure (Chemistry 10a, 10c and Biology 4e, 4f)
- Enzymes (Chemistry 8a, 8b, 8c and Biology 1b)
- Activation Energy (Chemistry 8c)
- Endergonic (anabolic) and Exergonic (catabolic) processes (Chemistry 7b, 7c)

III. The Cell

- Plasma membrane (Biology 1a)
- Organelles (Biology 1e, Biology 1g)
- Cytoskeleton (Biology 1j)
- Cell cycle
- Protein synthesis (Biology 1d, 4a, 4b, 5a)
- Compartmentalization
- Membrane Transport (Chemistry 9b)
- Tonicity
- ATP (Biology 9h)
- Stem cells to fully differentiated cells (Biology 4d)
- Cellular Respiration (Biology 1g)
- Glycolysis
- Krebs Cycle
- Electron Transport Chain
- Chemiosmosis (Biology 1i)

IV. Tissues of the Human Body

- Epithelial
- Muscular
- Nervous
- Connective

Spring Semester

I. Introduction to the Organ Systems of the Body

- Major organs of each organ system
- Role(s) in maintaining homeostasis
- Examples of structure and function
- Explain how the system is interrelated to all others
- Examples of membrane transport
- 3-D model of some structure specific to that system

II. Integumentary System

- Layers of the skin and their tissue composition
- Accessory organs of the skin
- Body temperature regulation (Biology 9c)
- Role as a barrier to water and pathogens (Biology 10a)

III. Skeletal System

- Bone structure, development and growth
- Bone Functions: movement, protection, hematopoiesis
- Skeletal organization
- Calcium homeostasis (Biology 9i)

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- Hormonal control of bone growth (Biology 9i)

IV. Muscular System

- Muscle structure (Biology 9h)
- Contraction (Biology 9h)
- Skeletal, smooth and cardiac muscle
- Major skeletal muscles

V. Nervous System

- Central and peripheral nervous systems (Biology 9b)
- Functions: sensation, integration, response (Biology 9c, 9d, 9e)
- Neuron structure, myelin sheath
- Action potentials (Biology 9d)
- Synaptic transmission (Biology 9d)

VI. Digestive System

- Alimentary canal and accessory organs
- Digestive enzymes (Biology 9f)
- Absorption and secretion
- Hormonal regulation (Biology 9i)

VII. Reproductive System

- Organs of reproduction (Biology 2b)
- Hormonal control of egg and sperm production (Biology 9i)

VIII. Urinary System

- Major organs structure and nephron structure
- Glomerular filtration and the loop of Henle
- Regulation of urine production (Biology 9g, 9i)

IX. Lymphatic/Immune System

- Major organs and their roles in protection and fluid retention
- Phagocytes, B-lymphocytes, T-lymphocytes (Biology 10f)
- Nonspecific defense and immunity (Biology 10a, 10b, 10c, 10d, 10e)

X. Respiratory System

- Structure and major organs of the respiratory system
- Diaphragmatic control of negative pressure generation
- Partial pressure gradient diffusion oxygen and carbon dioxide (Chemistry 4b, 4i)
- Regulation of breathing (Biology 9a)

XI. Cardiovascular system

- Heart chambers and valves, pulmonary and systemic circuits (Biology 9a)
- Blood vessels
- Blood pressure regulation (Biology 9b, 9c)

XII. Career Exploration

- Discover possible careers
- Research job requirements
- Resume writing
- Job shadow

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IV. Key Assignments

Alignment of Key Assignment to California CCSS for Literacy in History/Social Studies, Science, and Technical Subjects is indicated in parentheses.

Structured Note Taking: Students will write structured notes from the textbook and supplementary materials for the entire school year. (RSLSTS 2,4,5,6,10)

Fall Semester

I. Introduction to Physiology

Homeostasis Lab

Cornerstone Assessment: Students will design an experiment to test a homeostatic mechanism (of their choosing) in the human body. They will write a formal lab report, which will include a title, background research/purpose, hypothesis, procedures, data tables, graphs and bibliography. (RSLSTS 1,3,6,8 and WSLHSSSTS 1,2,4,5,6,7,8,9,10)

II. Biochemistry

Catalase Enzyme Lab

pH Buffer Lab

III. The Cell

Osmosis and Diffusion Lab

Cell Cycle Slide Lab

Cell project, students will create an advertisement for a human cell incorporating cellular structure and function and present it to the class

IV. Tissues

Histology Lab

Spring Semester

I. Introduction to the Organ Systems of the Body

Organ System Presentation: Working in small groups, students will make a 5-7 minute presentation one of the 11 organ systems of the human body. With emphasis on applying prior knowledge the three themes of physiology, membrane transport and construct a 3-D model of some aspect of their system from a unique cellular structure to the entire organ system. (RSLSTS 2,4,5,6,7,9 and WSLHSSSTS 6)

II. Integumentary System

Mammalian Dissection Lab

III. Skeletal System

Comparative Skeletal Anatomy Lab

IV. Muscular System

Mammalian Dissection Lab

V. Nervous System

Nervous System Sensory Response Time Lab.

VI. Digestive System

Mammalian Dissection Lab

VIII. Lymphatic/Immune System

Immune System Story

IX. Respiratory System

*Respirometer Lab (Optional)

Mammalian Dissection Lab

X. Cardiovascular system

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Postural Blood Pressure Lab
*Sheep Heart Dissection (Optional)

XI. Urinary System

Mammalian Dissection Lab

VII. Reproductive System

Mammalian Dissection Lab

V. Instructional Methods and/or Strategies

- Direct Instruction including but not limited to lecture, example problems, and case studies.
- Mammalian dissection labs.
- Internet and multimedia activities may include but are not limited to webquests, simulations, research projects, animations and tutorials.
- Hands on laboratories with emphases on inquiry and investigation, data analysis and formulating conclusions.
- Hands on simulations & group activities to review, model/simulate phenomena, and reinforce major concepts and principles from direct instruction.
- Student research & presentations, individual and/or group, on concepts and principles.
- Utilization of technologies such as microscopes, dissection scopes, dissection tools, respirometers, sphygmomanometers, thermometers, timers, probeware, blood oxygen sensors.

VI. Assessment Methods and/or Tools

The student will be assessed using a variety of assessment tools:

- Laboratory Reports
- Quizzes- multiple choice, fill in the blank, matching, short answer questions
- Unit Exams- multiple choice, fill in the blank, matching, and short answer questions
- Student group and individual research projects and presentations
- Semester final exams
- Formative assessments embedded in lectures and discussions
- Informal and formal pre-assessment strategies through warm ups, quizzes, and teacher questioning

VII. Textbook(s) and Supplemental Instructional Materials

Textbook: "Hole's Essentials of Human Anatomy and Physiology" by Shier, Butler, and Lewis; Eleventh Edition, Copyright 2011; McGraw-Hill Science/Engineering/Math. ISBN-13: 978-0073378152

VIII. Alignment to California Common Core State Standards for Literacy in Science Literacy Claim 1-

- Students can read closely and critically to comprehend a range of increasingly complex literary and informational texts

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- Students will be required to read and take structured notes on sections from the textbook and supplementary documents.
- Students will be required to summarize each section and identify key questions and cues for each section of notes.
- Students will need to analyze each reading section for evidence of the three themes of physiology.

Literacy Claim 2 - Students can produce effective writing for a range of purposes and audiences.

- Students will write a formal lab report as well as answer analysis questions on exams and labs.
- The homeostasis lab report will be an iterative process that begins with developing a hypothesis, researching background information (utilizing the internet), and writing a rough draft that will be peer evaluated with a rubric.
- The final draft of the homeostasis lab report will include appropriate citations for background information, materials, procedures, as well as blank data tables, graphs and a bibliography.
- The homeostasis lab report will have specific mechanical and grammatical requirements as listed in the rubric.
- The homeostasis lab report will be made using a word-processing program to ease the revision process.

Literacy Claim 3 - Students can employ effective speaking and listening skills for a range of purposes and audiences.

- Students will be required to take notes during lectures and discussions led by the instructor.
- Students will be required to take notes during group and/or individual student presentations.
- Students will regularly be required to make short presentations in groups (or alone) on a variety of topics throughout the year.
- Students will be required to make at least two formal group presentations each year.

Literacy Claim 4 - Students can engage appropriately in collaborative and independent inquiry to investigate/research topics, pose questions, and gather and present information.

- Students will work in groups during the fall semester to make an advertising campaign to describe the components of a cell.
- Students will work in groups during the spring semester to develop a presentation for one of the 11 organ systems of the human body.
- Both of the project/presentations will require extensive collaboration and planning.
- Students will utilize technology to research and present.

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Literacy Claim 5 - Students can skillfully use and interpret written language across a range of literacy tasks.

- Students will utilize the Greek and Latin root words presented at the beginning of each chapter in the textbook to better understand the readings.
- Students are expected to utilize this vocabulary during short answer assessments.