

FOLSOM CORDOVA UNIFIED SCHOOL DISTRICT

HUMAN BODY SYSTEMS (HBS)

Date: January 2016
Proposed Grade Levels: 9-12
Grading: A-F

Subject Area: CTE
Course Length: One year
Credits: 5 per Semester

CTE Sector / Pathway: Health, Science, and Medical Technology / Biotechnology
Intent to Pursue 'A-G' College Prep Status: Yes
Prerequisite: Biology and/or Principles of Biomedical

COURSE DESCRIPTION:

In the Human Body Systems (HBS) course, students examine the interactions of body systems as they explore identity, communication, power, movement, protection, and homeostasis. Students assume the role of biomedical professionals to solve medical mysteries, design experiments, investigate the structures and functions of the human body, and use data acquisition software to monitor body functions such as, muscle movement, reflex and voluntary action, and respiration. Exploring science in action, students build organs and tissues on a skeletal manikin, and work through interesting real world cases. Students practice problem solving with structured activities and progress to open-ended projects and problems that require them to develop planning, documentation, communication, and other professional skills.

GENERAL GOALS/ ESSENTIAL QUESTIONS:

- In what ways do different human body systems work together to complete specific functions?
- How do scientists determine which areas of the brain are associated with specific actions, emotions or functions?
- How do feedback loops help regulate the action of hormones?
- What human body systems work to create process or distribute the body's main power sources?
- How do bones, muscles, and joints work together to enable movement and locomotion for the human body?
- How do medical professionals in different fields assist with burn care and rehabilitation?
- What body systems function to protect the human body?
- How do the systems of the body work together to defend against disease and injury and to maintain health and wellness?
- How do medical interventions help doctors and patients prevent, diagnose, and treat disease?

CCSS READING COMPONENT:

HBS is a course that focuses on the human body. This course will use PLTW lesson plans and curriculum. Students must utilize a number of different texts to gain access to information. The use of diagrams, graphs, video clips, and scholarly journals will be used. Students will gain knowledge through their research and first hand interaction with science phenomena.

CCSS WRITING COMPONENT:

Students will present their lab findings through a series of lab reports throughout the duration of the course. Students will also keep a Career Journal as they research different job possibilities within the field of study.

CCSS SPEAKING AND LISTENING COMPONENTS:

Students will work in pairs throughout the course. Students will constantly be communicating with one another to explain their thought process and their understanding. Students will present research findings to the class when appropriate for feedback and evaluation.

CTE INDUSTRY SECTOR / PATHWAY /STANDARDS:

The proposed CTE course code is 4253, Health Science Preparation with a CTE pathway code of 196, Health Science and Medical Technology.

CTE Anchor

Anchor Standard 2: Communication

Acquire and accurately use Arts, Media, and Entertainment sector terminology and protocols at the career and college readiness level for communicating effectively in oral, written, and multimedia formats.

- 2.1 Recognize the elements of communication using a sender–receiver model.
- 2.5 Communicate information and ideas effectively to multiple audiences using a variety of media.
- 2.2 Identify barriers to accurate and appropriate communication.

CTE Anchor

Anchor Standard 4: Technology

Use existing and emerging technology to investigate, research, and produce products and services, including new information, as required in the Arts, Media, and Entertainment sector workplace environment.

- 4.1 Use electronic reference materials to gather information and produce products and services.
- 4.3 Use information and communication technologies to synthesize, summarize, compare, and contrast information from multiple sources.
- 4.5 Research past, present, and projected technological advances as they impact a particular pathway.

CTE Anchor

Anchor Standard 5: Problem Solving and Critical Thinking

Conduct short, as well as more sustained research to create alternative solutions to answer a question or solve a problem unique to the Arts, Media, and Entertainment sector, using critical and creative thinking, logical reasoning, analysis, inquiry, and problem-solving techniques.

- 5.3 Use systems thinking to analyze how various components interact with each other to produce outcomes in a complex work environment.
- 5.4 Interpret information and draw conclusions, based on the best analysis, to make informed decisions.
- 5.5 Know how to apply mathematical computations related to health care procedures (metric and household, conversions and measurements).

5.6 Read, interpret, and extract information from documents.

CTE Anchor

Anchor Standard 7: Responsibility and Flexibility

Initiate, and participate in, a range of collaborations demonstrating behaviors that reflect personal and professional responsibility, flexibility, and respect in the Arts, Media, and Entertainment sector workplace environment and community settings.

7.5 Apply high-quality techniques to product or presentation design and development.

CTE Anchor

Anchor Standard 10: Technical Knowledge and Skills

Apply essential technical knowledge and skills common to all pathways in the Arts, Media, and Entertainment sector, following procedures when carrying out experiments or performing technical tasks.

10.1 Interpret and explain terminology and practices specific to the Health Science and Medical Technology sector.

CTE Anchor

Anchor Standard 11: Demonstration and Application

Demonstrate and apply the knowledge and skills contained in the Arts, Media, and Entertainment anchor standards, pathway standards, and performance indicators in classroom, laboratory, and workplace settings, and through the SkillsUSA career technical student organizations.

11.4 Employ entrepreneurial practices and behaviors appropriate to Health Science and Medical Technology sector opportunities.

11.5 Create a portfolio, or similar collection of work, that offers evidence through assessment and evaluation of skills and knowledge competency as contained in the anchor standards, pathway standards, and performance indicators.

Biotechnology Pathway

A1.2 Describe the use of model organisms in biotechnology research and manufacturing.

A2.2 Know the difference between personal, professional, and organizational ethics.

A2.3 Understand the necessity for accurate documentation and record keeping.

A3.2 Describe enzyme structure and function, diagram the impact of enzymes and catalysis on reaction rates, and recognize the emerging role of enzymes in replacing industrial chemicals.

A8.1 Follow written protocols and oral directions to perform a variety of laboratory and technical tasks.

A8.4 Outline the appropriate responses to a laboratory accident including identification of location and use of emergency equipment.

A8.5 Practice laboratory and personal safety including the location and use of emergency equipment (personal protective equipment, no food or drink, no open-toe shoes).

A8.9 Handle, transport, and store samples safely.

Patient Care Pathway

B2.1 Know basic human body structure and function in relationship specific to care between prevention, diagnosis, pathology, and treatment.

B2.3 Recognize common disease and disorders of the human body.

B2.4 Compare normal function of the human body to the diagnosis and treatment of disease and disorders.

B3.1 Apply mathematical computations related to health care procedures (metric *and* household, conversions and measurements).

B4.5 Evaluate information gathered and connect patient data to appropriate system of care.

B5.5 Know the basic structure of medical terms.

B7.2 Differentiate between normal and abnormal patient health status

B8.1 Explain the principles of body mechanics

B8.5 Integrate proper body mechanics, ergonomics, safety equipment, and techniques to prevent personal injury to patients and clients

DETAILED UNITS OF INSTRUCTION:

Unit 1: Identity

The goal of Unit 1 is to engage students in a discussion of what it means to be human. Students investigate the body systems and functions that all humans have in common and then look at differences in tissues, such as bone and muscle, and in molecules, such as DNA, to pinpoint unique identity. Students play the role of forensic anthropologists as they unlock the clues of identity found in bone and use restriction analysis and gel electrophoresis to analyze differences in DNA. Students begin to study histology and build upon their knowledge of human tissue.

Lesson 1.1- Identity- Human

Lesson 1.2- Identity- Tissues

Lesson 1.3- Identity- Molecules and Cells

Unit 2: Communication

The goal of Unit 2 is for students to investigate modes of communication within the human body, as well as the ways the human body communicates with the outside world. Students map the function of key regions of the brain and explore how the body detects, processes, and responds to internal and external stimuli. Students investigate the roles of electrical and chemical signals in communication and response in the human body. They explore the ways in which hormones and the endocrine system control body function in order to solve a medical mystery. Students compare response time to reflex and voluntary actions using data acquisition software, and they design experiments to test factors that can impact this response. By investigating the anatomy and physiology of the human eye, students learn how the body receives and interprets stimuli from the outside world.

Lesson 2.1- The Brain

Lesson 2.2- Electrical Communication

Lesson 2.3- Chemical Communication

Lesson 2.4- Communication with the Outside World

Unit 3: Power

The goal of Unit 3 is for students to investigate the human body systems that work to obtain, distribute, or process the body's primary resources for energy and power—food, oxygen, and water. Students make a model of the digestive system and design experiments to test the optimal conditions for enzymatic digestion. They explore lung function by diagnosing and treating a patient with breathing problems and use probes and data acquisition software to monitor their own lung function. Students investigate the

anatomy and physiology of the urinary system and run simulated urinalysis to identify health conditions and diagnose disease.

Lesson 3.1- Introduction to Power

Lesson 3.2- Food

Lesson 3.3- Oxygen

Lesson 3.4- Water

Unit 4: Movement

In Unit 4 students investigate movement of the human body, as well as the movement of substances within the body. By building muscle groups on a skeletal model, students learn how a muscle's structure is directly related to its function and to the actions it can produce. Students design experiments to test the requirements for muscle contraction and create models to show relaxation and contraction of the sarcomere. A study of blood flow illustrates the roles that smooth and cardiac muscles play in the transport of substances around the body. At the end of the unit, students combine information about power and movement to describe how the body fuels and responds to exercise. Playing the role of biomedical professionals in a combined medical practice that caters to athletes, students design a comprehensive training plan for an athlete. The plan includes all aspects of training, from diet and exercise, to hydration and injury prevention.

Lesson 4.1- Joints

Lesson 4.2- Muscles

Lesson 4.3- Blood Flow

Lesson 4.4- Energy and Motion

Unit 5: Protection

In this unit students explore ways in which the human body protects itself from injury and disease. Before students investigate specific defense mechanisms and the immune system, they explore the protective functions of skin, bone, and the feeling of pain. Antigen-antibody interactions are introduced, as well as the structure of the lymphatic and immune system. Students analyze data from a fictional illness and relate antibody response to the action of specific white blood cells.

Lesson 5.1- The Skin

Lesson 5.2- Bones

Lesson 5.3- Lymph and Blood Cells

Unit 6: Homeostasis

This final unit focuses on the connection between all of the human body systems and examines how these systems work together to maintain health and homeostasis. Students explore how the body deals with extreme external environments, as well as how the body reacts to and defends against injury and illness. Students begin to discuss and design medical interventions for a fictional case study. The activities in this lesson are an engagement for the subsequent course, entitled Medical Interventions (MI).

Lesson 6.1- Health and Wellness

TEXTBOOKS and RESOURCE MATERIALS:

- Laptop
- PLTW Learning Management System (LMS)
- PLTW Manikin
- Internet access

CONTENT SUBJECT AREA STANDARDS TO BE ADDRESSED:

HS.LS1.2 - From Molecules to Organisms: Structures and Processes

Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS.LS1.3 - From Molecules to Organisms: Structures and Processes

Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

HS.LS1.7 - From Molecules to Organisms: Structures and Processes

Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.

HS.LS3.1 - Heredity: Inheritance and Variation of Traits

Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

HS.ETS1.2 - Engineering Design

Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS.ETS1.3 - Engineering Design

Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function

Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (HS-LS1-3)

DCI - LS1.C - From Molecules to Organisms: Structures and Processes - Organization for Matter and Energy Flow in Organisms

The sugar molecules thus formed contain carbon, hydrogen, and oxygen: their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells. (HS-LS1-6)

DCI - LS1.C - From Molecules to Organisms: Structures and Processes - Organization for Matter and Energy Flow in Organisms

As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. (HS-LS1-6), (HS-LS1-7)

DCI - LS1.C - From Molecules to Organisms: Structures and Processes - Organization for Matter and Energy Flow in Organisms

As a result of these chemical reactions, energy is transferred from one system of interacting molecules to another. Cellular respiration is a chemical process in which the bonds of food molecules and oxygen molecules are broken and new compounds are formed that can transport energy to muscles. Cellular respiration also releases the energy needed to maintain body temperature despite ongoing energy transfer to the surrounding environment. (HS-LS1-7)

DCI - LS2.B - Ecosystems: Interactions, Energy, and Dynamics - Cycles of Matter and Energy Transfer in Ecosystems

Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. (HS-LS2-3)

DCI - LS3.A - Heredity: Inheritance and Variation of Traits - Inheritance of Traits

Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. (HS-LS3-1)

DCI - LS3.B - Heredity: Inheritance and Variation of Traits - Variation of Traits

In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, and viable mutations are inherited. (HS-LS3-2)

DCI - PS3.A - Energy - Definitions of Energy

"Electrical energy" may mean energy stored in a battery or energy transmitted by electric currents. (Secondary to HS-PS2-5)

DCI - PS3.A - Energy - Definitions of Energy

Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. (HS-PS3-1), (HS-PS3-2)

DCI - PS3.A - Energy - Definitions of Energy

At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. (HS-PS3-2), (HS-PS3-3)

DCI - PS3.B - Energy - Conservation of Energy and Energy Transfer

Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. (HS-PS3-1), (HS-PS3-4)

DCI - PS3.B - Energy - Conservation of Energy and Energy Transfer

Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system. (HS-PS3-1)

DCI - PS3.B - Energy - Conservation of Energy and Energy Transfer

The availability of energy limits that can occur in any system. (HS-PS3-1)

DCI - ETS1.C - Engineering Design - Optimizing the Design Solution

Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. (Secondary to HS-PS1-6)

CCRA.R.1 Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

CCRA.R.2 Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.

CCRA.R.7 Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

CCRA.R.10 Read and comprehend complex literary and informational texts independently and proficiently.

CCRA.SL.1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

CCRA.SL.2 Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.

CCRA.SL.4 Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.

CCRA.SL.5 Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.

CCRA.SL.6 Adapt speech to a variety of contexts and communicative tasks, demonstrating command of formal English when indicated or appropriate.

CCRA.W.1 Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

CCRA.W.2 Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

CCRA.W.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

CCRA.W.6 Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

CCRA.W.8 Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.

CCRA.L.1 Demonstrate command of the conventions of Standard English grammar and usage when writing or speaking.

CCRA.L.2 Demonstrate command of the conventions of Standard English capitalization, punctuation, and spelling when writing.

CCRA.L.4 Determine or clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized reference materials, as appropriate.

CCRA.L.5 Demonstrate understanding of word relationships and nuances in word meanings.

CCRA.L.6 Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level;

demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.

DISTRICT ESLRS to be ADDRESSED:

Students will be:

- **Self Directed Learners:** Students will constantly be challenged to rethink ideas or concepts. They must learn to solve problems and track their own learning to evaluate their level of proficiency. Students will know what they are expected to learn and thus will create an environment where students take ownership of their learning.
- **Effective Communicators:** Students will be assessed in many different ways. They will learn how to articulate what they know so they can be evaluated. Students will learn what form of communication works best for them.
- **Quality Producer/ Performer:** Students will produce a number of lab reports and projects to demonstrate their understanding of content.
- **Constructive Thinkers:** Students will be tasked to solve various problems throughout the course. This is how students will gain the knowledge and skills asked of them. No longer can they sit back and be passive learners. Students must engage and think through problem sets to learn the material.
- **Collaborative Workers:** Students will be teamed together through much of the course. They will learn how to work with other students to achieve a goal. They will research certain diseases, jobs/careers, and will give advice on how to improve certain medical concepts.
- **Responsible Citizens:** Through this course, students will learn how the medical field can impact themselves and their family. They will be able to identify factors that make certain treatments effective, as well as ineffective. They will be able to make informed choices on health risks of both themselves and their family members.