Indiana Department of Education
Academic Standards Course Framework

ANATOMY AND PHYSIOLOGY

Anatomy & Physiology is a course in which students investigate concepts related to Health Science, with emphasis on interdependence of systems and contributions of each system to the maintenance of a healthy body. Introduces students to the cell, which is the basic structural and functional united of all organisms, and covers tissues, integument, skeleton, muscular and nervous systems as an integrated unit. Through instruction, including laboratory activities, students apply concepts associated with Human Anatomy & Physiology. Students will understand the structure, organization and function of the various components of the healthy body in order to apply this knowledge in all health related fields.

Course Specifications

- DOE Code: 5276
- Recommended Grade Level: Grade 11-12
- Recommended Prerequisites: Biology
- Credits: 1 credit per semester, maximum of 2 semesters, maximum of 2 credits
- Counts as a Directed Elective or Elective for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas
- Fulfills a Core 40 Science course requirement for the General, Core 40, Core 40 with Academic Honors, and Core 40 with Technical Honors diplomas or counts as an Elective or Directed Elective for any diploma
- This course is aligned with postsecondary courses for Dual Credit
    - Vincennes University
        - BIOL 111/111L –Anatomy and Physiology
    - Ivy Tech
        - APHY 101 –Anatomy and Physiology I

Dual Credit
This course provides the opportunity for dual credit for students who meet postsecondary requirements for earning dual credit and successfully complete the dual credit requirements of this course.

Application of Content and Multiple Hour Offerings
Intensive laboratory applications are a component of this course and may be either school based or work based or a combination of the two. Work-based learning experiences should be in a closely related industry setting. Instructors shall have a standards-based training plan for students participating in work-based learning experiences. When a course is offered for multiple hours per semester, the amount of laboratory application or work-based learning needs to be increased proportionally.

Career and Technical Student Organizations (CTSOs)
Career and Technical Student Organizations are considered a powerful instructional tool when integrated into Career and Technical Education programs. They enhance the knowledge and skills students learn in a course by allowing a student to participate in a unique program of career and leadership development. Students should be encouraged to participate HOSA Health Occupations Student Association the CTSO for this area.

Content Standards

Domain – Levels of Organization in the Human Body: Cellular

Core Standard 1 Students confirm the different forms of cellular transport within the cell and across the plasma membrane.

Standards

AP-1.1 Verify anatomy and physiology and describe their subdivisions

AP-1.2 Analyze the functions of the organelles of the cell

AP-1.3 Evaluate the plasma membrane structure to active passive transport mechanisms

AP-1.4 Connect the difference between the transport processes relative to energy source, substances transported, direction, and mechanism

AP-1.5 Analyze the parts of a cell and their basic functions

Core Standard 2 Students synthesize stages and processes of somatic cell division and investigate cellular differentiation in the course of development and in the adult body.

Standards

AP-2.1 Analyze the functions of the parts of a microscope

AP-2.2 Analyze the phases of the cell cycle using models and a microscope

AP-2.3 Evaluate the key phases of the cell cycle and describe the key events in each phase, including cytokinesis

AP-2.4 Evaluate the process of cell division and why cells are considered living

AP-2.5 Verify gene and explain their functions

AP-2.6 Connect transcription and translation

Domain – Levels of Organization in the Human Body: Tissue and Organs

Core Standard 3 Students apply and adapt the role of adhesion molecules and how these contribute to tissue formation.

Standards

AP-3.1 Verify homeostasis and explain its significance

AP-3.2 Recommend the 11 organ systems of the body and identify their components

AP-3.3 Analyze common body movements

AP-3.4 Evaluate the anatomical position

AP-3.5 Choose the correct anatomical terms to describe body directions, regions, and body planes

AP-3.6 Evaluate the importance of water in the human body

AP-3.7 Connect the relationship between homeostasis imbalance and disease

AP-3.8 Verify anatomy and physiology and describe their subdivisions

AP-3.9 Choose the different levels of structural organization that make up the human body, and explain their relationship

AP-3.10 Choose and name the major body cavities and their subdivisions and list the major organs contained within them

Core Standard 4 Students analyze the relationships between and the histology and physiological functions of tissues and their cellular and biochemical composition.

Standards

AP-4.1 Choose the nine regions and four quadrants of the abdominopelvic cavity and list

organs they contain

AP-4.2 Synthesize chemical element and list the elements that form the bulk of body matter

AP-4.3 Choose the different levels of structural organization that make up the human body, and explain their relationships

AP-4.4 Confirm how negative and positive feedback maintain body homeostasis

AP-4.5 Name the different levels of structural organization that make up the human body

AP-4.6 Evaluate and locate the four basic tissue types of the body and explain their functions

AP-4.7 Verify atomic number, atomic mass, atomic weight, isotope, and radioisotope

AP-4.8 Verify the three types of chemical reactions: synthesis, decomposition, and exchange

AP-4.9 Verify acid and base, and explain the concept of PH

AP-4.10 Establish and compare the building blocks, general structures, and biological functions of carbohydrates, proteins, lipids, and nucleic acids

Domain – Movement and Support in the Human Body: The Integumentary System

Core Standard 5 Students analyze the structure of the skin, including layers as well as accessory structures such as hair follicles, glands, and nails.

Standards

AP-5.1 Identify the microscopic anatomy, location, and roles of the four basic tissue types

AP-5.2 Identify mucous, serous, and synovial membranes

Core Standard 6 Students connect the function of the Integumentary system and the cause and effect of diseases associated with the integumentary system.

Standards

AP-6.1 Verify the functions of the skin

AP-6.2 Analyze the roles of the specific layers of the skin

AP-6.3 Describe the structure and functions of the accessory structures o f the skin

AP-6.4 Identify the gross anatomy of the skin and the accessory structures

Domain – Movement and Support in the Human Body: Skeletal System

Core Standard 7 Students evaluate the structure, development, growth, and functions of bones.

Standards

AP-7.1 Analyze the major regions of the skeleton and describe their relative functions

AP-7.2 Select and describe common body movements

AP-7.3 Select and provide examples of the types of synovial joints

AP-7.4 Synthesize the structure and function of the gross and microscopic structures of skeletal muscle

AP-7.5 Select the four bone classes and provide examples of each

AP-7.6 Choose and describe the functions of the bone

AP-7.7 Evaluate the gross anatomy of a typical long bone

AP-7.8 Analyze the histology of compact and cancellous bone

AP-7.9 Verify inorganic and organic portions of the bone

AP-7.10 Verify intramembranous and endochondral ossification

AP-7.11 Verify the role of osteoblasts, osteobytes, and osteoclasts

Ap-7.12 Connect how hormones and stress regulate bone remodeling

AP-7.13 Verify the steps in fracture repair

AP-7.14 Analyze microscopic structures of bone

AP-7.15 Analyze the major parts of the axial and appendicular skeleton

AP-7.16 Evaluate the structures of a typical vertebrae and identify regional features of cervical, thoracic, and lumbar vertebrae

AP-7.17 Evaluate the skull bones and their major features

AP-7.18 Analyze bones of the thoracic cage

AP-7.19 Evaluate bones forming the pectoral girdle and their major features

AP-7.20 Analyze the bones of the upper limbs and their major features

AP-7.21 Evaluate the bones of the lower limb and their major features

AP-7.22 Choose characteristics of the fetal skull

AP-7.23 Select the bones of the os coxa and their major features

Domain – Movement and Support in the Human Body: The Muscular System

Core Standard 8 Students connect physiology and structure of skeletal, smooth, and cardiac muscle as they interact to provide movement and support of the human body.

Standards

AP-8.1 Analyze the sliding filament model of muscle contraction

AP-8.2 Evaluate the methods that are used to produce ATP for muscle contraction

AP-8.3 Select the different types of muscle contraction

AP-8.4 Establish four important functions of muscle tissue

AP-8.5 Verify microscopic anatomy of skeletal muscle

AP-8.6 Select the location of the major skeletal muscles

AP-8.7 Evaluate the definition of origin, insertion and action of a muscle and identify the O, I, A of one muscle from each region of the body

Core Standard 9 Students evaluate the microscopic structure, organization, functions, and molecular basis of contraction in skeletal, smooth, and cardiac muscle.

Standards

AP-9.1 Choose the types of skeletal muscle fibers (fast-twitch, slow twitch)

AP-9.2 Choose muscle twitch, tetnas, and motor unit

AP-9.3 Connect the gross, microscopic anatomy, contractile mechanisms of smooth muscle and cardiac muscle to skeletal muscle

AP-9.4 Describe the structure and function of the gross and microscopic structures of skeletal muscle

AP-9.5 Choose characteristics of the three major types of levers

Domain – Integration and Coordination in the Human Body: The Nervous System

Core Standard 10 Students establish the nervous system consists of two parts: the peripheral nervous system and the central nervous system, and understand the structure and function of each.

Standards

AP-10.1 Describe the basic functions of the nervous system

AP-10.2 Explain the basic functions of the nervous system

AP-10.3 Describe functions and differences in the parts of the autonomic nervous system

AP-10.4 Describe in the parts of the autonomic nervous system.

AP-10.5 Identify characteristics of sensory receptors

AP-10.6 Describe olfactory receptors and their role in the physiology of smell

AP-10.7 Describe gustatory receptors and their role in the physiology of taste

AP-10.8 Describe neurotransmitters and explain their roles in synaptic transmission

AP-10.9 Name the components of a reflex arc and identify their roles in nervous system function

AP-10.10 Identify the component of parts of the brain and spinal cord

Core Standard 11 Students apply concepts of contemporary electrophysiological technologies such as (for example) electroencephalogram (EEG), electrocardiogram (ECG), transcutaneous electrical nerve stimulation (TENS) and cardioversion.

Standards

AP-11.1 Define resting membrane potential and describe its electrochemical basis

AP-11.2 Compare and contrast action and graded potentials

AP-11.3 Explain how action potentials are generated and propagated along neurons

AP-11.4 Identify gross and microscopic anatomy of nervous tissue

AP-11.5 Identify the protective roles of the cranial bones, meanings, and cerebrospinal fluid

AP-11.6 Identify the component parts of a reflex arc

AP-11.7 Identify the gross and microscopic anatomy of the eye

AP-11.8 Identify the gross and microscopic anatomy of the ear

Domain – Integration and Coordination in the Human Body: Somatic and Special Senses.
Core Standard 12 Students connect somatic senses and special senses and classify sensory receptors according to the types of stimuli that activate them.

Standards

AP-12.1 Verify the division, origin, and function of component parts of the brain

AP-12.2 Evaluate the functions of the cranial nerves

AP-12.3 Analyze the gross and microscopic structure of the spinal cord

AP-12.4 Connect the anatomy and physiology of sensory and motor pathways in the brain and spinal cord

Domain – Integration and Coordination in the Human Body: The Endocrine System
Core Standard 13 Students apply and adapt the structure and function of the endocrine system in relation to homeostasis, including a discussion of the specific role of hormones and distinguishing between endocrine glands and endocrine cells found in other organs.

Standards

AP-13.1 Establish the general function of the endocrine system

AP-13.2 Verify gland and differentiate between endocrine glands

Domain – Absorption and Excretion in the Human Body: The Respiratory System
Core Standard 14 Students verify and locate major organs of the respiratory system and discuss their functions.

Standards

AP-14.1 Confirm the general functions of the respiratory system

AP-14.2 Choose the mechanisms of gas exchange in the lungs and tissues

Core Standard 15 Students evaluate the breathing processes (i.e. inspiration, expiration, respiratory volumes and capacities).

Standards

AP-15.1 Connect how oxygen is carried in the blood and what influences oxygen loading and unloading

AP-15.2 Establish the processes of internal and external respiration

Domain – Absorption and Excretion in the Human Body: The Urinary System

Core Standard 16 Students evaluate and locate major organs of the urinary system and discuss their functions.

Standards

AP-16.1 Establish the general functions of the urinary system

AP-16.2 Apply and adapt the regulation of water intake and output

AP-16.3 Integrate the major fluid compartments including intracellular, intravascular and interstitial

Core Standard 17 Students analyze the function of the kidneys in relation to homeostatic control of bodily fluids, blood pressure and erythrocyte production.

Standards

AP-17.1 Analyze the functional process of urine formation, including filtration, re-absorption, and secretion.

AP-17.2 Select factors that regulate urine volume and composition

AP-17.3 Evaluate buffer systems and their role in acid/base balance

Domain – Transport in the Human Body: The Blood

Core Standard 18 Students evaluate the process of homeostasis and how it is achieved.

Standards

AP-18.1 Evaluate the process of homeostasis, including coagulation

Core Standard 19 Students analyze the functions of the blood including its role in responding to invading microorganisms, its defense mechanisms (e.g. acute inflammation), and the immune response.

Standards

AP-19.1 Analyze the general functions of the blood

AP-19.2 Evaluate the composition and function of plasma

AP-19.3 Analyze the composition and function of the formed elements of the blood

AP-19.4 Evaluate the functional roles and characteristics of the different types of blood vessels

AP-19.5 Verify how carbon dioxide is carried in the blood

AP-19.6 Connect the regulation of blood volume, heart rate, stroke, volume, cardiac output and blood pressure

Domain – Transport in the Human Body: The Cardiovascular System

Core Standard 20 Students apply concepts and locate the organs of the cardiovascular system and discuss their functions.

Standards

AP-20.1 Select the general functions of the cardiovascular system

AP-20.2 Verify the physiology of cardiac muscle contraction

Core Standard 21 Students manage the cardiac cycle and explain how it is controlled.

Standards

AP-21.1 Integrate the cardiac cycle, including basic rhythm of heart beat, and pressure and volume changes

AP-21.2 Connect control of pulmonary ventilation

Domain – Transport in the Human Body: The Lymphatic System and Immune Mechanisms

Core Standard 22 Students select the major organs of the lymphatic system and discuss their functions.

Standards

AP-22.1 Analyze the general functions of the lymphatic system

Core Standard 23 Students establish the lines of defense including the cellular and non-cellular components of the immune system.

Standards

AP-23.1 Evaluate the pattern of lymph circulation

Domain – Absorption and Excretion in the Human Body: The Digestive System

Core Standard 24 Students synthesize and locate major and accessory organs of the digestive system and discuss their functions.

Standards

AP-24.1 Verify the mechanical and chemical processes of digestion and absorption

AP-24.2 Confirm hormonal and neural regulation of digestive processes

Core Standard 25 Students evaluate the digestive processes from ingestion to defecation.

Standards

AP-25.1 Choose the functions of the different organs of the gastrointestinal tract and the accessory organs of digestion

Domain – The Life Cycle in the Human Body: The Reproductive System

Core Standard 26 Students analyze and locate major and accessory organs of the female reproductive systems and discuss their functions including oogenesis and spermatogenesis.

Standards

AP-26.1 Evaluate the general functions of the reproductive system

AP-26.2 Select the specific roles of the ovaries, fallopian tubes, uterus, and vagina

AP-26.3 Integrate the developmental highlights or an embryo and fetus

AP-26.4 Design the birth process

Core Standard 27 Students connect the role of hormones in the reproductive system.

Standards

AP-27.1 Establish the specific roles of the testes, epididymis vas deferens, seminal vesticles, prostate, bulbourethral glands, and urethra

AP-27.2 Analyze the hormonal changes during the menstrual cycle

AP-27.3 Verify the hormonal changes that occur during pregnancy

AP-27.4 Describe sex determination

Process Standards

Common Core Literacy Standards for Technical Subjects

Reading Standards for Literacy in Technical Subjects 11-12

The standards below begin at grade 11 and define what students should understand and be able to do by the end of grade 12. The CCR anchor standards and high school standards in literacy work in tandem to define college and career readiness expectations – the former providing broad standards, the latter providing additional specificity.

Key Ideas and Details

11-12.RT.1 Cite specific textual evidence to support analysis of technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

11-12.RT.2 Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

11-12.RT.3 Follow precisely a complex multistep procedure when performing technical tasks; analyze the specific results based on explanations in the text.

Craft and Structure

11-12.RT.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific context relevant to *grades 11-12 texts and topics*.

11-12.RT.5 Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.

11-12.RT.6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.

Integration of Knowledge and Idea

11-12.RT.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

11-12.RT.8 Evaluate the hypotheses, data, analysis, and conclusions in a technical subject, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

11-12.RT.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

Range of Reading and Level of Text Complexity

11-12.RT.10 By the end of grade 12, read and comprehend technical texts in the grades 11-CCR text complexity band independently and proficiently.

Writing Standards for Literacy in Technical Subjects 11-12

The standards below begin at grade 11 and define what students should understand and be able to do by the end of grade 12. The CCR anchor standards and high school standards in literacy work in tandem to define college and career readiness expectations – the former providing broad standards, the latter providing additional specificity.

Text Types and Purposes

11-12.WT.1 Write arguments focused on *discipline-specific content*.

11-12.WT.2 Write informative/explanatory texts, including technical processes.

11-12.WT.3 Students will not write narratives in technical subjects. *Note: Students' narrative*

skills continue to grow in these grades. The Standards require that students be able to incorporate narrative elements effectively into arguments and informative/explanatory texts. In technical, students must be able to write precise enough descriptions of the step-by-step procedures they use in their technical work that others can replicate them and (possibly) reach the same results.

Production and Distribution of Writing

11-12.WT.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

11-12.WT.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

11-12.WT.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

Research to Build and Present Knowledge

11-12.WT.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

11-12.WT.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectivity to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation

11-12.WT.9 Draw evidence from informational texts to support analysis, reflection, and research.

Range of Writing

11-12.WT.10 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.