Oakwood City School District
Human Anatomy and Physiology

Human Anatomy and Physiology

This course offers a rigorous and challenging review of the human organism, its cells, tissues, organs and systems. Both normal functions and pathologies will be examined. The specific body systems to be studied and the sequence of investigation are detailed below.

This course meets the Graduation Requirements of an Advanced Science.

Science Inquiry and Application Standards

During the years of grades 9 through 12 all students must use the following scientific processes with appropriate laboratory safety techniques to construct their knowledge and understanding in all science content areas. These are ongoing skills that will be developed and intertwined within the content of the course.

- Identify questions and concepts that guide scientific investigations
- Design and conduct scientific investigations
- Use technology and mathematics to improve investigations and communications
- Formulate and revise explanations and models using logic and evidence (critical thinking)
- Recognize and analyze explanations and models
- Communicate and support a scientific argument

English Language Arts Standards for Science & Technical Subjects

I Key Ideas and Details

A Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

B 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.

C Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

II Craft and Structure

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

B Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.

C 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.

III Integration of Knowledge and Ideas

A 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.

B Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

C 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.

IV Range of Reading and Level of Text Complexity

A By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently.

Writing Standards for Science & Technical Subjects

I Text Types and Purposes Standard 1

A Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.

B Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.

C Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.

D Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

E Provide a concluding statement or section that follows from or supports the argument presented.

II Text Types and Purposes Standard 2

A Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

B Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.

C Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.

D Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.

E Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic).

III Production and Distribution of Writing

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

B 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.

C 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.

IV Research to Build and Present Knowledge

A 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.

B Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

C Draw evidence from informational texts to support analysis, reflection, and research.

V Range of Writing

A 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.

Oakwood City School District
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Content Standards

I Histology, Integumentary System

A Define the terms anatomy and physiology.
B Identify the principal systems of the human body.
C Define the anatomical position and compare common, anatomical terms used to describe various regions of the body.
D Define specific directional terms and anatomical planes used in association with the human body.
E Identify by name and location the principal body cavities, and organs contained within them.
F Define a tissue and classify the tissues of the human body.
G Describe the structure and functions of select cell junctions
H Describe the general features, functions, and specific examples of select epithelial tissue.
I Describe the general features, functions, and specific examples of select connective tissue.
J Describe the general features, functions, and specific examples of select muscle tissue.
K Describe the general features, functions, and specific examples of select nerve tissue.
L Describe the general features, functions, and specific examples of glandular tissue.
M Describe the general features, functions, and specific examples of 3 select types of membranes.
N Describe anatomy and physiology of the skin
O Explain the basis of skin color
P Compare the anatomy, distribution, and physiology of hair, sebaceous, sudiferous, and ceruminous glands
Q Explain the role of skin in helping to maintain normal body temperature.
R Describe the causes and effects of select skin pathologies.
S Capably utilize select medical/technical terms in the discussion of the above concepts.
T Demonstrate the ability to capably utilize the classroom microscope and slide collections to inspect, interpret and portray select normal and pathological tissue samples.

II Osteology

A Discuss the functions of bone.
B Identify the parts of a long bone.
C Describe the histological features of spongy and compact bone.
D Compare and contrast the process of endochondral and intramembranous ossification.
E Describe the stages of bone repair and remodeling after traumatic injury.
F Describe the role of bone in the metabolism of calcium.
G Identify those nutritional and influences on the normal development of the skeletal system.
H Capably describe select pathologies associated with the skeletal system.
I Classify the principle types of bones, on the basis of shape and location.
J Describe the various select markings on the surface of bones.
K Identify the bones of the skull and their major markings.
L Identify the skulls sutures, fontanels and foramina.
M Identify the bones of the vertebral column and their main features.
N Identify the bones forming the thorax, and their major markings.
O Compare and contrast select features of the adult skull with that of pre-adolescent and geriatric specimen.
P Identify the bones of the pectoral girdle, the upper limb, their component bones and their major markings.
Q Identify the bones of the pelvic girdle, the lower limb, their component bones and their major markings.
R Classify joints on the basis of structure and function.
S Contrast the structure, kind of movement, and location of immovable, slightly movable and freely movable joints.
T Describe the structures, types, and movements of freely movable joints.
U Discuss the identity, causes, and symptoms of select pathologies/joint disorders.
V Analyze the various artificial joints, such as the knee, with respect to design criteria, functionality and mimicry of normal range of motion.

III Myology

A Identify specific movements at various hinge, pivot, and ball and socket joints B. List the characteristics and functions of muscle tissue.
B Compare and contrast the location, histological appearance, macroscopic morphology, nervous and hormonal control, functions and regenerative capabilities of three types of muscle tissue.
C Describe the structure and importance of a neuromuscular junction and motor unit.
D Describe the principal events of excitation contraction coupling.
E List the steps of muscular contraction associated with the sliding filament theory.

F Explain how a muscle twitch can be recorded and evaluated.
G Compare and contrast the characteristics of isotonic and isometric contractions.
H Describe the three types of skeletal muscle fibers and their characteristics.
I Identify the various sources of energy for muscular contraction.
J Identify and describe specific muscle tissue disorders.
K Describe the functional relationship of the skeletal and muscle systems in producing body movements.
L Identify, compare and contrast the components of three lever systems with relationship to force produced, mechanical advantage, distance and speed of movement.
M Discuss select body movements as activities of groups of muscles by explaining the roles of the prime mover, synergist, antagonist, and fixator.
N Define the criteria established to name skeletal muscles.
O Identify select skeletal muscles in different regions of the body by name, origin, action and insertion.
P Describe specific injuries to skeletal muscles.
Q Acquire and interpret the statistical information prepared in tabular and graphic format regarding the physiology of exercise .

IV Cardiovascular System

A Describe the anatomical location of the heart and the structure and functions of the wall, chambers, great vessels and valves of the heart.
B Describe the blood supply of the heart.
C Explain the structural and functional features of the conduction system of the heart.
D Describe the physiology of cardiac muscle contraction.
E Explain the meaning of electrocardiogram and its diagnostic importance.
F Describe the phases, timing, sounds, pressures and volumes associated with a cardiac cycle.
G Define cardiac output and describe the factors affecting it.
H Explain the regulation of heart rate.
I Describe and explain the causative factors of specific cardiac disorders.
J Contrast the structure and function of the various types of blood vessels.
K Explain the factors that regulate the velocity and volume of blood flow.
L Discuss the various pressures involved in the movement of fluids between capillaries and interstitial space.
M Explain how the return of venous blood to the heart is accomplished.
N Describe how blood pressure is regulated.
O Define the three stages of shock.
P Define pulse and blood pressures and contrast the clinical significance of systolic, diastolic, and pulse pressure.

Q Identify select arteries and veins of the systemic, hepatic portal, pulmonary, cardiac and fetal circulations.
R List the causes, symptoms, and treatment of select pathologies.

V Hematology

A Contrast the roles of specific body fluids in maintaining homeostasis.
B Define the functions and physical characteristics of the blood's various components.
C List the components of plasma, explaining their importance.
D Compare the origins, histology, and functions of the cellular elements of the blood.
E Identify the stages of hemostasis, as well as those factors that promote or inhibit these reactions.
F Identify the stages of blood clotting (i.e coagulation), as well as those factors that promote or inhibit these reactions.
G Explain the ABO and Rh blood groupings.
H Describe and explain the symptoms and causative factors of specific hematological disorders.
I Describe those biologically compatible qualities sought in artificial blood as advanced by recent research

VI Respiration

A Identify the organs of the respiratory system and describe their functions.
B Explain the structure of the respiratory membrane and describe its function in the diffusion of respiratory gasses.
C Describe the mechanics (anatomy and physiology) of inspiration and expiration, both lung volumes and pressures.
D Demonstrate an understanding of specific gas laws (Boyle's, Charles' and Dalton's) with regards to the normal functioning of the respiratory system.
E Explain how respiratory gasses are carried in the blood stream.
F Describe the specific factors which control the rate and depth of breathing, specifically in regards to specific sensors and brain centers.
G Utilize an oxygen-Hb dissociation curve graphic to explain the relationship of pO2 to hemoglobin saturation under varying physiological conditions (pH, temperature)
H Acquire and analyze data to determine individual lung volumes
I Analyze lab data to determine oxygen debt.

VII Gastrointestinal System

A Identify the specified organs of the GI tract and accessory organs of digestion and their functions.
B Describe the four functional features of the GI tract, i.e digestion, secretion, absorption, motility.
C Describe the mechanical movements of the GI tract.
D Compare and contrast the specific histological layers and their modifications throughout the GI tract.
E dentify and describe how specific exocrine and endocrine secretions are regulated throughout the GI tract.
F Define absorption and explain how the end products of digestion are absorbed.
G Define the processes involved in the formation and elimination of fecal waste.
H Identify those components of the nervous system that influence / regulate digestive processes.
I Describe specific disorders of the GI system.

VIII Nutrition & Metabolism

A Explain how food intake is regulated.
B Define the term "nutrient" and how this definition is applied to carbohydrates, lipids, proteins, minerals, vitamins and water.
C Define the term "metabolism" with regards to the sources, biochemical functions, caloric values, and RDA of the above cited nutrients.
D Cite specific pathologies associated with the nutrients listed above.

IX Renal System

A Describe the functions of the kidneys.
B Identify the external and internal gross anatomical features of the kidneys.
C Identify the structural adaptations of a nephron for urine formation.
D Discuss the process of urine formation through the processes of glomerular filtration, tubular reabsorption, and tubular secretion.
E Describe how the kidneys produce dilute and concentrated urine.
F Explain the process of hemodialysis.
G Describe the structure and physiology of the ureters, urinary bladder and urethra.
H List and describe the physical characteristics, normal chemical constituents, and abnormal components of urine.
I Describe the effect(s) of specific neural paths, endocrine secretions, and diet on the function(s) of the renal system.
J Describe specific pathologies of the renal system.

K Capably utilize select medical terminology associated with the renal system.

X Endocrinology

A Define the components of the endocrine system and compare/contrast the functions of the endocrine and nervous system in maintaining homeostasis.
B Describe how hormones are transported in the blood and how they interact with their target cells.
C Compare the four chemical classes of hormones, citing specific examples.
D Explain the two general mechanisms of hormonal action.
E Describe the control of hormonal secretions via negative feedback cycles, citing specific examples.
F Describe the release of hormones stored in the posterior pituitary gland.
G Describe the location, histology, hormones and functions of the following endocrine glands: pituitary, hypothalamus, thyroid, parathyroids, adrenals, pancreas, pineal, and thymus.
H Describe specific pathologies of the endocrine system.
I Capably utilize select medical terminology associated with the endocrine system.
J Capably cite, interpret and utilize experimental data provided in various handouts/graphics .

XI Reproductive System

A Define reproduction and classify the organs of reproduction by function.
B Explain the structure and histology of select male reproductive structures.
C Explain the the structure and histology of select male reproductive structures.
D Compare the principal events of the menstrual and ovarian cycle.
E Describe the symptoms and causes of select male, female pathologies such as infertility.
F Correctly utilize technical vocabulary associated with the reproductive system.
G Explain the hormonal similarities and differences of the male and female reproductive system with regards to specific hormones, target tissues, periodicity, and actions.
H Describe specific methods of determining the state of pregnancy.
I Describe the processes of meiosis in the formation of haploid gametes
J Compare/contrast the various types of birth control and their effectiveness.
K Compare/contrast the embryonic development of the reproductive systems.

XII Embryology

A Explain the processes associated with fertilization, morula formation, blastocyst development, and implantation.
B Describe how IVF is performed.
C Compare the sources, target tissues and functions of the maternal and placental hormones during pregnancy.
D Describe specific events occurring during the period of embryonic development.
E Describe specific events occurring during the period of fetal development.
F Identify specific prenatal diagnostic tests and the utilization of medical information provided.
G Describe the anatomical and physiological changes associated with gestation.
H Explain the respiratory and cardiac adjustments that occur in the neonate at birth.
I Discuss the physiology and control of lactation.
J Discuss select pathologies associated with prenatal development.
K Define and describe select genetic disorders.

XIII Immunology

A Describe the components of the lymphatic system and list their functions.
B Discuss how edema develops.
C C. Discuss the roles of specific anatomical structures (i.e. skin, lymph nodes) in nonspecific resistance to disease.
D Discuss the roles of specific substances (i.e. mucous, interferon, complement, cytokines) in nonspecific resistance to disease.
E Discuss the roles of specific processes (i.e. inflammation, chemotaxis) in nonspecific resistance to disease.
F Discuss the roles of specific cells (i.e. nk cells) in nonspecific resistance to disease.
G Define the four types of immunity and how they may be acquired.
H Describe how T cells and B cells develop.
I Explain the relationship between an antigen and an antibody.
J Describe the roles of antigen presenting cells, T cells, and B cells in both cell mediated and anti- body mediated immunity.
K Explain how self-tolerance occurs.
L Compare and contrast the primary and secondary immune responses.
M Discuss the relationship of immunology to cancer.
N Describe the clinical symptoms of select pathologies.
O Capably define and utilize specific medical technology terms associated with the immune system.

XIV Neurology I

A Describe the five functions of the human nervous system
B Compare and contrast the cellular features of neurons and glial cells.
C Describe the structure and functions of the three types of neurons.
D Identify the rest state (membrane potential) of a nerve cell.
E List the sequence of events by which an action potential is initiated and propagated.
F Describe the activities by which nerve cells are repolarized.
G Explain the events of synaptic transmission, citing specific neurotransmitters and their effect on the post--synaptic neuron.
H Describe those conditions, such as select pathologies, that interfere with the normal transmission of neural signals.
I Sketch and explain the four basic types of neural circuits.
J Describe the gross and cross-sectioned anatomical features of the human spinal cord.
K Describe the functions and locations of specific sensory and motor tracts in the spinal cord.
L Identify the component parts of the reflex art with regards to function and location.
M List and describe specific reflexive circuits and their clinical importance.
N Identify the anatomical locations and functions of the 4 plexii and select spinal nerves.
O Describe select spinal cord pathologies and medical research.

XV Neurology II

A Identify the principal parts of the brain and describe how the brain is protected
B Explain the formation and circulation of cerebro-spinal fluid
C Describe the blood supply to the brain and the blood brain barrier
D Compare the structure and functions of the brain stem, diencephalons, cerebrum, and cerebellum.
E Review the embryological formation of the brain
F Identify the various neurotransmitters in the brain, the different types of neuropeptides and their functions.
G Identify specific anatomical features of the brain such as sulci, gyri, fissures, ventricles.
H Identify specific functional areas of the cerebral cortex.
I .Define a cranial nerve and identify the twelve pairs of cranial nerves by
J Capably utilize medical terminology associate with this unit of study.
K Identify the components of the somatosensory and motor cortices.
L Describe the integration of sensory input and motor output.
M Compare specific integrative functions such as memory, wakefulness, and sleep.

N List the clinical symptoms of specific brain disorders.

XVI Neurology III

A Define the concept of neural sensations, their levels and components
B Describe the classification of sensory receptors.
C List the location and function of the receptors for tactile, thermal, and pain sensations.
D Distinguish somatic, visceral, referred, and phantom pain.
E Locate the receptors for olfaction and describe the neural pathway for smell.
F Identify the gustatory receptors and the neural pathway for taste.
G List and describe the accessory structures of the eye and the structural divisions of the eyeball.
H Describe image formation with correct utilization of terms such as accommodation, refraction, and constriction of the pupil.
I Describe how photoreceptors and photopigments work in vision.
J Describe the retinal processing of visual input and the neural pathway of light sensation to the brain.
K Describe the anatomical subdivisions of the ear.
L List the principal events in the physiology of hearing.
M Identify the receptor organs of equilibrium and how they function.
N Capably describe select sensory pathologies.
O Define medical terminology associated with the sense organs.

XVII Oncology

A Learn and capably utilize specific terms relevant to this area of study.
B Demonstrate the ability to analyze and interpret statistical, graphic information regarding populations.
C Describe the biology of cancer with regards to specific genetic, cellular, and tissue changes that take place.
D Identify the specific components and research contributing to various theories, discoveries of cancer.
E Compare and contrast normal cells to cancerous cells
F Compare and contrast benign to malignant neoplasms
G Describe the pathogenesis of cancer.
H Describe current prognoses and treatments of select cancers.
I Cite specific epidemiological studies regarding the prevalence of specific cancers
J Review select etiologies of cancer (radiation, chem. carcinogens, viral agents, heredity).
K Compare and contrast different methods of treating cancer.

L Cite specific recommendations regarding minimizing personal cancer risks.
M Capably cite, interpret and utilize experimental data provided in various handouts/graphics from additional sources (i.e. SciAm offprints, on-line articles), etc.

XVIII Gerontology

A Learn and capably utilize specific terms relevant to this area of study.
B Demonstrate the ability to analyze and interpret statistical, graphic information regarding populations.
C Describe the biology of aging with regards to specific anatomical changes that take place in cells, tissues, organs, and systems.
D Describe the biology of aging with regards to specific physiological changes that take place in cells, tissues, organs, and systems.
E Identify the specific components and research contributing to various theories, discoveries of aging.
F Define the term “prolongevity” and list those activities which promote healthy aging.
G Review select pathological changes associated with the aging process, specifically senile dementia of the Alzheimer’s type.
H Capably cite, interpret and utilize experimental data provided in various handouts/graphics from additional sources