Anatomy and Physiology

Grade 12

Prerequisite: Physics

Credit Value: 5

ABSTRACT

Comparative Anatomy and Physiology is a science course designed for students who are considering enrolling in a post-secondary program with emphasis on the life science and/or health science fields. The course focuses on important concepts in comparative anatomy and physiology, including the muscular, skeletal, digestive, circulatory, integumentary, respiratory, and nervous systems of the body. The dissection of higher-level mammals is used as a tool for comparative analysis of the major body systems.

Adopted by the Somerville Board of Education on July 25, 2017
# Anatomy and Physiology – Grade 12

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<tr>
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### Essential Question:
- How does structure relate to function in living systems from the organismal to the cellular level?
- How does the specialization of tissue relate to location?
- How does the skeletal system provide a framework to support the rest of the body?
- How does the evolution of the human musculature affect a full range of movement?

### Content:
- **Introduction to Anatomy and Physiology**
- **Tissue Organization and The Integumentary System**
- **The Skeletal System**
- **The Muscular System**

### Skills and Topics:
- Define anatomy and physiology and describe areas of specialty for each discipline (e.g., careers)
- Identify the major levels of organization in living organisms from simplest to most complex
- Identify the organ systems of the human body and the major components of each system
- Justify the importance of homeostasis
- Use anatomical terms to describe body sections, body regions, and relative positions
- Identify the major body cavities and their subdivisions
- Identify the body's major types of tissue and their roles
- Describe the types and functions of each epithelial tissue type
- Detail the structure and function of types of connective tissue
- Distinguish among types of muscle tissue and the function of each
- Analyze how aging and ultraviolet radiation affects tissues and the skin
- Explain the function and role of the integumentary system
- Explain the causes of variation in pigmentation
- Describe the dynamic movements of the skeleton and muscle articulation
- Explain how the skin responds to injury and how it repairs itself
- Discuss the function of the accessory organs/glands of the skin
- State the function of the skeletal system
- Compare and contrast the major types of bone (e.g., long, short, flat, irregular)
- Identify the structure of long bones and bone markings
- Describe the formation of the bony skeleton
- Analyze the function and development of both compact and spongy bone
- Identify major landmarks on various bones within the body
- Identify the bones of the skull and cranium and discuss their structure and function
- Identify the structure and function of the bony thorax
- Identify the form and function of the bones of the arm, forearm, and hand
- Compare and contrast skeletal, cardiac, and smooth muscle tissue by their structure and function
- Identify the characteristics and role of skeletal muscle
- Identify and relate connective tissue wrappings
- Describe the organization and components of muscular tissue
- Explain how muscle tissue contracts and describe different types of muscle contractions
- Distinguish between aerobic endurance and anaerobic endurance and the demands placed on muscles during activity
- Discuss the function of the accessory organs/glands of the skin
- Explain how the skin responds to injury and how it repairs itself
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<tr>
<td>• distinguish among types of joints and how joint structure affects mobility</td>
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<td>• identify and locate the projections of the pelvic girdle</td>
<td>• relate muscle effects of exercise and aging</td>
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<td>• recognize and classify the bones of the lower limbs and feet</td>
<td>• explain the function of axial and appendicular muscles according to their origin, insertion, and action</td>
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<td>• distinguish among types of bone fractures and their repair</td>
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<td>• explore bone abnormalities</td>
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<td>• (e.g., arthritis, gigantism, osteoporosis)</td>
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<td></td>
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<td>• differentiate between the axial and appendicular skeletons</td>
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<td></td>
<td>• identify the components of the axial and appendicular skeletons</td>
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<td>• discuss the functions of different vertebral regions (e.g., cervical, thoracic, lumbar, sacral)</td>
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<td>• identify the muscles associated with the axial skeleton: head, neck, back, and trunk</td>
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<td>• identify the muscles associated with the appendicular skeleton</td>
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<td><strong>Summative Assessments:</strong></td>
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<tr>
<td><strong>Performance Assessments:</strong></td>
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<td>Health/PE: 2.1.12.A.1-2, 2.1.12.B.1-3, 2.1.12.C.1-3, 2.1.12.D.1, 2.2.12.A.1, 2.2.12.A.3, 2.2.12.D.1, 2.3.12.A.1</td>
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*2016 NJSLS:
  - RL: Reading Literature
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  - W: Writing
  - SL: Speaking and Listening
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  - S: Statistics and Probability
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### Essential Question:
- How does the cardiovascular system contribute to homeostasis?
- How are the lungs, diaphragm, and ribs adapted for exchange of gases?
- How do tissues, organs, and glands work together to process nutrients?
- How do nervous impulses control different parts of the body?

### Content:
- The Circulatory System and Blood
- The Respiratory System
- The Digestive System
- The Brain and Senses

### Skills and Topics:
- Explain various transport mechanisms within the body
- Define the components of plasma
- Describe the components and function of blood
- Identify factors that determine a person's blood type
- Identify the types of blood vessels
- Describe the general features of the heart
- Trace blood flow through the heart, identifying major blood vessels, chambers, and heart valves
- Explain how blood flow is maintained
- Describe the factors that influence blood pressure and how it is regulated
- Locate and describe the structure of the pericardium and the heart wall
- Discuss the external and internal anatomy of the chambers of the heart
- Describe the primary functions of the respiratory system
- Trace the passage of air through the system
- Explain the process of gas exchange through breathing, internal respiration, and external respiration
- Explain the mechanics of breathing
- Identify the structure and function of the lungs and pleural coverings
- Describe the anatomy of the respiratory membrane and the events of respiration
- Identify respiratory disorders
- Describe factors that influence the rate of respiration
- Describe the muscles involved in respiratory movements
- Explain how Boyle's law is used in breathing
- Determine vital lung capacity
- Describe the basic processes performed by the digestive system
- Identify the location of the salivary glands and describe the functions of their secretions
- Describe the structure and function of the tongue
- Analyze the parts of a typical tooth
- Describe the process of food mastication
- Explain the anatomy and functions of the oral cavity, pharynx, and esophagus
- Identify the organs of the digestive tract and explain the function of each
- Describe the location, anatomy, histology, and functions of the esophagus
- Describe the phases of deglutition
- Evaluate the structure and function of the layers forming the wall of the gastrointestinal tract
- Explain how positive and negative feedback are involved in homeostatic regulation
- Analyze the anatomical organization and the functions of the nervous system
- List the major regions of the brain and determine the actions of the body they control
- Describe the structure of nervous tissue and neuron anatomy
- Identify the lobes of the cerebrum and sensory/motor areas of the cerebral cortex
- Identify the parts of a reflex arc
- Map sensory and motor pathways
- Discuss hemispheric dominance and memory
- Identify the parts of the brain stem and discuss their functions
### Skills and Topics:

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<td><strong>Skills and Topics:</strong></td>
<td>• delineate the structure and function of heart valves within pulmonary and systemic circulation systems</td>
<td>• describe the location, anatomy, histology, and functions of the stomach, pancreas, liver, gall bladder, and small and large intestines</td>
<td>• distinguish between the central and peripheral nervous systems</td>
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<td>• discuss the structural and functional characteristics of the autonomic nervous control of the heart (e.g., pacemaker-vagus nerve)</td>
<td>• trace the passage of food through the digestive system</td>
<td>• explain the structure and function of the spinal cord</td>
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<td>• describe the conduction system of electrical stimulation to the sino-atrial node</td>
<td>• describe the anatomy and function of the stomach and its role in digestion and absorption</td>
<td>• describe the structure and classification of nerves</td>
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<td>• identify and explain the characteristics of heart sounds (lubb/dub)</td>
<td>• identify the major chemical reactions that are important for the body's physiology</td>
<td>• identify the and explain the function of cranial nerves based on the innervated area</td>
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<td>• relate the timing of heart sounds and pressure changes during diastole and systole</td>
<td>• locate and identify all accessory organs of the digestive system</td>
<td>• explore the causes and possible treatment of traumatic brain injuries</td>
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<td>• evaluate the landmarks on a common electrocardiogram (EKG)</td>
<td>• describe the structure and function of the pancreas, liver, and gall bladder and explain how their activities are regulated</td>
<td>• discuss the general senses: sound, vision, tactility</td>
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<td>• outline the vessels through which blood moves passing from the heart to the capillaries and back</td>
<td>• identify fluids that aid in the digestive process</td>
<td>• delineate special senses</td>
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<td>• outline factors that affect the regulation of heart rate (e.g., emotional, hormonal, physical)</td>
<td>• compare and contrast mechanical and chemical digestion</td>
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<td>• investigate cardiovascular diseases</td>
<td>• describe the digestion and absorption of carbohydrates, lipids, and proteins</td>
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<td>• explore pulmonary and peripheral congestion</td>
<td>• describe the phases of digestion and the hormones that regulate digestive activities</td>
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<td>• identify the major arteries and veins and their functions</td>
<td>• explain how the circulatory system responds to stress, emotions, and exercise</td>
<td>• identify the effects of age on the cardiovascular system</td>
<td>• evaluate the changes affecting the digestive system with age</td>
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**Integration of Technology:** Internet, Web Quests, wireless laptop computers, SMART Boards, multimedia presentations

**Writing:** Open-ended responses, conclusions and analysis of exploratory activities

**Formative Assessments:** Warm-up activities, exploratory activities, class discussions, student participation, quizzes

**Summative Assessments:** Projects, authentic assessments, quizzes, tests, final examination

**Performance Assessments:** Exploratory laboratory activities, analysis of medical case studies, evaluation of bioethical case studies

**Interdisciplinary Connections:**
- **ELA:** RST.1-10, WHST.1.a-e, WHST.2.a.e, WHST.3-10
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**21st Century Themes:**
- Financial Awareness
- Civic Literacy
- Financial, Economic, Business, and Entrepreneurial Literacy
- Health Literacy

**21st Century Skills:**
- Creativity and Innovation
- Media Literacy
- Critical Thinking and Problem Solving
- ICT Literacy
- Communication and Collaboration
- Information Literacy
- Life and Career Skills

**Resources:**

**Career Clusters:** Applicable career options are discussed as they arise throughout the science program. Career options include, but are not limited to, the Agriculture, Food, and Natural Resources Career Cluster; Arts, A/V Technology, and Communications Career Cluster; Education and Training Career Cluster; Health Science Career Cluster; Manufacturing Career Cluster; Marketing Career Cluster; Science, Technology, Engineering and Mathematics Career Cluster.

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  F: Functions
  G: Geometry
  S: Statistics and Probability*
Anatomy and Physiology
Course Requirements

Grade: 12  Prerequisite: Physics  Credit Value: 5
Length of Course: Academic Year

Course Description

Comparative Anatomy and Physiology is a science course designed for students who are considering enrolling in a post-secondary program with emphasis on the life science and/or health science fields. The course focuses on important concepts in comparative anatomy and physiology, including the muscular, skeletal, digestive, circulatory, integumentary, respiratory, and nervous systems of the body. The dissection of higher-level mammals is used as a tool for comparative analysis of the major body systems.

Course Content

This course will consist of the following units of study:

- Introduction to Anatomy and Physiology
- Tissue Organization and The Integumentary System
- The Skeletal System
- The Muscular System
- The Circulatory System and Blood
- The Respiratory System
- The Digestive System
- The Brain and Senses

Course Objectives

The student will demonstrate the ability to answer in detail the following essential questions:

- How does structure relate to function in living systems from the organismal to the cellular level?
- How does the specialization of tissue relate to location?
- How does the skeletal system provide a framework to support the rest of the body?
- How does the evolution of the human musculature affect a full range of movement?
- How does the cardiovascular system contribute to homeostasis?
- How are the lungs, diaphragm, and ribs adapted for exchange of gases?
- How do tissues, organs, and glands work together to process nutrients?
- How do nervous impulses control different parts of the body?
- What are the post-graduation and/or career options that apply to the course content?
Evaluation Process

A final average of 65% or better is required to be awarded course credit. Throughout the length of this course, students may be evaluated on the basis of, but not limited to:

- Formative Assessments, such as writing prompts, journals, and portfolios
- Summative Assessments, such as quizzes, tests, and midterm and final examinations
- Performance Assessments, such as projects and presentations
- Class Participation
- Homework

Specific weights will be determined by course and level.
Anatomy and Physiology
Student Agreement

STUDENT NAME: ____________________________________________

Last Name               First Name

GRADE: ________________

My signature below indicates that I have received a copy of the Somerville Public Schools Course Requirements for Anatomy and Physiology.

I acknowledge my responsibility to read and understand all of the information contained in the Anatomy and Physiology Course Requirements information and syllabus packet.

________________________________  ______________
Student Signature               Date

Note: Please share the course requirements for Anatomy and Physiology with your parents.