Fairfield Public Schools
Science Curriculum

Draft Units

Human Anatomy and Physiology - Brains, Bones, and Brawn

Human Anatomy and Physiology - Brains, Bones, and Brawn: Description

Standards for this course are taken from the *Next Generation Science Standards* and are of three types:

Disciplinary Core Ideas (DCIs): Shown as content objectives, these standards define what students should know about the most essential ideas in the major science disciplines. The focus is on a limited number of core ideas in science and engineering both within and across the disciplines to avoid the shallow coverage of a large number of topics and to allow more time for teachers and students to explore each idea in greater depth. Reduction of the sheer sum of details to be mastered is intended to give time for students to engage in scientific investigations and argumentation and to achieve depth of understanding of the core ideas presented.

Science and Engineering Practices (SEP): These standards enable students to apply the content in the DCI's and the skills of practicing scientists and engineers to explain phenomena and solve real world problems. Engaging in the practices of science helps students understand how scientific knowledge develops; such direct involvement gives them an appreciation of the wide range of approaches that are used to investigate, model, and explain the world. Engaging in the practices of engineering likewise helps students understand the work of engineers, as well as the links between engineering and science.

Crosscutting Concepts: These standards provide students with connections and intellectual tools that are related across the differing areas of disciplinary content and can enrich their application of practices and their understanding of core ideas. These broad concepts tie together the influence of engineering, technology, and science on society and the natural world.

http://www.nextgenscience.org/next-generation-science-standards

CROSS CUTTING CONCEPTS

Patterns: Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.

Cause and effect: Mechanism and explanation. Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.

Scale, proportion, and quantity. In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance.

Systems and system models. Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering.

Energy and matter: Flows, cycles, and conservation. Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.

Structure and function. The way in which an object or living thing is shaped and its substructure determine many of its properties and functions.

Stability and change. For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.

Human Anatomy and Physiology - Brains, Bones and Brawn

Course Essential Questions
• How is the human body designed to maintain structure and function? • How do the human body systems work together to maintain homeostasis? • What is the impact if a human body system does not function properly and fails to maintain homeostasis?

Course: Semester-at-a Glance

Unit	Title	Unit Essential Questions
1	Anatomical Terminology and Body Tissues	Why is a common language and specific terminology necessary for anatomical communication? Why are three different body planes needed to describe and observe the human body? Why are different body tissues necessary to perform all of the specific functions of the body?
2	Skeletal System and Joints	Why is a skeletal system necessary for the form and function of the human body? Why do bones go through a predictable pattern of growth and healing? What are the scientific names of the different bones? What are the main types of joints and how do they allow for different movements? Why are tendons and ligaments necessary for proper structure and function of the skeletal system? What types of disease and deficiencies affect the skeletal system?
3	Muscular System	Why is a muscular system necessary for the form and function of the human body? How does muscle contraction create movement at joints? What are the scientific names of the major muscles? How does muscle energy use change and adapt to meet physical demands? What types of disease and deficiencies affect the muscular system?
4	Nervous System	Why is a nervous system necessary for the form and function of the human body? What are the main parts of the nervous system? What are the scientific names and associated functions of the major regions of the brain? How are nerve impulses transmitted? What types of disease and deficiencies affect the nervous system?
5	Integumentary System (Skin)	Why is an integumentary system necessary for the form and function of the human body? What are the scientific names and associated functions of the major parts of the skin? What determines variations in skin color? What types of diseases and injuries affect the skin?

Unit 1: Anatomical Terminology and Body Tissues

Overview

To prevent misunderstanding, anatomists use an accepted set of terms that allow body structures and locations to be identified and communicated clearly. The human body exhibits many levels of structural complexity from cells and tissues to organs and organ systems. Groups of cells that are similar in structure and function are called tissues. The study of tissue types will provide a foundation for understanding how those tissues contribute to the structure and function of organs.

Unit Content Objectives

At the conclusion of this unit, students will be able to:

- **Utilize anatomical terminology.**
- **Identify the three major body planes and sections.**
- **Identify and discuss the relationship between structure and function of the different body tissues.**

Unit Essential Questions

- Why is a common language and specific terminology necessary for anatomical communication?
- Why are three different body planes needed to describe and observe the human body?
- Why are different body tissues necessary to perform all of the specific functions of the body?

Crosscutting Concepts

- Structure and Function
- Systems and System Models
- Scale, Proportion, and Quantity
- Stability and Change

NGSS Unit Standards

DISCIPLINARY CORE IDEAS (DCI):

LS1.A: Structure and Function

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

LS1.B: Growth and Development of Organisms

- In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism.

LS1.C: 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) 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)

SCIENCE AND ENGINEERING PRACTICES (SEP):

- Developing and Using Models
- Constructing Explanations and Designing Solutions
- Planning and Carrying out Investigations

Corresponding CT Core Standards:
ELA/Literacy –
Mathematics –

Unit 2: Skeletal System and Joints

Overview

The components of the skeletal system support the body and provide a framework. Skeletal muscles attach to bones to create movement at joints. Other functions of the skeletal system include protection, blood cell formation, and mineral storage. Bone structure will be examined at both the microscopic and macroscopic levels to relate structure to function.

- **Unit Content Objectives**

At the conclusion of this unit, students will be able to:

- **Label a human skeleton and account for all adult bones.**
- **Define the relative functions of the major regions of the skeleton.**
- **Identify the functions of bone.**
- **Compare and contrast the histology of compact and spongy bone.**
- **Trace the process of bone healing and remodeling.**
- **Analyze common disorders that affect the skeletal system.**
- **Classify joints structurally and functionally.**
- **Compare and contrast tendons and ligaments.**
- **Identify the symptoms and problems associated with common joint disorders.**

Unit Essential Questions

- Why is a skeletal system necessary for the form and function of the human body?
- Why do bones go through a predictable pattern of growth and healing?
- What are the scientific names of the different bones?
- What are the main types of joints and how do they allow for different movements?
- Why are tendons and ligaments necessary for proper structure and function of the skeletal system?
- What types of disease and deficiencies affect the skeletal system?

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Mathematics –

Unit 3: Muscular System

Overview

The muscles of the body are capable of contraction which results in movement. Muscle tissue movement may be under voluntary or involuntary control. Skeletal muscles generate the voluntary mobility of the body such as walking and running. Smooth muscle tissue is responsible for involuntary movements such as those required for digestion, blood flow, and heart contractions.

Unit Content Objectives

At the conclusion of this unit, students will be able to:

- **Identify and label major muscles and muscle groups.**
- **Associate major muscles with their actions.**
- **Compare and contrast the basic types of muscle tissue.**
- **Diagram the gross structure of a skeletal muscle.**
- **Analyze the sliding filament mechanism of muscle contraction.**
- **Compare and contrast the effects of aerobic exercise and resistance exercise on muscles.**
- **Analyze common disorders that affect the muscular system.**

Unit Essential Questions

- Why is a muscular system necessary for the form and function of the human body?
- How does muscle contraction create movement at joints?
- What are the scientific names of the major muscles?
- How does muscle energy use change and adapt to meet physical demands?
- What types of disease and deficiencies affect the muscular system?

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Unit 4: Nervous System

Overview

The nervous system is the body's fast-acting control system. It consists of the brain, spinal cord, nerves, and sensory receptors. The body must constantly respond to several external and internal stimuli. Sensory receptors detect these stimuli and send nerve impulses to the central nervous system, which assesses this information and responds by activating the appropriate body effectors.

Unit Content Objectives

At the conclusion of this unit, students will be able to:

- **Label the different anatomical parts and regions of the human brain.**
- **Categorize the structural and functional divisions of the nervous system.**
- **Classify neurons structurally and functionally.**
- **Summarize the functions of the major regions of the cerebral hemispheres, brain stem and cerebellum.**
- **Analyze common disorders that affect the nervous system.**

Unit Essential Questions

- Why is a nervous system necessary for the form and function of the human body?
- What are the main parts of the nervous system?
- What are the scientific names and associated functions of the major regions of the brain?
- How are nerve impulses transmitted?
- What types of disease and deficiencies affect the nervous system?

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Unit 5: Integumentary System (Skin)

Overview

The integumentary system is the external covering of the body. Functions of the integumentary system include waterproofing the body, protecting deeper tissues from injury, absorbing harmful UV radiation, and regulating body temperature. Temperature, pressure, and pain receptors located in the skin alert us to these stimuli at the body surface and respond appropriately, if necessary.

Unit Content Objectives

At the conclusion of this unit, students will be able to:

- **Label the anatomy of human skin.**
- **Identify the functions of the skin.**
- **Define the function of melanin and its role in skin color determination.**
- **Summarize the characteristics of burns.**
- **Analyze common disorders that affect the integumentary system.**

Unit Essential Questions

- Why is an integumentary system necessary for the form and function of the human body?
- What are the scientific names and associated functions of the major parts of the skin?
- What determines variations in skin color?
- What types of diseases and injuries affect the skin?

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