

# Anatomy and Physiology

<b>Primary Career Cluster:</b>	Health Science
<b>Course Content:</b>	<a href="mailto:CTE.Standards@tn.gov">CTE.Standards@tn.gov</a>
<b>Course Code(s):</b>	C14H09
<b>Prerequisite(s):</b>	Suggested prerequisite: <i>Health Science Education</i> (C14H14). Suggested prerequisite or co-requisite: <i>Biology I</i> (G03H53)
<b>Credit:</b>	1
<b>Grade Level:</b>	10-12
<b>Focus Elective Graduation Requirements:</b>	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Health Science courses. In addition, satisfies one credit of laboratory science required for graduation.
<b>POS Concentrator:</b>	This course satisfies one out of two required courses to meet the Perkins V concentrator definition, when taken in sequence in the approved program of study.
<b>Programs of Study and Sequence:</b>	This is the second or third course in the <i>Diagnostic Services, Nursing Services, Emergency Services, Therapeutic Services</i> and <i>Sport and Human Performance</i> programs of study.
<b>Aligned Student Organization(s):</b>	HOSA: <a href="http://www.tennesseehosa.org">http://www.tennesseehosa.org</a>
<b>Coordinating Work-Based Learning:</b>	Teachers are encouraged to use embedded WBL activities such as informational interviewing, job shadowing, and career mentoring. For information, visit <a href="https://www.tn.gov/education/career-and-technical-education/work-based-learning.html">https://www.tn.gov/education/career-and-technical-education/work-based-learning.html</a> .
<b>Promoted Tennessee Student Industry Credentials:</b>	Credentials are aligned with postsecondary and employment opportunities and with the competencies and skills that students acquire through their selected program of study. For a listing of promoted student industry credentials, visit <a href="https://www.tn.gov/education/career-and-technical-education/student-industry-certification.html">https://www.tn.gov/education/career-and-technical-education/student-industry-certification.html</a>
<b>Teacher Endorsement(s):</b>	577, 720
<b>Required Teacher Certifications/Training:</b>	None
<b>Teacher Resources:</b>	<a href="https://www.tn.gov/education/career-and-technical-education/career-clusters/cte-cluster-health-science.html">https://www.tn.gov/education/career-and-technical-education/career-clusters/cte-cluster-health-science.html</a> Best for All Central: <a href="https://bestforall.tnedu.gov/">https://bestforall.tnedu.gov/</a>

## Course at a Glance

CTE courses provide students with an opportunity to develop specific academic, technical, and 21st century skills necessary to be successful in career and in life. In pursuit of ensuring every student in Tennessee achieves this level of success, we begin with rigorous course standards which feed into intentionally designed programs of study.

Students engage in industry relevant content through general education integration and experiences such as career & technical student organizations (CTSO) and work-based learning (WBL). Through these experiences, students are immersed with industry standard content and technology, solve industry-based problems, meaningfully interact with industry professionals and use/produce industry specific, informational texts.

### Using a Career and Technical Student Organization (CTSO) in Your Classroom

CTSOs are a great resource to put classroom learning into real-life experiences for your students through classroom, regional, state, and national competitions, and leadership opportunities. Below are CTSO connections for this course, note this is not an exhaustive list.

- Participate in CTSO Fall Leadership Conference to engage with peers by demonstrating logical thought processes and developing industry specific skills that involve teamwork and project management
- Participate in contests that highlight job skill demonstration; interviewing skills; community service activities, extemporaneous speaking, and job interview
- Participate in leadership activities such as Organizational Leadership, Prepared Speaking, HOSA Service Project, Creative Problem Solving, and HOSA Service Project.

For more ideas and information, visit Tennessee HOSA at <http://www.tennesseehosa.org/>

### Using Work-based Learning in Your Classroom

Sustained and coordinated activities that relate to the course content are the key to successful work-based learning. Possible activities for this course include the following. This is not an exhaustive list.

- **Standards 1.1- 2.5** | Job shadow an exercise physiologist, athletic trainer, or physical therapist.
- **Standards 3.1-3.4** | Interview a patient with an endocrine or neurological disorder to practice preparing a history and physical report.
- **Standards 4.1- 4.8** | Participate in a service-learning project for the American Heart Association or the American Lung Association.
- **Standards 5.1- 5.4** | Visit a dialysis center or work with a dietitian to create a school wide diabetes awareness project.
- **Standards 6.1- 6.2** | Interview a genetics counselor

For more ideas and information, visit <https://www.tn.gov/education/career-and-technical-education/work-based-learning.html>.

## Course Description

*Anatomy and Physiology* is designed to develop an understanding of the structures and functions of the human body, while relating those to knowledge and skills associated with pathophysiology. Upon completion of this course, proficient students will be able to (1) apply the gross anatomy from earlier courses to a deeper understanding of all body systems, (2) identify the organs and structures of the support and movement systems, (3) relate the structure and function of the communication, control, and integration system, and (4) demonstrate a professional, working understanding of the transportation, respiration, excretory, and reproduction systems.

## Program of Study Application

This is the second or third level course in the *Diagnostic Services, Nursing Services, Emergency Services, Therapeutic Services, and Sport and Human Performance* programs of study. For more information on the benefits and requirements of implementing these programs in full, please visit the Health Science website at <https://www.tn.gov/education/career-and-technical-education/career-clusters/cte-cluster-health-science.html>.

## Course Standards

### 1. Organization of the Human Body

- 1.1 Organization of the body: Review the relationship between anatomy and physiology (A&P) from previous courses differentiating the **major organ systems** of the human body by their anatomy and physiology and engage in an argument about defined boundaries due to their **functional connectivity**. Characterize the organizational levels of the human body and observe patterns in **cell types and tissue types** across organ systems.
- 1.2 Body cavities and directional terms: Use a human model to differentiate the **major body cavities and organs** located within them. Describe the model using proper anatomical and **directional terminology** for **body regions, planes, and cavities**.
- 1.3 Homeostasis and feedback mechanisms: Evaluate how organisms use **positive and negative feedback mechanisms** to maintain their **internal environment** and respond to **external environmental changes**. Investigate possible consequences that can occur if the body does not maintain **homeostasis**. Summarize how **cellular metabolism** can affect the body's homeostatic state.

### 2. Support and Movement

- 2.1 Integumentary system: Analyze the **anatomical structures of the integumentary system** and investigate their role in the physiological processes of **protection, temperature homeostasis, and sensation**. Assess the microscopic components of the **skin layers** in a cross-sectional image summarizing potential **diseases, disorders, and syndromes** possible for each layer.

- 2.2 Bone formation, growth, and repair: Summarize the **processes of bone formation, growth, and repair**. Diagram **microscopic bone structures**, identifying regions that participate in **hematopoiesis** and **storage of minerals and fat**. Discuss **diseases and disorders** of the skeletal system as they relate to **bone formation, growth, repair, hematopoiesis, and storage of minerals and fat**.
- 2.3 Skeletal anatomy, function, and movement: Label on a skeleton, the **major bones** within the **axial and appendicular divisions**, relating their **physiological roles** in creating a body scaffold, internal organ protection, and anchor points for skeletal muscles participating in movement. Demonstrate the generation of **movement of bones through antagonistic muscle groups**.
- 2.4 Joints and articulation: Classify joints based on their **structure and function**. Compare and contrast the **three types of joints** and provide an example of each including the involvement of tendons, ligaments, bursae, and cartilage where applicable. Determine the **effects of various types of arthritis** on each category of joint.
- 2.5 Types of muscle and muscle anatomy, physiology, and pathophysiology: Differentiate **visceral, cardiac, and skeletal muscle tissues** based on anatomical criteria and their physiological role in the movement of body parts and/or substances. Model the **gross and microscopic anatomy of skeletal muscle and muscle fibers** and provide examples of possible **pathophysiology**. Use the model to highlight **major muscle groups** and explain the **physiology of skeletal muscle contraction**.

### 3. Communication, Control, and Integration

- 3.1 Hormones and the endocrine system: Relate the **hormones produced by the endocrine system** to the glands that produce them and their **effects on target organs** using the concept of **negative feedback**. Explain the relationship between **receptors and ligands** and differentiate between **steroid and non-steroid hormones as ligands**.
- 3.2 Nervous system anatomy: Compare and contrast the anatomy of the **central nervous system** and the **peripheral nervous system** including possible **diseases and disorders** of each. Link structures to their physiological roles and include the **structure and function of the somatic and autonomic nervous systems** in the explanation. Interpret the importance of **cerebrospinal fluid** and its connection to circulation including the phenomenon of the **blood-brain barrier** within the brain in the explanation.
- 3.3 Neurons and action potentials: Label the **cellular and subcellular structures of neurons** and explain the **molecular neurophysiology of membrane potentials** and the conduction of information through **synaptic transmission**. Evaluate the process of **action potentials** of the nervous system and name the factors that affect the speed at which a nerve impulse travels.

3.4 Central nervous system and sensory systems: Model the **major parts of the brain and spinal cord** relating each to its **source of sensory information** and/or its primary target of regulation. Identify and describe the **types of sensory receptors** found in the human body and explain the structures, functions, and limitations of the human sensory systems: **hearing, balance/proprioception, sight, touch, smell, and taste.**

#### 4. Respiration, Transportation, and Defense

4.1 Cardiac anatomy and circulation Create an artifact to outline the **structure and functions of the cardiovascular system**, paying special attention to the musculature of the walls, the chambers, and the valves of the heart and blood vessels. Demonstrate the **circulation of blood through the heart** comparing and contrasting **systemic and pulmonary circulation.**

4.2 Electrophysiology and the cardiac cycle Describe the phases of the **cardiac cycle** and the heart's **internal and external control mechanisms** involved in producing the heartbeat. Discuss how **heart rate** and **cardiac output** relate to one another. Listen to **heart sounds**, either digitally or with a stethoscope, to identify the **normal and abnormal sounds** made during the cardiac cycle. Give reasons for the abnormal sounds encountered.

4.3 Blood pressure and homeostasis: Create or use a model of the human heart to clarify **systole and diastole** related to **blood pressure** and the factors affecting **blood pressure's role in homeostasis.** Discuss the heart's **intrinsic and extrinsic control mechanisms** involved in producing a heartbeat.

4.4 Respiratory anatomy and physiology and pathophysiology of the cardiorespiratory system Examine how the **anatomy of the respiratory system** functions to provide **oxygen and carbon dioxide transport mechanisms** between the lungs and the circulatory system, considering **capillary structures, red blood cell structures, diffusion and affinity.** Discuss **pathophysiology of the cardiorespiratory system** and its effects on the human body.

4.5 Blood and its components: Identify the **liquid and cellular components of blood** using appropriate medical terminology. Summarize the structural characteristics, normal levels, function and life span of each. Analyze **how and where each component is manufactured** (i.e., as with **hematopoiesis and erythropoiesis**) and the **possible complications** with the development of cellular components.

4.6 Blood typing: Breakdown the **roles of antigens and antibodies** in the blood while explaining the **ABO system** and **Rh classification system.** In a lab setting with simulated blood, determine the ABO and Rh of samples with an explanation of results including a description of **cross-matching** and the causes and possible outcomes of a **transfusion reaction.**

- 4.7 Structure and function of the lymphatic system: Assess the relationship between the **structure and function of the lymphatic system**. Differentiate between **innate and adaptive immunity**, the cells involved, and how each functions to maintain **homeostasis** in the body.
- 4.8 Temperature homeostasis: Interpret the relationship between the **integumentary, muscular, and cardiovascular systems in temperature homeostasis**. Relate how malfunctions in any of the three systems can affect temperature regulation.

## 5. Nutrition, and Excretion

- 5.1 Gastrointestinal system and the hepatic portal system Model the **sequential organization of the alimentary canal** and its **accessory organs** in order to describe the physiological role of each including a discussion of the **major digestive enzymes and hormones** produced along with their functions. Outline how the **hepatic portal system** couples the digestive and cardiovascular systems.
- 5.2 Absorption and transport Analyze **gastrointestinal wall histology** and interpret how the anatomical architecture supports the efficient **absorption and transport of molecules** into the cardiovascular or lymphatic circulation. Discuss **possible outcomes of a disruption** of this process.
- 5.3 Lipid transport: Demonstrate the **progression of lipid transport** from the digestive system, through the lymphatic system, and into the cardiovascular circulation.
- 5.4 Blood filtration and waste excretion by the urinary system: Design a concept map of the **structures of the urinary system** to establish the **physiological role of blood filtration and waste excretion from the body**. Include a detailed description of the **parts of a nephron** and how they assist in homeostatic mechanisms through **urine formation**. Clarify how **disorders of the urinary system** affect homeostasis.

## 6. Reproduction, Growth, and Development

- 6.1 Reproductive system anatomy and physiology: Outline the **structure and function of the male and female reproductive systems** that provide the physiological functions of **gametogenesis, fertilization, and embryogenesis**, based on the **secretion of hormones**. Correlate the **endocrine tissues of the reproductive system** with their roles in regulation of secondary sex characteristics, the female menstrual cycle, pregnancy, fetal development, and parturition.
- 6.2 Egg, sperm, and fertilization: Examine the **microscopic structures of the human egg and sperm** and determine how those structures relate to their function. Evaluate the **process of fertilization** then create a timeline of the phases of fetal development from fertilization until birth. Describe the abnormalities that can occur at each phase.

**The following artifacts are to reside in the student's portfolio:**

***One artifact from each of the following content areas:***

- a. Support and Movement
- b. Communication, Control, and Integration
- c. Respiration, Transportation and Defense
- d. Nutrition, and Excretion
- e. Reproduction, Growth, and Development

## **Standards Alignment Notes**

\*References to other standards include:

- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning](#)
  - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.