



SPRINGFIELD PUBLIC SCHOOLS

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Springfield Public Schools
Springfield, New Jersey 07081

Human Anatomy and Physiology
Grade 12

Curriculum Guide

2026

This curriculum may be modified through varying materials, techniques, and strategies as per an individual student's IEP.

Springfield Board of Education
Approved July 27, 2026

Springfield Public Schools

Cultivating compassionate and extraordinary learners!

EXTRACT OF THE MINUTES OF A MEETING OF
THE BOARD OF EDUCATION OF
THE TOWNSHIP OF SPRINGFIELD
COUNTY OF UNION, NEW JERSEY
AS RECORDED IN THE OFFICIAL MINUTE BOOK

Resolution: 21

Introduced By: Mrs. Gamarekian

Seconded By: Vice President Rinaldi

Adopted: July 27, 2026

Curriculum Adoption

To approve the following new and revised curriculum and courses for the 2026-2027 school year:

1. High School Courses

- a. AP Cybersecurity (new course)
- b. AP Business with Personal Finance (new course)
- c. AP Biology
- d. AP Chemistry
- e. AP Physics 1
- f. PLTW Robotics and Automation
- g. PLTW Introduction to Engineering Design
- h. PLTW Principles of Engineering
- i. Biology
- j. Biology Honors
- k. Chemistry
- l. Chemistry Honors
- m. Conceptual Physics
- n. Physics
- o. Environmental Science
- p. Forensics
- q. Human Anatomy and Physiology
- r. Oceanography
- s. Science 8
- t. Molecular Biology Research Lab (new course)

2. Middle School Courses

- a. Science 6
- b. Science 7

3. Elementary School Courses

- a. Kindergarten Science
- b. Grade 1 Science
- c. Grade 2 Science

Michelle Calas, School Business Administrator/Board Secretary

(continued)

I, Michelle Calas, School Business Administrator/ Board Secretary of the Springfield Board of Education, hereby certify that the extract from the minutes of a meeting of the Board of Education duly called and held on July 27, 2026 has been compared by me with the original minute book of said Board of Education, and is a true, complete and exact copy thereof, as far as the same relates to the subject matter to on said extract.

In WITNESS THEREOF, I have hereunto set my hand and seal of the Springfield Board of Education, this 28th day of July 2026.

SEAL



Michelle Calas
School Business Administrator/ Board Secretary



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Springfield Public Schools Springfield, New Jersey

**Rachel Goldberg
Superintendent of Schools**

**Erica Scudero
Assistant Superintendent**

Curriculum Developed By:

Dr. Norman Francis ~ Principal of Jonathan Dayton High School

Gregory Salmon ~ STEM Supervisor

Nathaniel Lazar ~ Biology Teacher



Unit Overview Template

Content Area: Science **Grade Level:** 12 **Unit Title:** Anatomy: Body Orientation, Urinary System, Cells and Connective Tissue

Unit Summary: This unit will investigate how we discuss body directions and regions, the organization of cells and tissues, and the liquid waste removal system of the kidneys and bladder.

Primary Interdisciplinary Connections: Engineering, Biology

21st Century Themes ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ ICT Literacy
☐ Information Literacy ☒ Life and Career Skills ☒ Communication and Collaboration ☐ Media Literacy

Unit Rationale: The study of anatomical structures and their functions provides an opportunity for understanding of the body and the disorders that result from homeostatic imbalances.

Career Readiness (Standard 9):

- 9.2.12.CAP.4: Evaluate different careers and develop various plans.
- 9.2.12.CAP.5: Assess and modify a personal plan to support current interests and postsecondary plans.
- 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
- 9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities.
- 9.4.12.GCA.1: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political, economic, cultural) may work better than others.
- 9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.
- 9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

Learning Targets

Standards: HS-LS1; HS-ETS1

Content Statements: From Molecules to Organisms: Structures and Processes; Engineering Design

CPI#:

Cumulative Progress Indicator (CPI):

HS-LS1-1

Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.



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HS-LS1-2	Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
HS-LS1-3	Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
8.2.12.ED.1	Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
8.2.12.ED.4	Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
HS.N.Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
SL.11-12.1	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with peers on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

Science and Engineering Practices:

Developing and Using Models

Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

- Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-2)

Planning and Carrying Out Investigations

Planning and carrying out in 9–12 builds on K–8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-LS1-3)

Constructing Explanations and Designing Solutions



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Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS1-1)
- Design a solution to a complex real-world problem, based on scientific knowledge, student generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-2)

Disciplinary Core Ideas (DCIs):

LS1.A: Structure and Function

- Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)
- All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (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)

ETS1.C: Optimizing the Design Solution

- Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (tradeoffs) may be needed. (HS-ETS1-2)

Crosscutting Concepts:

Systems and System Models

- Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. (HS-LS1-2)



Structure and Function

- Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. (HS-LS1-1)

Stability and Change

- Feedback (negative or positive) can stabilize or destabilize a system. (HS-LS1-3)

Connections to Nature of Science

Scientific Investigations Use a Variety of Methods

- Scientific inquiry is characterized by a common set of values that include: logical thinking, precision, open-mindedness, objectivity, skepticism, replicability of results, and honest and ethical reporting of findings. (HS-LS1-3)

Unit Essential Questions:

- What is the relationship between anatomy and physiology?
- What terminology is used to describe the anatomy of the human body?
- How does the urinary system maintain homeostasis?
- How do the structures of the kidneys reflect its function?
- How does medical imaging help diagnose disorders?
- How are tissues classified?
- How do tissues perform specific functions based on their structure?

Unit Enduring Understandings:

- The human body has two major cavities and many areas.
- Specialized terms are used to describe the location of areas on the body when it is in a particular position.
- Many imaging techniques are used to observe the inside of living bodies to help in the diagnosis of medical conditions.
- Epithelial and connective tissues have many arrangements and roles in the body, providing barriers, connections, and areas of growth.
- The kidney uses many small filtering structures to remove and recycle many solutes to keep balanced concentrations.
- The urinary system is the body's group of organs to regulate concentrations and contaminants in the blood.

Unit Learning Targets:

Students will....

- Identify and classify the regions of the body and body cavities.
- Relate the names of body regions to common body structures and names.



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- Compare structure and function of the epithelial cells and connective tissues.
- Demonstrate the direction and form of the anatomical position and directional terminology.
- Analyze the function and process of blood filtering by the kidneys.
- Compare the strengths and usefulness of different medical imaging techniques.
- Model the interaction between the hormones and target cells.
- Relate negative and positive feedback systems to real-world examples.
- Sequence the pathway of blood through the kidneys and nephrons.
- Explain the necessity of a language to describe locations and positions on the human body.
- Relate diseases and disorders to the failure of the kidney.
- Compare the differences in the study of Anatomy and Physiology.



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Evidence of Learning

Summative Assessment: 3 days

Equipment Needed: Lab materials, iPads

Teacher Resources: Exam pro test generator

Formative Assessments:

- Lab reports
- classwork
- Homework
- Group projects
- Discussions
- Case studies
- "Do now" activities
- Diagrams and labeling exercises



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Lesson Plans

Lesson	Time Frame
Lesson 1 2000 Meter Row Case	2 days
Lesson 2 Medical Imaging Presentations	3 days
Lesson 3 Chicken Wing Lab	3 days

Teacher Notes: This unit bridges complex digital physics with wet laboratory biology, requiring careful scheduling of hardware resources and organic specimens. Prior to launching the medical imaging analysis, ensure that student digital workstations are pre-loaded with open-source DICOM viewer software and that coordinate orientation maps are distributed to help students navigate anatomical planes. For the musculoskeletal laboratory dissection, coordinate the delivery of fresh, chilled specimens with regional suppliers no more than twenty-four hours before execution, ensuring that all dissecting instruments, protective goggles, and sanitary disposal receptacles are sterilized and stationed at waterproof work tables.

Curriculum Development Resources/Technology Resources:

Click the links below to access additional resources used to design this unit:

<http://sciencecases.lib.buffalo.edu/cs/files/crew.pdf>

<https://www.medicalradiation.com/types-of-medical-imaging/>

<http://wps.aw.com/wps/media/objects/5382/5512191/cbook/htm/0chap9.htm>



Lesson Plan 1 Template

Content Area: Science
 days

Lesson Title: 2000 Meter Row Case

Time Frame: 2

Lesson Components

21st Century Themes

- ☐ Global Awareness ☐ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☒ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☒ Communication and Collaboration ☐ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Engineering, Biology

Integration of Technology:

iPads

Equipment Needed:

iPads; Packet/Worksheet

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: - Collaborate to diagnose a patient using physiological data and evidence. - Explain homeostatic responses to changing stimuli through observation and modeling. - Interpret information from a given scenario to construct explanations about body system	Lesson Sequence Phenomenon: 2000 Meter Row Case: During a grueling 2000-meter rowing machine trial, an elite athlete experiences sudden, agonizing quadriceps burning, a spike in core temperature to 102 degrees Fahrenheit, and rapid breathing, which culminates post-race in the excretion of dark, tea-colored urine containing high concentrations of myoglobin protein fragments because the mechanical stress of overexertion tore the microscopic cell membranes	- Completion of worksheet - Homeostasis test



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responses during exercise.

of their skeletal muscle tissue, forcing the kidneys to rapidly alter their filtration rates to prevent acute renal shutdown.

2. Do Now: Homeostasis and Negative Feedback Loops

Students examine a diagram of a negative feedback loop (temperature regulation or blood glucose regulation) and label the stimulus, receptor, control center, and response. Students briefly discuss how the body maintains stable internal conditions.

3. Hands-On Physiological Investigation

Students participate in a short activity modeling how the body responds to exercise.

In small groups, students collect real physiological data from a volunteer before and after light exercise (such as stepping in place or walking stairs for 1–2 minutes). Students measure and record:

- Heart rate
- Breathing rate
- Skin temperature

Students record data in a table and discuss:

- What changed after exercise?
- Which body systems were involved?



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- How do these responses help maintain homeostasis?

Students connect their observations to negative feedback mechanisms.

4. Case Study Investigation: Joe and the 2000 Meter

Students read the article describing Joe running the 2000 meter race.

Working in small diagnostic teams, students analyze Joe's symptoms and physiological changes. Groups are given data cards representing possible changes during intense exercise (e.g., increased heart rate, lactic acid buildup, increased respiration, sweating, oxygen debt).

Students use the data to determine:

- What stimulus Joe experienced
 - Which systems responded
 - Whether the response represents positive or negative feedback
- How the body restores homeostasis after intense exercise

5. Pair and Share



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Students discuss their diagnoses with a partner group and compare explanations.

Groups revise their explanations based on peer discussion and additional evidence.

6. Review Class Responses

The class reviews group explanations together. The teacher facilitates discussion linking student ideas to major homeostasis concepts such as:

- Negative feedback regulation
- Cardiovascular response to exercise
- Respiratory adjustments
- Thermoregulation

7. Whole Group Share

Each group briefly shares one physiological response that helped Joe maintain homeostasis during the race.

Students then construct a quick diagram of the negative feedback loop involved in one of Joe's responses (e.g., body temperature regulation during exercise).

Differentiation:

A variety of sources on homeostasis, graphics, and text. Students will be given benchmark lessons based on formative assessment data.

Resources Provided:

- Textbook



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- Worksheet



Lesson Plan 2 Template

Content Area: Science
 Frame: 3 days

Lesson Title: Medical Image Presentations

Time

Lesson Components

21st Century Themes

- ☐ Global Awareness ☐ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☒ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☒ Communication and Collaboration ☐ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Engineering, Biology

Integration of Technology:

- Google Slides
- Cloud-based DICOM web viewers loaded with anonymous patient scan files, allowing students to independently slice through real human anatomy along the sagittal, coronal, and transverse planes.
- Interactive 3D anatomical rendering applications to isolate skeletal structures and superimpose neurovascular pathways.
- Collaborative digital presentation software featuring embedded vector animations to illustrate the physical wave frequencies of different diagnostic modalities.
- Digital peer-review feedback portals for real-time grading and anonymous polling against clinical presentation criteria.

Equipment Needed:

- High-definition multi-planar CT and MRI film sheet replicas for physical light-box comparison.
- Handheld LED optical transilluminators to model wave attenuation through variable tissue densities.
- Desktop multi-axis coordinate grid maps representing anatomical spatial orientation planes.
- Student research workstations equipped with multi-monitor display capabilities.
- Color-coded tissue density simulation cards for physical sorting exercises.

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will:	Lesson Sequence	



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- Collaborate to prepare a comprehensive review of a medical imaging technique.
- Explain the mechanism or process by which the image is made.
- Create a presentation that provides the development, explanation, and use of a medical imaging technique.
- Interpret an example of a medical image.
- Present their work to classmates.

1. Phenomenon: A patient presenting with chronic, radiating lower back pain and localized numbness undergoes a series of diagnostic procedures where standard projection X-rays pass cleanly through soft tissues but are absorbed by dense bone matrices, showing zero structural defects, whereas a high-resonance magnetic resonance imaging scan uses radiofrequency pulses to manipulate hydrogen atom alignment in water molecules, exposing a cross-sectional view of a fluid-filled herniated disc compressing a lumbar nerve root along the sagittal plane.
2. Do Now Execution: Students complete a specialized spatial orientation ledger where they must map directional arrows (superior, inferior, anterior, posterior) onto blank radiographic film sheets and determine how a 3D structural body translates into a 2D projection plane.
3. Spatial Kinesthetic Lab Modeling: Students use physical clear acrylic boxes packed with layered gelatin (representing soft tissue) and hidden wooden

- Students will successfully execute a multi-planar anatomical tracing exercise, correctly labeling target structures across sagittal, coronal, and transverse perspectives with zero orientation errors.
- Students will deliver an evidence-based team presentation that accurately matches distinct tissue pathologies with their optimal technological imaging modality based on physical attenuation data.
- Students will define attenuation as the variable rate at which different physical tissue matrices absorb wave energy.
- Students will correctly isolate the structural limitations of standard projection X-rays when compared to high-resonance soft tissue scans on a diagnostic exit voucher.



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blocks (representing bone). They manipulate handheld LED transilluminators at varying angles to physically model how light waves scatter or attenuate, drawing boundaries where "shadows" form to map out tissue densities before moving to digital interfaces.

4. **Rubric Assignment and Technique Modeling:**

The teacher distributes the comprehensive diagnostic presentation criteria and delivers an interactive clinical model, demonstrating how to trace a radio wave pulse through soft tissue matrices using an open-source DICOM slice viewer.

5. **Collaborative Research and Interactive Component**

Construction: Student medical teams utilize their workstations to analyze real patient case files, compiling tissue density metrics and evaluating multi-planar cross-sections. They use interactive 3D anatomy rendering tools to slice through the spine, isolate the impinged nerve root, and construct an interactive, animated component for their final clinical presentation showing the exact



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- mechanism of a disc rupture.
6. **Diagnostic Case Presentations:** Student pairs act as consulting radiologists, projecting their digital anatomical portfolios and custom-built 3D model animations onto the screen to deliver their diagnostic arguments regarding soft tissue pathology and structural nerve compression to the clinical panel.

Differentiation:

Students work together to assist group members with development of information. Groups are designed based on formative assessment data.

Resources Provided:

- Textbook



Lesson Plan 3 Template

Content Area: Science
days

Lesson Title: Chicken Wing Lab

Time Frame: 3

Lesson Components

21st Century Themes

- ☐ Global Awareness ☐ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☒ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☒ Communication and Collaboration ☐ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Engineering, Biology

Integration of Technology:

- Google Slides
- Digital micro-endoscope cameras attached to student tablets, allowing teams to capture high-magnification video of collagen fiber alignment and muscle fascicle movement.
- Real-time collaborative database spreadsheets to log and cross-examine joint range-of-motion angles across the classroom.
- Slow-motion video analysis software to measure and graph tissue deformation and retraction speeds when tendons are mechanically pulled.
- Interactive histological reference portals to instantly compare macro-level fresh tissue observations with microscopic stained tissue matrices.

Equipment Needed:

- iPads
- Fresh, chilled chicken wing specimens (one per student pair).
- High-precision anatomical dissection kits (scalpels, blunt-tipped probes, fine scissors, and forceps).
- Waterproof wax dissection trays with stainless steel pins.
- Digital handheld goniometers for measuring joint articulation degrees.
- Heavy-duty nitrile protective gloves, fluid-resistant lab aprons, and impact safety goggles.
- Anti-bacterial sanitizing wipes and biohazard disposal receptacles.

Goals/Objectives

**Learning Activities/
Instructional Strategies**

**Formative Assessment
Tasks**



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Students will:

- Dissect a chicken wing.
- Relate the structure of each layer of tissue to the function.
- Manipulate the wing to observe the function of different connective tissue.
- Relate the structure of the wing to technologies developed by engineers.
- Define antagonistic muscle pairs inline (a structural arrangement of two muscle networks that pull in opposite directions across a joint, where one contracts to flex the limb while the other relaxes) as a mechanical movement system.
- Describe tensile strength inline (the maximum capacity of a structural tissue or material to withstand pulling or stretching forces without tearing or failing) as a property of dense regular connective tissue.
- Execute a multi-stage physical dissection protocol to isolate, manipulate, and identify epithelial, muscular, and connective tissue subsystems.
- Analyze a mechanical tissue model to explain

Lesson Sequence

1. **Phenomenon:** When an avian wing limb undergoes mechanical dissection, the outer waterproof stratified epithelial boundary peels away to reveal a complex structural network where glistening, parallel collagen bundles of dense regular connective tissue form high-tensile tendons that anchor muscles directly to bone surfaces, while neighboring translucent, frictionless hyaline cartilage caps the joint surfaces to prevent bone-on-bone grinding during rapid, antagonistic muscle contractions.
2. **Do Now Execution:** Students complete a histological identification ledger, classifying microscopic image samples of stratified squamous epithelium, adipose deposits, and dense regular connective tissue based on cell density and extracellular matrix arrangements.
3. **Procedural Protocol and Safety Briefing:** The teacher projects a digital safety matrix, demonstrating proper blade handling grips, pointing out anatomical landmarks on a master model, and enforcing the non-verbal "blades down, hands clear" posture for safety updates.
4. **Guided Mechanical Dissection Phase:** Student research pairs fit their

- Students will successfully complete their laboratory dissection prompts, correctly matching four distinct physical tissue zones (epithelium, tendon, muscle, cartilage) with their active functional roles in limb mobility.
- Students will demonstrate proper safety compliance during a live workspace technique check, handling sharp dissection tools with zero accidental slips or boundary violations.
- Students will define tensile strength as the capacity of dense regular connective tissue to resist intense pulling forces.
- Students will correctly diagram the mechanical pulling interaction of antagonistic muscle pairs on a biomechanical exit ticket.



how structural changes in collagen density alter joint articulation efficiency.

protective gear, stabilize their wing specimens in the wax trays, and perform fine incisions through the translucent deep fascia. They carefully peel away the epithelial boundary to expose the underlying skeletal muscles, using digital endoscopes to capture micro-structural photos of the tissue boundaries.

5. **Antagonistic Articulation and Tensile Simulation:** Students isolate the biceps and triceps muscle bellies, manually pulling each independent bundle to observe antagonistic extension and flexion across the hinge joint. They use digital goniometers to measure and log the max articulation arc angle, then slice open the muscle to expose and pin the glistening, high-tensile collagen tendons anchored to the bone.
6. **Deep Articular Joint Inspection:** Pairs dissect the surrounding capsular ligaments to expose the hinge joint cavity. They manipulate the bone ends to feel the smooth, sliding properties of the blue-white, translucent hyaline cartilage capping the joint surfaces, testing bone-on-bone friction boundaries where the protective cartilage terminates.
7. **Laboratory Sterilization Routine:** Students dismantle



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their tissue models, drop all organic waste into targeted biohazard bins, submerge dissecting instruments in chemical sanitizing baths, and wipe down their desktop grid templates with surface anti-bacterial agents.

8. Synthesis and Structural Wrap-Up: The teacher leads a rapid data compilation review, displaying student endoscope captures on the screen while teams present their mechanical explanations linking structural tissue traits directly to full-limb locomotion.

Differentiation:

- Pre-cut skin templates featuring initiated incision entry paths are provided to substitute for raw dermal cutting steps for student pairs navigating fine-motor manipulation challenges.
- Dissection trays are pre-lined with high-contrast color boundary stickers to establish clear, distinct regions for tool placement and sample orientation.
- Visual structural prompt cards illustrating the exact physical contrast between a muscle belly, a tendon cord, and a cartilage cap are positioned at each station.
- Advanced students can use hanging weights to measure the exact elongation and failure points of isolated tendon strands, computing real-time tensile limits against cross-sectional thickness.
- Structured sentence frames are embedded directly into the lab summary documents:
When I pull the upper muscle bundle, the lower muscle undergoes [blank], causing the joint to flex. This pulling force is transferred directly to the bone surface by high-tensile [blank], while bone-on-bone grinding is prevented by a smooth layer of [blank] cartilage.

Resources Provided:

- Textbook
- Lab worksheets



Lesson Reflection

Reflect on the lesson you have developed and rate the degree to which the lesson **Strongly**, **Moderately** or **Weakly** meets the criteria below.

Lesson Activities	Strongly	Moderately	Weakly
Are challenging Strongly and require higher order thinking and problem solving skills	☒	☐	☐
Allow for student choice	☐	☒	☐
Provide scaffolding for acquiring targeted knowledge/skills	☐	☒	☐
Integrate global perspectives	☐	☒	☐
Integrate 21st century skills	☒	☐	☐
Provide opportunities for interdisciplinary connection and transfer of knowledge and skills	☐	☒	☐
Foster student use of technology as a tool to develop critical thinking, creativity and innovation skills	☒	☐	☐
Are varied to address different student learning styles and preferences	☒	☐	☐
Are differentiated based on student needs	☐	☒	☐
Are student-centered with teacher acting as a facilitator and co-learner during the teaching and learning process	☒	☐	☐
Provide means for students to demonstrate knowledge and skills and progress in meeting learning goals and objectives	☒	☐	☐
Provide opportunities for student reflection and self-assessment	☐	☒	☐
Provide data to inform and adjust instruction to better meet the varying needs of learners	☒	☐	☐

Curriculum Design Template

Content Area: Science and Physiology

Grade Level: 12

Course Title: Human Anatomy

Created: 2021

Board Approved on:



Unit Overview Template

Content Area: Science **Grade Level:** 12 **Unit Title:** Anatomy: Skeletal, Muscular , Integumentary

Unit Summary: This unit will investigate how the integumentary, skeletal, and muscular systems maintain homeostasis of the body by providing structure, barriers, and the ability to move and respond to external conditions.

Primary Interdisciplinary Connections: Engineering, Biology

21st Century Themes ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ ICT Literacy

☒ Information Literacy ☒ Life and Career Skills ☒ Communication and Collaboration ☐ Media Literacy

Unit Rationale: The study of anatomical structures and their functions provides an opportunity for understanding of the body and the disorders that result from homeostatic imbalances.

Career Readiness (Standard 9):

9.2.12.CAP.4: Evaluate different careers and develop various plans.

9.2.12.CAP.5: Assess and modify a personal plan to support current interests and postsecondary plans.

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.

9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities.

9.4.12.GCA.1: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political, economic, cultural) may work better than others.

9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.

9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.

9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.

9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

Learning Targets

Standards: HS-LS1; HS-ETS1

Content Statements: From Molecules to Organisms: Structures and Processes; Engineering Design

CPI#: **Cumulative Progress Indicator (CPI):**



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HS-LS1-1	Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
HS-LS1-2	Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
HS-LS1-3	Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
HS-LS1-4	Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
8.2.12.ED.1	Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
8.2.12.ED.4	Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
HS.N.Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
SL.11-12.1	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with peers on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

Science and Engineering Practices:

Developing and Using Models

Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

- Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-2)
- Use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-4)

Planning and Carrying Out Investigations

Planning and carrying out in 9–12 builds on K–8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.



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- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HSL1-3)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS1-1)
- Design a solution to a complex real-world problem, based on scientific knowledge, student generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-2)

Disciplinary Core Ideas (DCIs):

LS1.A: Structure and Function

- Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)
- All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (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. (HS-LS1-4)

ETS1.C: Optimizing the Design Solution

- Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (tradeoffs) may be needed. (HS-ETS1-2)

Crosscutting Concepts:

Systems and System Models

- Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. (HS-LS1-2), (HS-LS1-4)

Structure and Function

- Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. (HS-LS1-1)

Stability and Change

- Feedback (negative or positive) can stabilize or destabilize a system. (HS-LS1-3)

Connections to Nature of Science

Scientific Investigations Use a Variety of Methods

- Scientific inquiry is characterized by a common set of values that include: logical thinking, precision, open-mindedness, objectivity, skepticism, replicability of results, and honest and ethical reporting of findings. (HS-LS1-3)

Unit Essential Questions:

- How do tissues perform specific functions based on their structure?
- How does the skin maintain and protect the body as its outermost boundary?
- What is the composition of skeletal and muscular structures?
- How does the skeletal system provide a framework and protection for the body?
- How does the muscular system provide a system of motion for the body?

Unit Enduring Understandings:

- Body membranes line or cover, protect, and lubricate body surfaces.



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- The skin contains structures of tissue layers, nails, hair, sweat and sebaceous glands with specialized functions to maintain homeostasis.
- The skeletal system provides an internal framework for the body and anchors skeletal muscles so that muscle contraction can cause movement.
- Names of bones and joints are used to identify the structures of the appendicular and axial skeleton.
- The muscular system provides for movement of the body and its parts, maintains posture, generates heat, and stabilizes joints.
- An action potential is initiated in a muscle cell to stimulate a muscle contraction.

Unit Learning Targets:

Students will....

Compare the structure of the major membrane types.

Name the layers of the epidermis, and describe the characteristics of each.

Differentiate first-, second-, and third-degree burns.

Name the factors that determine skin color, and describe the function of melanin.

Summarize the characteristics of basal cell carcinoma, squamous cell carcinoma, and malignant melanoma.

Name and describe the various types of bones and bone fractures.

Identify the subdivisions of the skeleton as axial or appendicular.

Discuss the importance of the intervertebral discs and spinal curvatures.

Name and identify the bones of the skull.

Describe the important differences between a male and female pelvis.

Describe the effects of aerobic and resistance exercises on skeletal muscles and other body organs.

Define the muscular system.

Describe the events of muscle cell contraction.

Define origin, insertion, prime mover, antagonist, synergist, and fixator as they relate to muscles.

Name and locate the major muscles of the human body and state the action of each.



Evidence of Learning

Summative Assessment: 3 days

Equipment Needed: N/A

Teacher Resources: exam pro test generator

Formative Assessments:

- Lab reports
- Classwork
- Homework
- Group projects
- Discussions
- Case studies
- "Do now" activities
- Diagrams, Labeling exercises



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Lesson Plans

Lesson	Time Frame
Lesson 1 Skin Activity Lab	2 days
Lesson 2 Bone Joint Construction/Hip Lab	2 days
Lesson 3 Robotic Arm	5 days

Teacher Notes: This instructional unit transitions from active sensory dermatological testing to heavy structural engineering fabrication, requiring diverse physical materials and clean workspace management. When organizing the cutaneous sensory mapping laboratories, ensure that all tactile grid stamps, thermal testing probes, and localized chemical delivery systems are calibrated and sanitized between uses. For the mechanical joint construction and prosthetic articulation phases, establish a centralized distribution hub containing high-tensile structural cables, pivot hardware, low-friction synthetic washers, and fast-curing modeling compounds to prevent material deficits and tracking bottlenecks during construction.

Curriculum Development Resources/Technology Resources:

Click the links below to access additional resources used to design this unit:

<http://www.g2conline.org/>



Lesson Plan 1 Template

Content Area: Science Lesson Title: Skin Activity Lab Time Frame: 2 days

Lesson Components

21st Century Themes

- ☐ Global Awareness ☐ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☒ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☒ Communication and Collaboration ☐ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Engineering, Biology

Integration of Technology:

- Google Sheets interactive class databases featuring conditional formatting to track, pool, and graph collaborative cellular classification data and thermal trends in real time.
- High-resolution 3D digital modeling software examples allowing students to digitally dissect, rotate, and isolate specific micro-anatomical structures of integumentary layers and follicular units.
- Cloud-based digital pathology slide viewers equipped with high-magnification matrix controls for remote tissue scanning and margin analysis.
- Interactive burn surface area calculators utilizing real-world medical algorithms to estimate fluid resuscitation requirements based on tissue destruction data.

Equipment Needed:

- iPads for Google Slides
- Compound light microscopes with multi-magnification nosepieces (10x, 40x, 100x oil).
- Prepared histological slide sets of healthy human skin (thick and thin variations).
- Pathological slide sets displaying basal cell carcinoma, squamous cell carcinoma, and malignant melanoma.
- Anatomical 3D human skin models with removable layered structural components.
- Clinical colorimetric photo portfolios displaying stage-specific skin burns and scar formations.

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will:	Lesson Sequence	



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- Sort and classify different skin slides based on structural thickness and cellular characteristics under high-power microscopy.
- Identify the markers of skin cancers by analyzing tissue irregularities, asymmetrical borders, and cellular malignancy indicators.
- Identify structures of hair and glands in a model, mapping their precise depth within the dermal and epidermal boundaries.
- Classify and describe the separate degrees of burns using structural damage metrics and physiological tissue layer boundaries.
- Determine muscular function loss due to burns and compare how varying depths of integumentary destruction alter deep motor performance.

1. **Phenomenon:** A person stepping outdoors from an air-conditioned room into a humid 100-degree environment experiences an immediate activation of sympathetic nerve pathways, causing cutaneous blood vessels to dilate and eccrine sweat glands to pump water onto the stratified squamous epidermal surface, which lowers core temperature via evaporative cooling, whereas an adjacent deep skin laceration breaching the dermis triggers an immediate clotting cascade and a rush of fibroblast cells that lay down a chaotic, rigid matrix of collagen fibers, leaving a permanent fibrous scar that lacks the elasticity, pigment cells, and sweat glands of the surrounding uninjured integument.
2. **Review Lab Activities and Procedures:** The teacher introduces the operational parameters for the multi-station laboratory, outlining safe microscope operation rules, 3D model tracking protocols, and data entry guidelines for the collaborative cloud spreadsheets.
3. **Station Deployment and Workspace Preparation:** The laboratory environment is organized into four separate, fully

- Completion of activity list
- Skin test
- Students will successfully finalize their Google Sheets data matrix, correctly categorizing skin pathologies and burn classifications with at least 85% accuracy based on clinical evidence.
- Students will deliver a concise diagnostic summary during station audits, accurately matching cancer tissue markers to corresponding pathological slide regions.
- Students will define the boundaries of first-, second-, and third-degree burns using structural tissue depth limits.
- Students will correctly diagram the direct correlation between deep dermal burn scarring and superficial muscular restriction on an interactive exit summary slip.



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	equipped analytical states around the room, each dedicated to a specific investigative task to optimize traffic flow and team rotation. 4. Histological Sliding and Observation State: Student pairs manipulate compound microscopes to scan, sort, and classify human skin slides. They contrast healthy epidermal margins against malignant cells, logging cellular tracking observations and marking specific diagnostic cancer parameters in their data books. 5. Structural Modeling and Annotation State: Using iPads and physical 3D skin models, students locate and label the precise spatial positioning of sebaceous glands, arrector pili muscles, and nerve receptors, entering their structural coordinate keys directly into a shared Google Sheet. 6. Clinical Burn Pathology Assessment State: Teams examine high-definition clinical images of first-, second-, and third-degree burns, tracing tissue destruction limits across the hypodermis. They compute localized muscular function loss by evaluating how scar contraction forces restrict underlying joint mobility, recording their analytical	
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- responses on the digital lab sheet.
7. Synthesis and Workspace Alignment: The teacher shares the aggregated Google Sheets data array on the main board, and student teams contrast their pathology findings to build a final class-wide summary matching integumentary integrity with full-body homeostatic preservation.

Differentiation:

- Pre-focused slide matrices featuring pre-mapped target coordinates are provided to substitute for raw fine-focus adjustments for student pairs navigating sensory tracking challenges.
- Station direction checklists feature high-contrast color-coded banners matching layout zones to ensure clear spatial targets during rapid transitions.
- Visual identification key cards showing the visual layout differences between healthy tissue layers and irregular cell masses are displayed at each observation hub.
- Advanced students can use their iPads to calculate estimated fluid resuscitation volumes for severe burn models, applying clinical medical algorithms against total body surface area charts.
- Structured sentence frames are embedded directly into the lab documentation interfaces: The slide displays [blank] carcinoma because the cell margins are highly [blank], while a deep third-degree burn compromises underlying muscular movement because the flexible dermis is completely replaced by a rigid matrix of [blank] fibers.

Resources Provided:

- High-magnification skin pathology imaging directories, digital dermoscopy training programs, and clinical burn management case logs.
- Core Lab Pack (Microscope diagnostic log grids, anatomical feature indicator pins, burn classification reference matrices, and digital spreadsheet access passes).
- Tissue specimen arrays, structural tracking alignment boards, and high-contrast pathological reference charts.



Lesson Plan 2 Template

Content Area: Science Lesson Title: Bone Joint Construction/Hip Lab

Time Frame: 2 days

Lesson Components

21st Century Themes

- ☐ Global Awareness ☐ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☒ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☐ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☒ Communication and Collaboration ☒ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Engineering, Biology

Integration of Technology:

- Google Slides collaborative workspace modules configured for high-speed anatomical assembly tracking, template labeling, and group presentations.
- Native iPad camera and integrated markup tools to capture, crop, and draw structural anatomical boundaries over physical student-constructed bone assemblies.
- Cloud-hosted digital textbook repositories for interactive skeletal reference and bone marking identification.

Equipment Needed:

- Student iPads.
- Physical model bone collection samples (including distinct long, short, flat, and irregular bone types).
- Disarticulated shoulder girdle bone models (clavicle, scapula, and proximal humerus components).
- Real-scale or highly accurate model replicas of male and female pelvic girdles.
- Desktop metric sliding calipers and angle protractors for pelvic inlet analysis.

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: • Sort and classify long, short, irregular, and flat bones from a mixed laboratory anatomical	Lesson Sequence 1. Phenomenon: An elderly patient who suffers a sudden trip and fall experiences an acute femoral neck	• Students will successfully complete their comparative pelvic lab reports, accurately measuring



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collection using macro-structural characteristics.

- Build a shoulder girdle from the identified bones, matching the exact articular surfaces of the scapula, clavicle, and humerus.
- Create an image and edit it with the correct label of their bone model, utilizing digital vector lines to map out structural bone markings.
- Compare and describe the difference between a male and female hip using subpubic angle geometry, iliac flare span, and pelvic inlet shapes.

fracture because age-related demineralization has degraded the micro-architectural trabecular struts inside their spongy bone tissue, causing the deep multi-axial ball-and-socket synovial hip joint to completely lose its weight-bearing alignment and locking the surrounding dense regular connective tissue capsular ligaments into a state of severe, agonizing spasm that prevents any rotational articulation.

2. Macro-Structural Bone Sorting Lab Phase: Working in specialized osteology teams, students evaluate a mixed laboratory tray of real or replica bones. They physically sort the items into distinct structural buckets—long, short, flat, and irregular—documenting the structural advantages of each shape category in their laboratory logs.
3. Shoulder Girdle Mechanical Assembly Challenge: Groups isolate the specific bones required to construct the human upper appendicular anchor. They manipulate the scapula,

and documenting the structural differences between male and female hip angles with zero geometric calculation errors.

- Students will deliver a clean, digitally labeled shoulder girdle diagram that correctly positions and identifies all primary skeletal attachment sites and articular faces.
- Students will define the physical features that distinguish a long bone from an irregular or flat bone based on structural dimension ratios.
- Students will correctly explain how loss of internal trabecular bone mass triggers structural macro-joint alignment failures during low-impact falls on an end-of-class exit log.



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	clavicle, and humerus to recreate the glenohumeral and acromioclavicular joints, pinning the bones into their functional, weight-bearing anatomical alignment. 4. Digital Image Capture and Markup Execution: Using their iPads, students take clear, high-resolution photographs of their completed shoulder girdle constructs. They import these images into an editing workspace, using vector markup tools to overlay clean, precise anatomical labels pointing out the acromion process, glenoid cavity, and coracoid process. 5. Pelvic Dimorphism Comparative Analysis: Teams pivot to the hip station to contrast physical models of male and female pelvises. Using physical calipers and protractors, they measure the specific geometry of the subpubic arch and chart the width of the greater sciatic notch to complete their formal comparative lab reports. 6. Formative Assessment Tasks & Group Debates: The teacher circulates for quick structural checkpoints	
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- while student teams upload their labeled diagrams directly into a shared class Google Slides deck. This leads into a collaborative group discussion regarding how structural variations in bone density directly influence fracture risks.
7. **Shoulder Girdle Joint Presentations:** Student pairs share their completed Google Slides decks with the room, utilizing their edited diagrams to deliver short, evidence-based descriptions of how the shoulder girdle trades structural stability to maximize multi-axial directional mobility.

Differentiation:

- **Peer-Supported Workspace Alliances:** Students are strategically paired in collaborative engineering teams to allow members with advanced spatial manipulation skills to assist partners navigating fine-motor or analytical barriers.
- **Targeted Benchmark Interventions:** The teacher delivers real-time mini-lessons at a dedicated pull-out station during the lab, utilizing formative sorting data to re-teach bone identification features to struggling teams.
- Visual structural reference cards displaying the exact differences between male and female pubic arches are positioned directly alongside the physical hip specimens.
- Advanced students can compute the specific percentage difference between male and female pelvic inlet diameters, utilizing their measurements to model obstetrical clearance limits.
- Structured sentence frames are embedded into the hip analysis sheets: The female pelvis exhibits a much [blank] subpubic angle compared to the male model, which serves an evolutionary purpose, while the shoulder girdle forms a highly mobile [blank] joint that is susceptible to dislocation because its socket is very shallow.

Resources Provided:



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- Interactive PowerPoint presentation containing deep structural osteology notes and bone marking reference keys.
- Digital and physical core anatomy textbook chapters focusing on the appendicular skeleton.
- Real-scale laboratory bone sorting collections, disarticulated shoulder models, and dimorphic pelvic specimens.



Lesson Plan 3 Template

Content Area: Science
days

Lesson Title: Robotic Arm

Time Frame: 5

Lesson Components

21st Century Themes

- ☐ Global Awareness ☐ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☒ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☒ Communication and Collaboration ☐ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Engineering, Biology

Integration of Technology:

- Google Sheets cloud-based team spreadsheets to maintain a centralized performance data log, calculate design efficiency metrics, and graph mechanical success ratios across multiple trial loops.
- Student iPads utilized specifically for high-magnification digital blueprint drafting, recording slow-motion video analysis of mechanical joint articulation, and accessing cloud-based structural rubric specifications.

Equipment Needed:

- Student iPads for capturing trial footage, viewing engineering guidelines, and entering structural data.
- Heavy-duty corrugated cardboard sheets and backing panels for structural limb scaffolding.
- Braided twine and high-tensile nylon fishing line to simulate skeletal muscle tendons and cable pathways.
- Standard steel paperclips and variable-size binder clips for custom structural fasteners and pivot line-guides.
- Wide wooden tongue depressors and standard popsicle sticks to model rigid long bones (humerus, radius, ulna).
- Low-friction plastic washers, brass brads, elastic bands, and hot glue bonding systems.
- Standardized testing load objects (empty plastic cups, tennis balls, or wooden blocks) and metric mass balances.

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will:	Lesson Sequence 1. Phenomenon: A specialized biomedical	



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- Create a device to perform a task, executing a functional engineering design process to meet specific load and grasp constraints.
- Relate the structure of their device to an actual arm, explicitly mapping mechanical components to human bones, joints, tendons, and antagonistic muscle groups.
- Design a grasping mechanism and two-jointed arm capable of translating mechanical pulling forces into secure structural manipulation.

- prosthetic upper limb uses superficial electromyography sensors pressed against a patient's residual limb to detect micro-volt electrical action potentials traveling along the sarcolemma of skeletal muscle fibers, instantly translating those physiological nerve signals into mechanical commands that engage motorized gears and synthetic cables to mimic the antagonistic pulling forces of the human biceps and triceps brachii muscles across a hinge joint.
2. Requirements Clarification and Task Definition: The teacher projects the engineering rubric on the main screen, defining the task parameters: groups must construct a working mechanical arm featuring a functional grasping hand and two structural joints that can successfully lift and move a target load.
 3. Digital Blueprint and Schematic Drafting: Using their iPads, students access layout software to sketch a detailed technical blueprint of their arm design. They must explicitly color-code and label which materials represent the humerus, radius, elbow joint, digits, and antagonistic tendon cables (fishing line vs. twine) before any fabrication begins.

- Final Task Performance Evaluation: A live engineering execution audit where the constructed robotic arm must successfully grasp, lift, and transfer a standardized mass without experiencing structural joint collapse or cable failure.
- Anatomical Muscle Test Checkpoint: A structural oral or written diagnostic quiz where student teams must demonstrate the exact mechanical pulling action of their cable pairs and correctly explain how those cords simulate human biceps and triceps mechanics.
- Students will define an antagonistic muscle system as a paired structural arrangement where one cable must pull to cause joint flexion while the opposite line relaxes or pulls to achieve extension.
- Students will correctly link physical engineering materials to their corresponding biological tissue



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	4. Materials Procurement and Component Layout: Teams open their construction kits, gathering measured allocations of cardboard, tongue depressors, and line fasteners. They prepare the rigid structural "bone" frameworks by stabilizing their popsicle stick supports onto the cardboard arm links. 5. Mechanical Grasp and Joint Construction Phase: Student engineering pairs build the physical articulation systems. They secure binder clips to act as tendon guides, loop fishing lines through cardboard digits to form a flexor tendon system, and wire an opposing elastic or twine line to act as an extensor system, establishing a working antagonistic pair across the mechanical elbow hinge. 6. Live Functional Trials and Task Performance: Student teams position their completed robotic arms at the testing field. They perform standardized operational trials, attempting to reach out, articulate the joints, actuate the terminal grasper, lift the target testing object, and safely deposit it across a measured boundary line. 7. Spreadsheet Performance Data Logging: During and immediately after the testing trials, students	targets on a final laboratory verification slip.
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open Google Sheets on their iPads to input their engineering metrics. They log the total weight of their device, the mass of the load lifted, the maximum joint angle achieved without structural failure, and successful execution times, creating a live class-wide comparative chart.

Differentiation:

- Structural Prototyping Models and Step Guidance: Completed baseline sample models, instructional animation loops, and step-by-step video breakdowns detailing simple mechanical prosthetics are loaded onto specific student iPads to assist teams navigating spatial or analytical processing hurdles.
- Tactical Resource Modifications: Pre-punched cardboard links and larger, high-grip binder clips are provided to substitute for raw tool cutting steps for student pairs working through fine-motor coordination barriers.
- Visual component mapping cards matching biological tissue labels with specific building materials are placed at each workspace.
- Advanced students can use their Google Sheets databases to write custom formulas that calculate the exact mechanical advantage of their leverage systems, analyzing how moving the tendon attachment site changes pulling efficiency.
- Structured sentence frames are embedded into the design logs: The nylon fishing line in our device mimics the high-tensile [blank] of a human muscle, and when we pull the top cord to flex the elbow joint, the bottom twine cord acts as the [blank] muscle by relaxing to allow full articulation.

Resources Provided:

- Digital human musculoskeletal biomechanics textbook chapters and prosthetic engineering documentation files.
- Structural Fabrication Pack (Anatomical blueprint grids, material stress-limit tables, trial tracking ledgers, and digital class spreadsheet passes).
- Do-it-yourself structural craft kits, mechanical connector arrays, and geometric alignment guides.



Lesson Reflection

Reflect on the lesson you have developed and rate the degree to which the lesson **Strongly**, **Moderately** or **Weakly** meets the criteria below.

Lesson Activities	Strongly	Moderately	Weakly
Are challenging Strongly and require higher order thinking and problem solving skills	☒	☐	☐
Allow for student choice	☐	☒	☐
Provide scaffolding for acquiring targeted knowledge/skills	☐	☒	☐
Integrate global perspectives	☐	☒	☐
Integrate 21st century skills	☒	☐	☐
Provide opportunities for interdisciplinary connection and transfer of knowledge and skills	☒	☐	☐
Foster student use of technology as a tool to develop critical thinking, creativity and innovation skills	☐	☒	☐
Are varied to address different student learning styles and preferences	☐	☒	☐
Are differentiated based on student needs	☒	☐	☐
Are student-centered with teacher acting as a facilitator and co-learner during the teaching and learning process	☒	☐	☐
Provide means for students to demonstrate knowledge and skills and progress in meeting learning goals and objectives	☒	☐	☐
Provide opportunities for student reflection and self-assessment	☒	☐	☐
Provide data to inform and adjust instruction to better meet the varying needs of learners	☒	☐	☐

Curriculum Design Template

Content Area: Science and Physiology

Grade Level: 12

Course Title: Human Anatomy

Created: 2021

Board Approved on:



Unit Overview Template

Content Area: Science **Grade Level:** 12 **Unit Title:** Anatomy: Nervous, Endocrine, Digestive Systems

Unit Summary: This unit will investigate how the nervous, endocrine, and digestive systems maintain homeostasis of the body by monitoring and communicating, with emphasis on how structure determines function.

Primary Interdisciplinary Connections: Engineering, Biology

21st Century Themes ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ ICT Literacy

☐ Information Literacy ☒ Life and Career Skills ☒ Communication and Collaboration ☐ Media Literacy

Unit Rationale: The study of anatomical structures and their functions provides an opportunity for understanding of the body and the disorders that result from homeostatic imbalances.

Career Readiness (Standard 9):

9.2.12.CAP.4: Evaluate different careers and develop various plans.

9.2.12.CAP.5: Assess and modify a personal plan to support current interests and postsecondary plans.

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.

9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities.

9.4.12.GCA.1: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political, economic, cultural) may work better than others.

9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.

9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.

9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.

9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

Learning Targets

Standards: HS-LS1; HS-ETS1

Content Statements: From Molecules to Organisms: Structures and Processes; Engineering Design

CPI#:

Cumulative Progress Indicator (CPI):



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HS-LS1-1	Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
HS-LS1-2	Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
HS-LS1-3	Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
HS-LS1-5	Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
8.2.12.ED.1	Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
8.2.12.ED.4	Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
HS.N.Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
SL.11-12.1	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with peers on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

Science and Engineering Practices:

Developing and Using Models

Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

- Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-2)
- Use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-5)

Planning and Carrying Out Investigations

Planning and carrying out in 9–12 builds on K–8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.



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- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HSL1-3)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS1-1)
- Design a solution to a complex real-world problem, based on scientific knowledge, student generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-2)

Disciplinary Core Ideas (DCIs):

LS1.A: Structure and Function

- Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)
- All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (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.C: Organization for Matter and Energy Flow in Organisms

- The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. (HS-LS1-5)

ETS1.C: Optimizing the Design Solution



- Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (tradeoffs) may be needed. (HS-ETS1-2)

Crosscutting Concepts:

Systems and System Models

- Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. (HS-LS1-2)

Structure and Function

- Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. (HS-LS1-1)

Stability and Change

- Feedback (negative or positive) can stabilize or destabilize a system. (HS-LS1-3)

Energy and Matter

- Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-LS1-5)

Connections to Nature of Science

Scientific Investigations Use a Variety of Methods

- Scientific inquiry is characterized by a common set of values that include: logical thinking, precision, open-mindedness, objectivity, skepticism, replicability of results, and honest and ethical reporting of findings. (HS-LS1-3)

Unit Essential Questions:

- How does the nervous system protect and regulate body processes?
- What effect does injury or disease have on the nervous system?
- How are the sensory organ structures arranged to detect changes and inform the nervous system?
- How does the endocrine system maintain homeostasis?
- What are the effects of hormonal imbalance?
- How do the structures of the digestive system enable each organ to perform its function?
- What are the effects of diseases of the digestive system on the health of an individual?



- What is the effect of aging on the systems?

Unit Enduring Understandings:

- The central nervous system (CNS) and peripheral nervous system (PNS) coordinate nervous system functions.
- The structure and function of the supporting cells of the CNS and PNS determine how injury and disease affects these cells.
- The structure of the eye and ear provide efficient feedback to the central nervous system.
- The actions of the endocrine are coordinated to maintain homeostasis through a feedback system.
- The production and level of hormones determines the efficiency of the glands and hormones.
- The digestive system structures enable food to be processed and metabolized.
- The digestion of food involves physical and chemical processing.
- Diseases of the systems and aging will affect their function and result in an imbalance of homeostasis.

Unit Learning Targets:

Students will....

- Identify and classify the divisions of the nervous system.
- Relate the structure of a neuron to its function.
- Compare structure and function of the supporting cells of the nervous system.
- Demonstrate the pathway of the reflex arc.
- Analyze case studies related to diseases of the nervous system.
- Model the structure of the brain using dissection or clay.
- Compare the actions of the endocrine system to those of the nervous system.
- Model the interaction between the hormones and target cells.
- Relate negative and positive feedback systems to real-world examples.
- Sequence the pathway of food through the digestive system.
- Compare the functions of each structure of the digestive system.
- Relate diseases and disorders to the failure to metabolize nutrients.



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Evidence of Learning

Summative Assessment: 3 days

Equipment Needed: iPads, lab materials

Teacher Resources: Exam pro test generator

Formative Assessments:

- Lab reports
- Classwork
- Homework
- Group projects
- Discussions
- Case studies
- "Do now" activities



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Lesson Plans

Lesson	Time Frame
Lesson 1 Brain Activity List	3 days
Lesson 2 Exercise Physiology Hormonal Response	1 day
Lesson 3 Adventures in the Digestive System	4 days

Teacher Notes: This advanced unit combines fast-paced neurological testing arrays with complex metabolic tracking and simulated chemical digestion protocols. Before launching the neurological mapping activities, verify that all reflex response timers, sensory discrimination calipers, and electronic data logging sheets are fully functional and distributed across student workstations. For the chemical digestion simulations, set up a dedicated chemical preparation zone containing standardized artificial gastric fluids, enzyme concentrates, pH indicators, and graduated delivery pipettes to ensure that tracking variables remain uniform across all student lab pairs.

Curriculum Development Resources/Technology Resources:

Click the links below to access additional resources used to design this unit:

<http://www.g2conline.org/>

<http://www.nytimes.com/2010/01/03/opinion/03kristof.html>

https://www.ted.com/playlists/1/how_does_my_brain_work



Lesson Plan 1 Template

Content Area: Science
days

Lesson Title: Brain Activity List

Time Frame: 3

Lesson Components

21st Century Themes

- ☐ Global Awareness ☐ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☒ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☒ Communication and Collaboration ☐ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Engineering, Biology

Integration of Technology:

- Interactive neuroscience databases (such as the G2C - Genes to Cognition interactive platform) to map, navigate, and simulate neurological pathways, functions, and corresponding clinical brain disorders.
- Student iPads utilized specifically for high-definition streaming of neuro-engineering TED Talks, accessing digital news media archives, and uploading peer analysis summaries to class discussion boards.

Equipment Needed:

- Student iPads for viewing primary source videos, researching articles, and manipulating digital brain maps.
- Anatomical 3D human brain models with detachable, interlocking lobes and structural components.
- Fine-tip color marker sets for structural tissue mapping and pathway charting.
- Printed multi-planar neurological diagram layouts (sagittal, coronal, and superior views).

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: • Differentiate between functions of brain lobes by mapping cognitive and motor commands across	Lesson Sequence 1. Phenomenon: A patient diagnosed with a severe stroke in the left hemisphere of their cerebral cortex can fully understand spoken	• Completion of Activity List: A comprehensive tracking folder containing the finalized G2C



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specific cortical zones. ● Relate micronutrient deficiency to spinal cord development, focusing on the biochemical role of folate in preventing embryonic neural tube defects. ● Distinguish between lobes on a brain model, using physical landmarks like the central sulcus and lateral fissure to isolate tissue boundaries. ● Assess new information on brain presentations by analyzing modern neuro-engineering case studies to evaluate emerging therapeutic interventions.	sentences and visualize complex objects but remains completely unable to speak words or coordinate the muscles of their right arm, whereas an adjacent small lesion in the cerebellum leaves their speech perfectly intact but causes their fingers to tremble uncontrollably whenever they reach out to grasp a pencil because the fine-motor coordination loops that calibrate muscular speed and distance have lost their predictive timing signals. 2. G2C Digital Mapping and Matrix Completion: Working on their iPads, students access the digital G2C network. They cross-examine interactive clinical files to populate a master diagnostic matrix matching the frontal, parietal, occipital, and temporal lobes with their operational parameters and secondary lesion disorders. 3. Micronutrient and Neural Tube Analysis: Students pivot to digital health archives to read primary research articles detailing the interactions between	functional matrix, labeled color diagrams, and primary source article reviews, graded for anatomical accuracy. ● Brain Presentation Peer Assessment: A real-time digital submission where students write an objective summary evaluating the methodology and data validity of the modern brain research presented in the TED videos. ● Students will define the physical boundary lines that isolate the primary lobes of the cerebral cortex from the sub-cortical tissue of the cerebellum. ● Students will correctly outline the developmental link between early vitamin deficiencies and permanent structural failures of the central nervous system on an exit ticket.
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and maternal diet. They draft analytical commentary arguing how vitamin B₉ (folate) deficiencies physically halt the closure of the neural tube along the primitive spinal axis.

4. **Multi-Planar Structural Coloration Lab:** Utilizing physical brain models and detailed anatomical worksheets, pairs trace major surface grooves. They color-code independent functional zones on their diagrams, establishing clear visual boundaries between the sensory cortex, motor strip, Broca's language zone, and the localized tissue of the cerebellum.
5. **Neuro-Engineering Speaker Evaluation:** Students use their iPads to watch two curated TED Talks highlighting state-of-the-art brain-machine interfaces and neural plasticity studies. They critique the findings, extracting core data points regarding how damaged neural networks reorganize after traumatic strokes.
6. **Activity List Synthesis and Audits:** The teacher runs a centralized data audit as



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teams check off the completion milestones of their activity lists. This culminates in an open-floor debate where students use their updated brain maps to solve the exact physiological mechanisms of the lesson's anchoring stroke phenomenon.

Differentiation:

- Targeted Benchmark Interventions: The teacher utilizes live formative progress from the activity checklists to pull out struggling teams for immediate, micro-lessons on cortical landmark identification using physical 3D models.
- Visual and Structural Accommodations: Simplified G2C navigation maps and pre-bordered color templates are pinned to workspaces to support teams navigating high-density reading or fine-motor processing challenges.
- High-contrast locator stickers are provided to mark key linguistic zones (like Broca's and Wernicke's areas) directly onto physical lab models.
- Advanced students can research the molecular ion channels involved in resting membrane potentials, charting how a localized lack of blood flow during a stroke compromises cell health.
- Structured sentence frames are built directly into the lesson log sheets: The patient's inability to coordinate speech points to a stroke inside the [blank] lobe of the left hemisphere, whereas a loss of smooth, predictive motor timing indicates that a lesion has compromised the structural loops of the [blank].

Resources Provided:

- Specialized clinical neurology activity lists featuring step-by-step tech tracking pathways and article links.
- Digital references including access passes to the G2C platform, neuro-developmental research archives, and curated TED playlist links.
- Physical lab arrays including disarticulated brain cross-section replicas, multi-colored fiber indicators, and structural mapping templates.

Lesson Plan 2 Template

Content Area: Science
Time Frame: 1day

Lesson Title: Exercise Physiology Hormonal Response

Lesson Components



21st Century Themes

- ☐ Global Awareness ☐ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☒ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☐ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☒ Communication and Collaboration ☒ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Engineering, Biology

Integration of Technology:

- Google Sheets interactive data sets pre-loaded with physiological metrics (insulin, glucagon, epinephrine, and cortisol levels) tracking trained versus untrained athletes across a gradient of work intensities.
- Student iPads utilized specifically to construct collaborative analysis slides in Google Slides, manipulating digital data visualization graphs, and logging physiological arguments.

Equipment Needed:

- Student iPads for data plotting, graph modeling, and digital slide design.
- Precision mechanical graph alignment overlays or transparent grid rulers.
- Laminated physical multi-variable endocrine feedback pathway maps.
- Color-coded homeostatic tracking token sets for physical feedback loop modeling.

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: • Analyze fluctuation of hormone levels during exercise by plotting circulating concentrations against time and work output parameters. • Evaluate graphs to analyze changing levels of hormone during exercise, tracking specific inflection points	Lesson Sequence 1. Phenomenon: An amateur runner sprinting up a steep hill experiencing a sudden drop in blood glucose levels experiences an immediate activation of the adrenal medulla and pancreas, causing a massive systemic release of epinephrine and glucagon into the bloodstream that forces the liver to rapidly convert stored glycogen into	• Class Discussion Engagement: A live collaborative check where students must verbally justify their endocrine pathway models using quantitative data values directly from their work charts.



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relative to a subject's aerobic limit (Percent VO_2 max).

- Relate function of hormone in the body to changes of levels during exercise, mapping metabolic demands directly to pancreatic and adrenal glandular outputs.
- Compare the hormonal response of trained and untrained athletes, isolating how physical conditioning alters endocrine sensitivity and physiological efficiency.

usable sugar within seconds, whereas their circulating insulin levels plummet to near zero to ensure that skeletal muscles can absorb the fuel while protecting the central nervous system from entering a fatal hypoglycemic coma.

2. Multi-Variable Graph Analysis Phase: Working in sports medicine research pairs, students use their iPads to open data logs showing endocrine shifts across escalating work intensities (Percent VO_2 max). They map out exact points where insulin drops and glucagon/epinephrine spike, using digital alignment guides to track variables simultaneously.
3. Physiological Brainstorming & Variable Evaluation: Teams evaluate their plotted data arrays to uncover the systemic reasons behind these endocrine shifts. They use physical homeostatic tracking tokens on path maps to model how a failure to suppress insulin during high-intensity exercise would cause immediate,

- Written Evaluation and Analysis Document: A completed analytical report embedded within the student Google Slides deck that accurately describes the mechanical relationships between VO_2 max, hormone fluctuation, and metabolic homeostatic control.
- Students will define the physiological meaning of Percent VO_2 max as the measurement of exercise intensity relative to an individual's maximum oxygen consumption rate.
- Students will correctly identify the primary target tissue where glucagon initiates glycogenolysis (the breakdown of stored glycogen



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	catastrophic hypoglycemia. 4. Comparative Profile Building (Trained vs. Untrained): Using a shared Google Sheets database, students extract comparative hormone profiles. They analyze why a conditioned athlete releases significantly less epinephrine at a given workload than an unconditioned peer, identifying how cellular receptors adapt to training. 5. Synthesis & Presentation Deck Assembly: Student pairs translate their findings into a structured, analytical segment inside a Google Slides workspace. They insert their annotated endocrine graphs alongside a concise, written physiological description explaining how these chemical signals coordinate fuel delivery under acute physical stress. 6. Formative Debates and Group Discussion: The teacher displays the student slide decks on the main screen, leading a collaborative class discussion where students	into glucose) on a digital exit ticket.
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defend their conclusions using quantitative graph trends to solve the exact systemic loops driving the lesson's anchoring phenomenon.

Differentiation:

- **Targeted Benchmark Interventions:** The teacher uses ongoing data checkpoints during graph evaluation to gather struggling teams at a central board, delivering targeted mini-lessons on how to isolate independent vs. dependent variables on a dual-axis physiological chart.
- **Visual and Layout Scaffolding:** Pre-labeled graph grids featuring color-matched coordinate lines (red for catabolic hormones, blue for anabolic hormones) are deployed to assist teams managing visual or data tracking friction.
- Standardized coordinate prompt sheets showing baseline resting values are positioned directly next to every station display.
- Advanced students can compute the mathematical rate of change for hormone clearing times, graphing the slope of the endocrine decline during post-exercise recovery phases.
- Structured sentence frames are built directly into the slide analysis templates: As the runner's exercise intensity rises past 60% of their [blank], the pancreas responds by decreasing [blank] output and increasing [blank] secretion, allowing the liver to rapidly release stored glucose into the blood.

Resources Provided:

- Comprehensive PowerPoint slide decks pre-loaded with physiological exercise graphs, hormone profiles, and endocrine feedback loops.
- Digital human anatomy and physiology textbook chapters focused on the endocrine system and exercise metabolism.
- Curated spreadsheets containing raw clinical hormone metrics from real-world athletic performance trials.



Lesson Plan 3 Template

Content Area: Science
Frame: 4 days

Lesson Title: Adventures in the Digestive System Time

Lesson Components

21st Century Themes

- ☐ Global Awareness ☐ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☒ Health Literacy

21st Century Skills

- ☒ Creativity and Innovation ☐ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☒ Communication and Collaboration ☐ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Biology

Integration of Technology:

- Student iPads utilized specifically for navigating high-definition digital gastrointestinal endoscopy galleries, drafting multi-stage narrative blueprints, and compiling collaborative project logs on shared drives.
- Cloud-based medical imaging portals to cross-examine macroscopic structural profiles of primary gastrointestinal tracts.

Equipment Needed:

- Student iPads for research, narrative storyboards, and digital presentation design.
- Mixed anatomical physical crafting material assortments (including flexible polymer tubing, textured foam segments, cellulose sponges, and high-tensile binding agents).
- Anatomical 3D human digestive system models featuring removable gastric and intestinal segments.
- Universal metric tape measures for calculating comparative surface area scales.

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: • Create a story that takes the reader on a passage through the digestive system, crafting an anatomically accurate narrative journey from the oral cavity to excretion.	Lesson Sequence 1. Phenomenon: An individual who swallows a capsule containing a miniaturized wireless telemetry camera captures footage showing the smooth muscle walls of the esophagus executing rhythmic, involuntary	• Brainstorming Ideas Activity Checkpoint: A structured peer-reviewed outline documenting the proposed narrative sequence,



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- Relate the structure of each site to the function, mapping tissue adaptations like the villi/microvilli patterns to specialized absorption and transport tasks.
- Explain the physical and chemical breakdown of food at each structure, isolating specific enzyme targets (such as salivary amylase and pepsin) and mechanical churning zones.

contractions that push a mass of food downward against gravity even while the person stands on their head, followed by an immediate immersion into a churning pool of highly acidic fluid that breaks down dense protein bonds while specialized mucous cells line the stomach wall to prevent the organ from digesting itself.

2. Structural Overview and Technical Mapping: The teacher coordinates an initial interactive structural review, anchoring tissue roles directly to the capsule camera phenomenon. Students use their iPads to trace primary organs and locate physical boundaries where processing shifts from mechanical breakdown to nutrient absorption.
3. Rubric Deconstruction and Narrative Project Framing: The teacher introduces the formal narrative assessment metrics, clarifying that stories must explicitly document both mechanical and chemical actions, specify pH variations, and detail structural tissue adaptations at every stop.
4. Brainstorming and Structural Note-Taking Session: Working in narrative design pairs,

characters (e.g., a specific food bolus), and a breakdown of all mechanical and chemical actions at each station.

- Comprehensive Anatomy Note Log: A technical diagnostic journal capturing the precise structural properties of each digestive site, verified for anatomical accuracy before writing begins.
- Students will define peristalsis as the rhythmic, involuntary wave of smooth muscle contractions that propels food through the gastrointestinal tract.
- Students will correctly isolate the stomach as the primary organ where highly acidic gastric juices activate pepsin to initiate chemical protein denaturation on an end-of-class log.



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students use their iPads to execute focused technical brainstorming. They record specialized notes on the micro-anatomy of each site—such as the rugae folds of the stomach and the multi-layered mucosal linings—building an evidence-based roadmap for their text.

5. **Digestive System Structural Model**
Assembly: Moving from concept to physical layout, student teams build 3D physical models of the gastrointestinal pathway. Utilizing textured craft materials, they construct representations of the track, engineering realistic structural variations like the high-surface-area folds of the small intestine to demonstrate mechanical absorption capabilities.
6. **Peer Narrative Audits and Structural Synthesis:**
Teams share their storyboards and model layouts with neighboring groups, cross-checking that the path of the bolus and chyme matches real physiological timelines. The class discusses how an alteration in stomach acidity or a loss of intestinal microvilli would derail the entire systemic energy distribution loop.

Differentiation:



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- **Targeted Benchmark Interventions:** The teacher uses ongoing structural note audits to gather struggling teams at a reference table, delivering targeted mini-lessons on how to distinguish mechanical mastication from chemical enzymatic hydrolysis.
- **Visual and Structural Scaffolding:** Graphic organizer templates pre-divided into color-matched processing zones (blue for mechanical, yellow for chemical) are deployed to assist teams navigating complex physiological pathways.
- **Illustrated tissue identification keys** showing the visual differences between esophageal stratified epithelium and simple columnar intestinal linings are placed at each workspace.
- **Advanced students** can research the endocrine feedback controls of digestion, charting how secretin and cholecystokinin (CCK) coordinate enzymatic releases from the pancreas and gallbladder.
- **Structured sentence frames** are built directly into the narrative project guides: As the capsule travels down the esophagus, it is pushed by coordinated waves of [blank], entering a highly acidic environment where the enzyme [blank] chemically breaks down proteins while a thick layer of [blank] protects the stomach walls from auto-digestion.

Resources Provided:

- Comprehensive digital anatomical textbooks and endoscopic imagery directories focusing on the human gastrointestinal tract.
- Master Lab Pack (Narrative rubric criteria sheets, chemical enzyme tracking charts, pH gradient map graphics, and 3D design verification logs).
- Scale-ratio references, anatomical tissue specimen guides, and high-resolution histology projection sets.



Lesson Reflection

Reflect on the lesson you have developed and rate the degree to which the lesson **Strongly**, **Moderately** or **Weakly** meets the criteria below.

Lesson Activities	Strongly	Moderately	Weakly
Are challenging Strongly and require higher order thinking and problem solving skills	☒	☐	☐
Allow for student choice	☐	☒	☐
Provide scaffolding for acquiring targeted knowledge/skills	☐	☒	☐
Integrate global perspectives	☐	☒	☐
Integrate 21st century skills	☒	☐	☐
Provide opportunities for interdisciplinary connection and transfer of knowledge and skills	☒	☐	☐
Foster student use of technology as a tool to develop critical thinking, creativity and innovation skills	☒	☐	☐
Are varied to address different student learning styles and preferences	☐	☒	☐
Are differentiated based on student needs	☒	☐	☐
Are student-centered with teacher acting as a facilitator and co-learner during the teaching and learning process	☒	☐	☐
Provide means for students to demonstrate knowledge and skills and progress in meeting learning goals and objectives	☒	☐	☐
Provide opportunities for student reflection and self-assessment	☒	☒	☐
Provide data to inform and adjust instruction to better meet the varying needs of learners	☒	☐	☐

Curriculum Design Template

Content Area: Science and Physiology

Grade Level: 12

Course Title: Human Anatomy

Created: 2021

Board Approved on:



Unit Overview Template

Content Area: Science **Grade Level:** 12 **Unit Title:** Blood, Immunity, Circulatory, Respiratory

Unit Summary: This unit will investigate how the blood, circulatory, and respiratory systems maintain homeostasis of the body by monitoring and communicating, with emphasis on how structure determines function.

Primary Interdisciplinary Connections: Biology

21st Century Themes ☒ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ ICT Literacy

☐ Information Literacy ☒ Life and Career Skills ☒ Communication and Collaboration ☐ Media Literacy

Unit Rationale: The study of anatomical structures and their functions provides an opportunity for understanding of the body and the disorders that result from homeostatic imbalances.

Career Readiness (Standard 9):

9.2.12.CAP.4: Evaluate different careers and develop various plans.

9.2.12.CAP.5: Assess and modify a personal plan to support current interests and postsecondary plans.

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.

9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities.

9.4.12.GCA.1: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political, economic, cultural) may work better than others.

9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources.

9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.

9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.

9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

Learning Targets

Standards: HS-LS1; HS-ETS1

Content Statements: From Molecules to Organisms: Structures and Processes; Engineering Design

CPI#:

Cumulative Progress Indicator (CPI):



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HS-LS1-1	Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
HS-LS1-2	Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
HS-LS1-3	Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
HS-LS1-7	Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
8.2.12.ED.1	Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
8.2.12.ED.4	Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
HS.N.Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
SL.11-12.1	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with peers on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

Science and Engineering Practices:

Developing and Using Models

Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

- Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-2)
- Use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-7)

Planning and Carrying Out Investigations



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Planning and carrying out in 9–12 builds on K–8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HSL1-3)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS1-1)
- Design a solution to a complex real-world problem, based on scientific knowledge, student generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-2)

Disciplinary Core Ideas (DCIs):

LS1.A: Structure and Function

- Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)
- All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (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.C: Organization for Matter and Energy Flow in Organisms



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- As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. (HS-LS1-7)
- 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)

ETS1.C: Optimizing the Design Solution

- Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (tradeoffs) may be needed. (HS-ETS1-2)

Crosscutting Concepts:

Systems and System Models

- Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. (HS-LS1-2)

Energy and Matter

- Energy cannot be created or destroyed—it only moves between one place and another place, between objects and/or fields, or between systems. (HS-LS1-7)

Structure and Function

- Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. (HS-LS1-1)
- Stability and Change Feedback (negative or positive) can stabilize or destabilize a system. (HS-LS1-3)

Connections to Nature of Science

Scientific Investigations Use a Variety of Methods

- Scientific inquiry is characterized by a common set of values that include: logical thinking, precision, open-mindedness, objectivity, skepticism, replicability of results, and honest and ethical reporting of findings. (HS-LS1-3)

Unit Essential Questions:



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- How do the cardiovascular and respiratory systems work together to regulate homeostasis?
- What effect does injury or disease have on the blood, cardiovascular and respiratory systems?
- How do the cellular and tissue structures of the cardiovascular and respiratory systems enable each organ to perform its function?
- What is the effect of aging on the systems?

Unit Enduring Understandings:

- The cardiovascular and respiratory systems work together to deliver oxygen and nutrients to cells and pick up waste.
- The formed elements of the blood have specific functions related to oxygen and nutrient delivery, immunity and hemostasis.
- Diseases and aging of the systems will affect their function and result in an imbalance of homeostasis.

Unit Learning Targets:

Students will....

Identify the components of blood and functions of each.

Compare normal and abnormal blood volume and composition.

Relate symptoms of blood disorders to functions of the blood.

Predict the results of blood type donations to recipients.

Relate the steps of the immune response to illness and infection.

Trace the pathway of blood through the body.

Demonstrate the pathway of blood through the heart structures.

Relate the nervous system regulation of the heart rate.

Analyze phases of normal electrical heart conduction and blood pressure.

Design a model of the heart.

Test and measure the effect of exercise on heart rate and pressure.

Relate the structures of the respiratory system to their functions.

Evaluate the importance of surface area to the respiratory system.

Analyze the relationship between the respiratory and circulatory systems during rest and exercise.

Describe the effects of disease and aging on the performance of the systems.

Evaluate new treatments available for diseases of the cardiovascular and respiratory system.

Performs tests to determine lung capacity.

Design a model of the respiratory system.

Evidence of Learning

Summative Assessment: 4 days



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Equipment Needed: iPads, lab materials

Teacher Resources: Exam Pro test generator

Formative Assessments:

- Lab reports
- Classwork
- Homework
- Group projects
- Discussions
- Case studies
- "Do now" activities



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Lesson Plans

Lesson	Time Frame
Lesson 1 Structure and Functions of Blood Cells	3 days
Lesson 2 Heart Conduction and Blood Flow	1 day
Lesson 3 Respiratory Lung Volumes	1 day

Teacher Notes: Websites, microscopes, dissection materials, and models will be used during these lessons to supplement textbook content

Curriculum Development Resources/Technology Resources:

Click the links below to access additional resources used to design this unit:

http://highered.mheducation.com/sites/0072495855/student_view0/chapter22/animation__the_cardiac_cycle__quiz_1_.html

http://highered.mheducation.com/sites/0072495855/student_view0/chapter22/animation__conducting_system_of_the_heart.html

<https://www.nhlbi.nih.gov/health/health-topics/topics/hhw/electricalty>http://www.mhhe.com/biosci/esp/2002_general/Esp/folder_structure/tr/m1/s7/trm1s7_3.htm URL here

<https://www.wisc-online.com/learn/natural-science/life-science/ap14704/white-blood-cells>

<https://www.wisc-online.com/learn/general-education/anatomy-and-physiology1/ap12504/the-anatomy-of-the-heart> URL here

<https://www.wisc-online.com/learn/general-education/anatomy-and-physiology1/ap14704/white-blood-cells>

<https://www.wisc-online.com/learn/natural-science/life-science/ap14604/red-blood-cells>



Lesson Plan 1 Template

Content Area: Science
 Time Frame: 3 days

Lesson Title: Structure and Function of Blood Cells

Lesson Components

21st Century Themes

- ☐ Global Awareness ☐ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☒ Health Literacy

21st Century Skills

- ☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☐ Life and Career Skills ☒ Communication and Collaboration ☐ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Biology

Integration of Technology:

- App-linked digital microscopes paired directly to student tablets, allowing teams to capture high-definition micrographs, run digital grid overlays, and annotate cellular structures in real time.
- Interactive molecular clotting animation portals to manipulate variable tracking sliders, simulating how structural cascades polymerize fibrinogen into solid fibrin networks.
- Collaborative cloud databases to input, pool, and graph class-wide cell-count distributions against reference medical margins.

Equipment Needed:

- Student iPads for running digital software interfaces, capturing microscopy images, and viewing digital animations.
- Digital compound microscopes with integrated USB/Bluetooth camera modules.
- Prepared healthy human blood smear reference slides (Wright-stained).
- Pathological human blood smear slides displaying profound anemia, thrombocytopenia, and acute leukemia variants.
- Quantitative patient clinical data packets featuring numeric blood cell count tables.

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: ● Identify and compare blood cells under high-magnification microscopy,	Lesson Sequence 1. Phenomenon: A patient presenting to an emergency department with severe fatigue, a high fever, and pinpoint	● Labeled Micrograph Capture Assignment: A digitally annotated blood smear image submitted via iPad,



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distinguishing erythrocytes, leukocytes, and thrombocytes based on structural geometry and staining patterns.

- Analyze blood diagrams and diagnose diseases by evaluating abnormal cell morphology and shifting population metrics within patient case file summaries.
- Use website animations to view the clotting sequence, mapping out the precise operational timeline of cascading plasma proteins and platelet plug formation.
- Differentiate between functions of various types of white blood cells, charting the independent pathways used by granulocytes and agranulocytes to destroy foreign invaders.

bruising across their skin undergoes a rapid complete blood count analysis revealing normal, biconcave red blood cells alongside a catastrophic deficit in cell-fragment thrombocytes, while a concurrent blood smear shows a massive, unregulated overproduction of immature, oversized, and non-functional blastic white blood cells that have crowded out healthy bone marrow niches and stripped the body of its primary homeostatic clotting and immune defense mechanisms.

2. Microscopic Inspection and Visual Smear Analysis: Working in clinical laboratory pairs, students calibrate their digital microscopes to scan healthy and pathological human blood smears under high power. They capture high-definition micrographs, utilizing their iPads to visually trace the dimpled, anucleated profiles of red blood cells against the complex, segmented nuclei of white blood cells.
3. Quantitative Patient Case File Analysis: Teams receive a clinical handout displaying

featuring precise anatomical indicator arrows identifying erythrocytes, thrombocytes, and at least three distinct white blood cell variants.

- Patient Quantitative Analysis Handout: A completed diagnostic evaluation matrix correctly calculating clinical population deviations and rendering accurate medical diagnoses for all hypothetical patients based on data evidence.
- Hemostasis Sequence Submission: A detailed written step-by-step description of the coagulation pathway, graded for accuracy regarding platelet activation and fibrin network polymerization.
- Immunological Narrative and Structural Document: An original clinical story file containing clear descriptions and illustrations of leukocyte behaviors during acute tissue infection.
- Students will define the physiological role of erythropoietin-stimul



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	numeric blood cell count data charts for multiple hypothetical emergency patients. Students compare these clinical cell values against standard medical baselines, calculating deviations to diagnose conditions such as leukocytosis, iron-deficiency anemia, or critical clotting failures. 4. Interactive Hemostasis Clotting Simulation: Students transition to their iPads to launch web-based molecular clotting animations. They track the chemical sequence initiated by tissue damage, drafting a structural timeline that details how raw platelets adhere to broken vessel walls and how chemical factor cascades weave a sticky, permanent fiber net to stop active bleeding. 5. Immunological Narrative and Structural Construction: Pairs synthesize their white blood cell data to write a detailed, first-person physiological narrative tracing an immune response through infected tissue. They document the exact sequential deployment of phagocytic neutrophils, histamine-releasing	ated biconcave red blood cells as the primary vehicle for systemic gas exchange and oxygen transport. • Students will correctly identify thrombocytes as the anucleated cell fragments required to initiate localized homeostatic plugs following vascular wall trauma on an exit sheet.
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basophils, and antibody-producing lymphocytes, inserting their custom micrographs directly into the document to illustrate cellular roles.

Differentiation:

- Targeted Benchmark Interventions: The teacher collects immediate visual feedback from the initial microscopy phase, assembling struggling teams at a central teaching screen to re-model the structural features that separate small thrombocytes from large granulocytes.
- Visual and Software Accommodations: High-contrast reference overlays showing pre-isolated cell templates are provided alongside the digital microscope viewing screens to help students navigate high-density tissue matrices.
- Color-coded population count summary keys are placed at data stations to assist pairs managing dense numerical interpretation friction.
- Advanced students can analyze data sets from hemolytic disease patients, computing real-time hematocrit percentage shifts and predicting how changes in plasma viscosity alter full-body heart workloads.
- Structured sentence frames are built directly into the lab summary sheets: The patient's blood smear displays a massive overproduction of blastic [blank] cells, which explains their immune vulnerability, while their pinpoint bruising is caused by a failure of cell-fragment [blank] to initialize the primary clotting sequence along broken blood vessels.

Resources Provided:

- Comprehensive digital histology reference chapters and online access credentials for the interactive molecular clotting animation databases.
- Core Lab Pack (Patient blood count clinical logs, leukocyte structural classification keys, narrative writing outline guides, and micrograph grading rubrics).
- Calibrated tissue reference diagrams, high-resolution pathological display files, and metric cellular sizing guides.



Lesson Plan 2 Template

Content Area: Science
 Frame: 1 day

Lesson Title: Heart Conduction and Blood Flow Time

Lesson Components

21st Century Themes

- ☐ Global Awareness ☐ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☒ Health Literacy

21st Century Skills

- ☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☐ Communication and Collaboration ☐ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Biology

Integration of Technology:

- Google Sheets cloud spreadsheets pre-programmed with cardiac output formulas ($CO = HR \times SV$) to track, calculate, and graph hemodynamic fluctuations under variable stroke volumes and heart rates.
- Student iPads utilized specifically for manipulating interactive 3D cardiac conduction simulators, analyzing real-time digital EKG diagnostic strips, and taking adaptive formative self-assessments.

Equipment Needed:

- Student iPads for running digital spreadsheet formulas, viewing conduction loops, and taking online check-ups.
- Acoustic medical stethoscopes with tunable diaphragms for auscultating mechanical heart valves.
- Physical 3D human heart models with removable anterior walls to expose internal chambers and valvular systems.
- Laminated clinical EKG diagnostic reference cards displaying normal sinus rhythms against pathological arrhythmias (e.g., heart blocks, fibrillation).

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: • Relate the structures of the heart to the pathway of blood, tracing deoxygenated and	Lesson Sequence 1. Phenomenon: During a routine physical examination, an endurance cyclist exhibits a resting heart rate of 42 beats per	• Correct Labeling of a Diagram of the Heart: A comprehensive physical or digital



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oxygenated fluid streams through specific chambers, valves, and great vessels. • Compare the electrical conduction pathway to the stages of the cardiac cycle, matching pacemaker node firings directly with mechanical atrial and ventricular pressures. • Analyze the EKG phases and relate to the cardiac cycle, mapping the P wave, QRS complex, and T wave to their corresponding myocardial polarization states. • Diagnose patients with electrical conduction abnormalities by interpreting morphological distortions on clinical electrocardiogram tracings. • Listen to the cardiac cycle of a student, successfully identifying the distinct "lub-dub" acoustic signatures of synchronized valvular closures. • Relate changes to cardiac output to athletic conditioning	minute alongside a highly structured electrocardiogram trace showing an extended diastolic filling phase, whereas a sedentary patient recovering from a massive myocardial infarction exhibits a rapid, disorganized pulse of 115 beats per minute with a severely flattened EKG ST-segment because dead ventricular tissue has blocked the electrical depolarization pathway, forcing the heart muscle to compromise its resting stroke volume and rapidly accelerate its contraction cycle to maintain homeostatic cardiac output. 2. Macro-Structural Mapping and Pathway Traversal: Working in clinical cardiology pairs, students utilize physical 3D heart models to identify and label chambers, septa, and valves. They physically navigate a colored pointer through the pathway of blood, contrasting the low-pressure pulmonary circuit with the high-resistance systemic loop. 3. Electrical Conduction and Animation Cross-Examination: Students log onto their iPads to watch interactive animations of the cardiac cycle. They trace the electrical depolarization	structural test requiring students to accurately plot the entire structural pathway of blood and localized conduction centers with 100% directional accuracy. • Cardiac Cycle Practice Quizzes: Adaptive online check-ups completed on iPads to verify student mastery of mechanical volume shifts and valvular operations. • Electrocardiogram Diagnostic Quiz: A formal evaluative assessment where students must analyze abnormal EKG waves to identify matching cardiac cycle disorders and conduction failures. • Cardiac Output Formula and Fluctuation Voucher: A written summary task where students write out the cardiac output equation, defining why stroke volume rises with athletic conditioning and how aging deconditions
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or disease and aging, evaluating how myocardial thickness and vascular resistance alter systemic perfusion efficiency.

vector as it leaves the sinoatrial (SA) node, propagates across the atria, pauses at the atrioventricular (AV) node, and darts down the Purkinje fibers, correlating these electrical signals directly with mechanical systole and diastole.

4. **EKG Arrhythmia Diagnostic Laboratory:** Teams evaluate a collection of patient EKG strips on their iPads. They analyze the presence, timing, and shape of the P, QRS, and T voltage waves, referencing their clinical diagnostic cards to identify specific electrical blocks, atrial flutters, or ventricular ischemic damage.

5. **Acoustic Valve Auscultation Activity:** Pairs sanitize their medical stethoscopes to perform a live acoustic tracking audit of a partner's heart rhythm. They listen to the distinct valve closures, matching the first heart sound ("lub" / AV valve closure) and second heart sound ("dub" / semilunar valve closure) to specific pressure spikes in the cardiac timeline.

6. **Hemodynamic Math Modeling and Spreadsheet Tracking:** Students open Google Sheets on their iPads to model cardiac output values under different physiological

myocardial efficiency.

- Students will define myocardial depolarization as the electrical change that triggers the mechanical contraction of heart muscle chambers.
- Students will correctly identify the closure of the atrioventricular valves as the physical event responsible for generating the first heart sound ("lub") during early ventricular systole on a data verification slip.



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scenarios. They input variable data points tracking an elite athlete versus an aging patient, writing formulas to compute how changes in stroke volume dictate total resting heart rate adjustments to maintain homeostatic blood delivery.

Differentiation:

- Targeted Benchmark Interventions: The teacher reviews live practice quiz metrics on their dashboard, instantly gathering struggling student pairs at a model station to re-teach the mechanical relationships between the QRS electrical surge and ventricular contraction.
- Visual and Structural Scaffolding: Pre-bordered EKG grids featuring color-coded wave markers (e.g., green for atrial activity, orange for ventricular activity) are provided to support teams managing visual tracking or data-reading friction.
- Standardized heart-sound timing templates are placed next to stethoscope bays to assist students in isolating target valve sounds.
- Advanced students can use their spreadsheets to calculate ejection fraction percentages, modeling how elevated systemic blood pressure forces the heart to alter its end-diastolic volume parameters over time.
- Structured sentence frames are integrated into the diagnostic logs: The patient's elongated EKG signature indicates a slow heart rate typical of a conditioned athlete whose large [blank] allows for high cardiac output at rest, whereas a flattened ST-segment indicates damaged ventricular tissue that cannot properly transmit the [blank] wave, forcing the heart to increase its [blank] to keep up systemic blood flow.

Resources Provided:

- Specialized digital human cardiovascular textbooks and web-based modules detailing EKG tracking parameters.
- Core Cardiology Pack (Multi-axis hemodynamic spreadsheets, EKG diagnostic criteria cards, step-by-step stethoscope routing instructions, and digital self-assessment keys).
- Professional acoustic stethoscopes, modular anatomical heart replicas, and clinical cardiac data profiles.



Lesson Plan 3 Template

Content Area: Science Lesson Title: Respiratory Volumes Time Frame: 1 day

Lesson Components

21st Century Themes

- ☐ Global Awareness ☐ Financial, Economic, Business and Entrepreneurial Literacy
☐ Civic Literacy ☒ Health Literacy

21st Century Skills

- ☐ Creativity and Innovation ☒ Critical Thinking and Problem Solving ☐ Information Literacy
☒ Life and Career Skills ☒ Communication and Collaboration ☐ Media Literacy ☐ ICT Literacy

Interdisciplinary Connections:

Engineering, Biology

Integration of Technology:

- Google Sheets interactive graphing workspaces pre-configured with mathematical modeling grids to convert raw respirometer displacement values into dynamic lung volume charts.
- Student iPads utilized specifically for navigating high-definition digital thoracic dissection modules, recording slow-motion respiratory expansion trials, and submitting statistical lung volume data to a collaborative classroom drive.

Equipment Needed:

- Student iPads for running data calculations, graphing lung metrics, and viewing micro-dissection streams.
- Handheld mechanical or digital respirometers (spirometers) equipped with sterile, single-use disposable mouthpieces.
- Preserved mammalian lung specimens (e.g., sheep plucks) or high-fidelity 3D human respiratory models.
- Advanced anatomical dissection tray sets (scalpels, blunt probes, cartilage-cutting scissors).
- Universal metric lung-volume displacement bags or calibration syringes.

Goals/Objectives	Learning Activities/ Instructional Strategies	Formative Assessment Tasks
Students will: • Identify and differentiate between lung volumes, classifying tidal volume, inspiratory reserve volume,	Lesson Sequence 1. Phenomenon: An elite free-diver can deliberately lower their heart rate and compress their chest to fully utilize a massive 6.5-liter total	• Correct Graphing and Labeling File: A finalized Google Sheets area graph that accurately plots



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expiratory reserve volume, and residual volume using fluid data metrics.

- Demonstrate and model lung volumes by executing controlled inhalation and exhalation profiles through a calibrated respirometer interface.
- Trace the pathway of air through the structures of the respiratory system, mapping the structural route from the nasal mucosa down to the microscopic alveolar gas-exchange beds.
- Identify respiratory system structures on dissection, isolating tissue features like the hyaline cartilage rings of the trachea and the spongy parenchymal lobes of the lungs.

lung capacity to remain submerged for minutes, whereas a lifelong smoker experiencing severe emphysema undergoes a structural breakdown of their microscopic alveolar walls, trapping stale air inside their chest and dramatically inflating their residual volume while slashing their functional vital capacity to less than 1.5 liters.

2. Upper and Lower Respiratory Structural Mapping: Working in pulmonology lab pairs, students utilize physical 3D respiratory models and diagram sheets to trace the structural pathway of air. They label vital boundaries, detailing how air travels through the pharynx, larynx, rigid trachea, primary bronchi, and branching bronchioles before reaching the terminal alveoli.
3. Controlled Respirometer Pulmonary Testing: Pairs sanitize their testing stations and install sterile, single-use mouthpieces onto their respirometers. Students execute precise breathing

and calculates individual lung volumes (\$TV\$, \$IRV\$, \$ERV\$, \$VC\$) with zero mathematical tracking errors.

- Respirometer Mechanical Technique Audit: A direct observational check ensuring the student uses optimal posture, tight lip seals, and controlled exhalation force to generate valid, reproducible lung volume metrics.
- Accurate Labeling of Dissected Structures: A practical laboratory diagnostic log requiring students to correctly identify and flag at least five distinct internal respiratory structures on their specimens.
- Structure and Function Interpretation Voucher: A written summary task where students explain how the rigid structure of the trachea prevents airway collapse and



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	profiles—demonstrating normal resting breaths to isolate Tidal Volume (\$TV\$), followed by maximum forced inhalations and exhalations to measure Vital Capacity (\$VC\$) and Expiratory Reserve Volume (\$ERV\$). 4. Google Sheets Data Modeling and Graphing: Students open their iPads and input their personal respirometer data points into a class-wide Google Sheets spreadsheet. They construct a customized multi-variable area chart that visually models their individual lung volumes, color-coding distinct capacities to analyze how their personal metrics contrast against standard demographic baselines. 5. Mammalian Thoracic Tissue Dissection Lab: Moving to the wet laboratory ventilation bay, student pairs analyze a preserved mammalian lung specimen. They use blunt probes and surgical scissors to split open the trachea, examining the structural resilience of its C-shaped hyaline cartilage rings before slicing through the deep	how alveolar wall destruction deforms residual volume parameters. • Students will define vital capacity as the maximum volume of air an individual can forcibly exhale after a maximum inhalation phase. • Students will correctly identify the primary functional role of ciliated epithelial cells lining the upper trachea as a continuous defensive filter to trap and clear inhaled foreign particulate matter on a final exit ticket.
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lobes to inspect the spongy, highly vascularized internal parenchyma where gas exchange occurs.

6. Pulmonology Synthesis and Structural Audits: The teacher projects the completed class Google Sheets data matrix onto the main display. Student pairs analyze the trends, discussing how an inflammatory narrowing of the bronchioles or a mechanical destruction of alveolar walls directly compromises vital capacity and deforms standard lung volume graphs.

Differentiation:

- Targeted Benchmark Interventions: The teacher monitors live graph entry data in Google Sheets, gathering struggling pairs at a central board to re-model the algebraic relationships between reserve volumes and total vital capacity.
- Visual and Structural Scaffolding: Pre-calibrated respirometer tracking scales and color-matched diagram keys (e.g., blue for conducting zones, pink for respiratory exchange zones) are deployed to assist teams managing spatial or data interpretation barriers.
- Simplified high-contrast structural prompt cards showing the exact incision lines for the trachea are pinned directly inside the dissection trays.
- Advanced students can compute their estimated residual lung volume using mathematical regression equations based on surface area and biological age, graphing how changes in alveolar elasticity expand stale air retention.
- Structured sentence frames are built directly into the lab documentation templates: When measuring breathing with a respirometer, a normal resting breath represents the [blank] volume, while the total air moved during a maximum forced exhalation is the [blank], which is severely restricted in emphysema patients because their damaged, non-elastic [blank] trap air inside the lungs.



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Resources Provided:

- Comprehensive digital respiratory physiology textbooks and video streams detailing macro-level thoracic surgeries and animal dissections.
- Core Pulmonology Pack (Multi-axis graphing templates, respirometer operational checklists, anatomical dissection pin-flags, and volumetric calculation matrices).
- Calibrated mechanical respirometers, sterile mouthpieces, preserved lung specimens, and heavy-duty dissection trays.



Lesson Reflection

Reflect on the lesson you have developed and rate the degree to which the lesson **Strongly**, **Moderately** or **Weakly** meets the criteria below.

Lesson Activities	Strongly	Moderately	Weakly
Are challenging Strongly and require higher order thinking and problem solving skills	☒	☐	☐
Allow for student choice	☐	☒	☐
Provide scaffolding for acquiring targeted knowledge/skills	☒	☐	☐
Integrate global perspectives	☐	☒	☐
Integrate 21st century skills	☐	☒	☐
Provide opportunities for interdisciplinary connection and transfer of knowledge and skills	☒	☐	☐
Foster student use of technology as a tool to develop critical thinking, creativity and innovation skills	☒	☐	☐
Are varied to address different student learning styles and preferences	☒	☐	☐
Are differentiated based on student needs	☐	☒	☐
Are student-centered with teacher acting as a facilitator and co-learner during the teaching and learning process	☐	☒	☐
Provide means for students to demonstrate knowledge and skills and progress in meeting learning goals and objectives	☒	☐	☐
Provide opportunities for student reflection and self-assessment	☐	☒	☐
Provide data to inform and adjust instruction to better meet the varying needs of learners	☒	☐	☐

Curriculum Design Template

Content Area: Science and Physiology

Grade Level: 11-12

Course Title: Human Anatomy

Created: 2026

Board Approved on:



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GLOBAL SKILLS

IEP AND 504 ACCOMMODATIONS AND MODIFICATIONS FOR EARLY CHILDHOOD AND ELEMENTARY SCHOOL STUDENTS:

Large print textbooks
Textbooks for at-home use
Additional time for assignments
Review of directions
Use of mnemonics
Have student restate information
Concrete examples
Adaptive writing utensils
Support auditory presentations with visuals
Use of a study carrel
Assistance in maintaining uncluttered space
Weekly home-school communication tools (notebook, daily log, phone calls or email messages)
Space for movement or breaks
Study sheets and teacher outlines
Extra visual and verbal cues and prompts
Math sheets with highlighted instructions
Graph paper to assist in organizing or lining up math problems
Use of computers and calculators
Books on tape
Graphic organizers
Quiet corner or room to calm down and relax when anxious
Preferential seating
Alteration of the classroom arrangement
Reduction of distractions
Answers to be dictated
Hands-on activities
Use of manipulatives
No penalty for spelling errors or sloppy handwriting
Follow a routine/schedule
Alternate quiet and active time
Teach time management skills
Rest breaks
Verbal and visual cues regarding directions and staying on task
Agenda book and checklists
Adjusted assignment timelines
Visual daily schedule



SPRINGFIELD PUBLIC SCHOOLS

**ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY
GLOBAL SKILLS**

Varied reinforcement procedures
Immediate feedback
Work-in-progress check
Personalized examples

TESTING AND ASSESSMENT ACCOMMODATIONS AND MODIFICATIONS:

Answers to be dictated
Frequent rest breaks
Additional time
Oral testing
Untimed tests
Choice of test format (multiple-choice, essay, true-false)
Alternate ways to evaluate (projects or oral presentations instead of written tests)
Accept short answers
Open-book tests
Read test and directions to student
Provide study outline prior to tests
Highlight key directions
Test in alternative site
Use of calculator
Extra credit option
Preview test procedures
Simplified test wording; rephrased test questions and/or directions

GENERAL ACCOMMODATIONS AND MODIFICATIONS:

Use of alternative books or materials on the topic being studied
Computerized spell-check support
Word bank of choices for answers to test questions
Provision of calculator and/or number line for math tests
Reworded questions in simpler language
Projects instead of written reports
Highlighting important words or phrases in reading assignments
Modified workload or length of assignments/tests
Modified time demands
Modified grades based on IEP

BEHAVIOR ACCOMMODATIONS MODIFICATIONS:



SPRINGFIELD PUBLIC SCHOOLS

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY
GLOBAL SKILLS

Breaks between tasks
Cue expected behavior
Daily feedback to student
Have contingency plans
Use de-escalating strategies
Use positive reinforcement
Use proximity/touch control
Use peer supports and mentoring
Model expected behavior by adults
Have parent sign homework
Have parent sign behavior chart
Set and post class rules
Chart progress and maintain data



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ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY
GLOBAL SKILLS

IEP AND 504 ACCOMMODATIONS AND MODIFICATIONS FOR MIDDLE AND HIGH SCHOOL STUDENTS:

Large print textbooks
Textbooks for at-home use
Additional time for assignments
A locker with adapted lock
Review of directions
Review sessions
Use of mnemonics
Have student restate information
Provision of notes or outlines
Concrete examples
Adaptive writing utensils
Support auditory presentations with visuals
Weekly or bi-weekly home-school communication
Space for movement or breaks
Study sheets and teacher outlines
Extra visual and verbal cues and prompts
Lab and math sheets with highlighted instructions
Graph paper to assist in organizing or lining up math problems
Use of tape recorder for lectures
Use of Interactive notebook
Use of a scribe
Use of computers and calculators
Books on tape
Graphic organizers
Quiet corner or room to calm down and relax when anxious
Preferential seating
Alteration of the classroom arrangement
Reduction of distractions
Answers to be dictated
Hands-on activities
Ability to type all assignments
Follow a routine/schedule
Teach time management and organizational skills
Rest breaks
Verbal and visual cues regarding directions and staying on task
Agenda book and checklists
Daily check-in with case manager or special education teacher
Adjusted assignment timelines
Visual daily schedule



SPRINGFIELD PUBLIC SCHOOLS

**ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY
GLOBAL SKILLS**

Varied reinforcement procedures
Immediate feedback
Work-in-progress check
Personalized examples

TESTING AND ASSESSMENT ACCOMMODATIONS AND MODIFICATIONS:

Answers to be dictated
Frequent rest breaks
Additional time
Oral testing
Choice of test format (multiple-choice, essay, true-false)
Alternate ways to evaluate (projects or oral presentations instead of written tests)
Accept short answers
Open-book or open-note tests
Read test and directions to student
Provide study guides prior to tests
Highlight key directions
Test in alternative site
Use of calculator
Extra credit option
Pace long-term projects
Preview test procedures
Simplified test wording; rephrased test questions and/or directions

GENERAL ACCOMMODATIONS AND MODIFICATIONS:

Allow outlining, instead of writing for an essay or major project
Use of alternative books or materials on the topic being studied
Computerized spell-check support
Word bank of choices for answers to test questions
Provision of calculator for math tests
Film or video supplements in place of reading text
Reworded questions in simpler language
Projects instead of written reports
Highlighting important words or phrases in reading assignments
Modified workload or length of assignments/tests
Modified time demands



SPRINGFIELD PUBLIC SCHOOLS

**ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY
GLOBAL SKILLS**

Pass/no pass option
Modified grades based on IEP

BEHAVIOR ACCOMMODATIONS FOR STUDENTS:

Breaks between tasks
Cue expected behavior
Daily feedback to student
Have contingency plans
Use de-escalating strategies
Use positive reinforcement
Use proximity/touch control
Use peer supports and mentoring
Model expected behavior by adults
Have parent sign homework
Set and post class rules
Chart progress and maintain data



Accommodations and Modifications for ESL Students

- Give tests orally
- Give instructions/directions in writing and orally
- Assign a peer tutor, same language or English speaking
- Allow use of bilingual/translation dictionary
- Provide summaries of text or study guides of particular chapters
- Allow errors in speaking
- Allow errors in writing
- Accept writing in first language
- Highlight key vocabulary
- Reduce amount of work required
- Assess comprehension through demonstration or other alternative means (gestures, drawings)
- Rephrase questions, directions, and explanations
- Reduce multiple choices on assessments
- Provide study guides and/ or outlines
- Shorten reading assignments
- Allow extended time for test/project completion
- Use of audio books
- Use of graphic organizers
- Use reduced text, so that print is not dense
- Use visuals/pictures throughout lesson/unit/assignment
- Adapt homework to reflect language proficiency/home support
- Adapt homework to reflect home support
- Provide hands-on activities and explanations
- Allow extended time to answer questions, and permit drawing, as an explanation
- Use of translation dictionaries to locate words in the native language
- Use anecdotal records and portfolio of work as forms of assessment
- Use story retellings to assess comprehension

What Does the Gifted and Talented Experience Look Like?
Springfield Public Schools

Mission Statement

The Gifted and Talented Program of the Springfield Public Schools aims to provide a meaningful and rigorous education that instills the value of lifelong learning and empowers all students to reach their full potential and become self-fulfilled creative leaders in accordance with the comprehensive standards of our state. We accomplish this by offering challenging, real-world experiences in a student-centered environment.

We recognize that students come from diverse socioeconomic, cultural, and ethnic backgrounds, and the mission of the gifted and talented program is to provide opportunities for students to explore their intellectual, creative, and artistic gifts and talents within the classroom and with beyond-the-classroom experiences. It is essential to provide diverse, appropriate, and ongoing learning experiences and environments that incorporate students' academic, psychological, and social needs. Our responsibility is to provide students with educational alternatives that teach, challenge, and expand their knowledge, while simultaneously stressing the development of independent and self-directed learners who continuously generate questions, analyze, synthesize, and evaluate information and ideas.

New Jersey Administrative Code 6A:8-3.1 defines students who are gifted and talented as those students who possess or demonstrate high levels of ability in one or more content areas when compared to their chronological peers in the local district and who require modification of their educational program if they are to achieve in accordance with their capabilities.

Goals:

To support our mission, we have established the following goals to guide our work:

- To infuse into the general education program a broad range of activities for high-level learning that will challenge all students to perform at advanced levels, and provide extended opportunities, resources, and support in particular areas where student interest or talent is demonstrated.
- To provide a continuum of gifted education services that will strengthen the total school program, offer enriching and challenging learning opportunities for all students, and provide specialized learning experiences
- To promote achievement of students' best potentials and increased ability.

Through a productive and collaborative relationship among the building principals, classroom teachers, and the Gifted and Talented teacher, our schools can create programming that will enhance the learning experience for every student and serve the unique and specialized needs of students currently demonstrating gifted behaviors.

Elements of the Schoolwide Enrichment Model, W.I.N (What I Need), differentiated instruction, advanced classes, or individual programs into a student's regular instruction program are integral to this overarching framework for gifted education in the Springfield School District.

Reference Board Policy and Regulation 2464 – Gifted and Talented Pupils (M)

Early Childhood Center **Edward V. Walton**

Schoolwide Virtual Enrichment

All first and second grade students have access to the [Gifted and Talented Virtual Classroom](#). This virtual classroom is a space for students to complete various challenges and enrichment opportunities at their own pace. Students can receive feedback and additional adaptable resources to meet their individual learning needs. The virtual classroom design expands accessibility to enrichment resources and allows students to choose learning activities according to their unique interests and abilities. The purpose of the activities is to encourage problem-solving, develop critical thinking

skills, and expand curiosity and imagination. Activities are aligned to the New Jersey Student Learning Standards.

Gifted and Talented Teacher as a Resource

The Gifted and Talented teacher serves as a resource to all teachers within Edward V. Walton School. Teachers seeking resources for their high-ability learners will receive additional support from the Gifted and Talented teacher in various ways. This support may include additional units of study, challenging resources, and student projects.

Elementary Schools

James Caldwell

Thelma L. Sandmeier

The goal is to engage small groups of students in intensive learning experiences through standards-based, rigorous, and relevant units of study that supplement, not supplant, the grade-level curriculum and support students' unique learning needs.

Enrichment Experience Grade 3

Beginning in third grade, the G&T teacher will cycle through all classrooms to work on problem-solving and enrichment tasks with students. Driven by assessment data, academic performance, student interest, and teacher observation, small groups of students will meet with the G&T teacher during W.I.N. (What I Need) periods throughout the week that the teacher is assigned to their classroom teacher. Groupings will be flexible and monitored to best meet each student's needs throughout the school year. Activities will include brain teasers, puzzles, strategic thinking, problem-solving, and STEM challenges.

Targeted Gifted and Talented Programing Grades 4-5

Students may become identified as Gifted and Talented in fourth grade. Students that are identified may receive support from the G&T Teacher for up to five periods (200 minutes) a week during W.I.N. (What I Need) periods. Identified students will meet to explore grade-level content while incorporating depth and complexity in a student-centered, problem-based environment. The Gifted and Talented Program aims to provide students with various advanced and challenging learning experiences across content areas to promote independent thinking skills, refine critical thinking and communication skills, cultivate joy in learning, and expand student interests through problem-solving. The instruction that students receive incorporates 21st Century Skills and advanced content that is challenging, hands-on, and relevant to the real world.

Strategies and Practices that Support Gifted and Talented Students

- Adjusted Pace of Lessons
- Inquiry-Based Instruction
- Higher-Order Thinking Activities
- Interest-Based Content
- Real World Problem Solving/Problem Based Learning
- Independent Study/Passion Projects
- Units of Study with Like-Minded Peers

Schoolwide Virtual Enrichment

All JCS and TLS students have access to grade level-specific [Gifted and Talented Virtual Classrooms](#). These virtual classrooms are a space for students to complete various challenges and enrichment opportunities at their own pace. Students are able to receive feedback and additional opportunities based on their needs. The virtual classrooms have expanded the accessibility of enrichment resources directly to the students and allows for students to choose opportunities according to their interests and abilities. The purpose of the activities is to encourage problem solving, develop critical thinking skills, and expand curiosity and imagination in conjunction with the New Jersey Student Learning Standards.

Gifted and Talented Teacher as a Resource

In addition to classroom support, the Gifted and Talented teacher also serves as a resource to all teachers in the building. Teachers that are seeking resources for their high ability learners will receive additional support from the Gifted and Talented teacher in various ways. This may include additional units of study, challenging resources, student projects, and meeting with the G&T teacher as needed.

Additional Enrichment Opportunities

Across all grade levels 3-5, as recommended by the classroom teacher, students exhibiting a need for additional enrichment may have the opportunity to meet with the G&T teacher as the schedule allows. Groupings will be flexible and monitored to best meet the students' needs throughout the school year. Activities will include, brain teasers, puzzles, strategic thinking activities, problem-solving challenges, and STEM challenges. Students engage in an extended process of asking questions, using resources, and developing answers that lead to thinking about what and how they are learning. Students are held accountable for how they work and use their time by demonstrating their learning through products or presentations.

Students self-select to participate in individual and/or group projects based on interest and commitment. The classroom teacher and/or the enrichment teacher will help guide and monitor student exploration of chosen topics, facilitating their learning with resources and teaching of needed skills.

Secondary Schools

Florence M. Gaudineer Middle School

Jonathan Dayton High School

Grades 6-12: Access to specific content programs with higher levels of academic challenges (i.e. Pre-Algebra, Accelerated Communication Arts, and Advanced Placement Classes)

Dual Credit Courses provide students the opportunity to obtain high school credit, and college credit, simultaneously through partnerships with several institutions.

Project Lead the Way (PLTW) students become builders of technology by engaging in real world activities. Students are empowered as design thinkers collaborating on real world projects.

Gifted and Talented Identification Criteria

The Springfield Schools Gifted and Talented Program recognizes that students require differentiated learning experiences beyond the core curriculum being taught because of their advanced abilities in one or more content areas. These students may also have other cognitive qualities such as curiosity, creativity, motivation, leadership, and passion that require modifications to their academic experience.

Multiple Measures of Eligibility

Kindergarten through grade twelve identification process for gifted and talented students includes multiple measures. Multiple measures may include but are not limited to: achievement test scores; grades; student performance or products; intelligence testing; parent, student, and/or teacher recommendation; and other appropriate measures. The identification methodology is developmentally appropriate, non-discriminatory, and related to the programs and services offered by the Springfield School District. The identification procedures are reviewed annually.

According to N.J.A.C. 6A:8-3.1, all public school districts must have a board-approved gifted and talented identification process and provide services for identified students enrolled in the grades of that school district. The regulations require that identification and services be made available to students in grades K-12.

When students are recommended for the Gifted and Talented Program there are multiple measures that are considered to determine if services are necessary and appropriate. The assessments used are as follows:

- Cognitive Abilities Test (CogAT)
- Classroom Performance/Student Portfolios
- DRA2 Level
- iReady Diagnostic Scores
- Gifted Indicators Checklist
- Start Strong/NJSLA Assessment Data

The N.J.A.C. requires that students be compared to their chronological peers in the local school district. The New Jersey Department of Education has not established state-level criteria for identifying students who are gifted, such as mandated tests or assessments, grade point averages, or IQ scores. Local school districts must use multiple measures to identify students.

Procedures

<https://www.straussesmay.com/seportal/Public/DistrictPolicy.aspx?policyid=2464&id=b8a33a9f505e4998a6db3fb8e1de778b>

Gifted and Talented Program Identification Matrix

Minimum Score Required for Consideration: 14 Points

1 Point	2 Points	3 Points
Cogat Assessment Overall Stanine Score of a 7	Cogat Assessment Overall Stanine Score of an 8	Cogat Assessment Overall Stanine Score of a 9
iReady Math Assessment Just Below Current Grade Level	iReady Math Assessment On Grade Level	iReady Math Assessment ½ Year + Above Current Level
iReady ELA On Grade Level	iReady ELA ½ Year Above Current Level	iReady ELA One Full Grade Level + Above Current Level
NJSLA Math Approaching Expectations	NJSLA Math Met Expectations	NJSLA Math Exceed Expectations
NJSLA ELA Approaching Expectations	NJSLA ELA Met Expectations	NJSLA ELA Exceed Expectations
HOPE Teacher Rating Scale Raw Score: 11 - 29	HOPE Teacher Rating Scale Raw Score: 30 - 49	HOPE Teacher Rating Scale Raw Score: 50-66

Team meetings present the opportunity to review data and assess the educational needs of all students. Teacher provides examples of student work exhibiting above and beyond grade level expectations, creativity, leadership, critical and abstract thinking. Programs for gifted and talented students will be periodically evaluated for their continuing efficacy and adjusted accordingly. The parent of any student identified as gifted or talented shall be consulted regarding any program designed to address the student's particular needs.

Resource Links

https://riversideinsights.com/cognitive_abilities_test

<https://www.curriculumassociates.com/programs/i-ready-learning>

<https://www.nj.gov/education/assessment/resources/>

<https://www.routledge.com/HOPE-Teacher-Rating-Scale-Involving-Teachers-in-Equitable-Identification/Gentry-Pereira-Peters-McIntosh-Fugate/p/book/9781618214522#:~:text=The%20HOPE%20Teacher%20Rating%20Scale,making%20it%20easy%20to%20use.>

Gifted and talented student: The "[*Strengthening Gifted and Talented Education Act*](#)" defines a gifted and talented student as a "student who possesses or demonstrates a high level of ability in one or more content areas when compared to their chronological peers in the school district and who require modifications of their educational program if they are to achieve in accordance with their capabilities."

Twice-exceptional (2E) students: A twice-exceptional (2E) student is defined as "a student who is both gifted and a student with a disability. These students may also be referred to as having dual exceptionalities or as being gifted with learning disabilities (GT/LD). This also applies to students who are gifted with ADHD or gifted with autism" (New Jersey Association for Gifted Children, www.nagc.org).

Instructional adaptation: An adjustment or modification to instruction enabling a student who is gifted and talented to participate in, benefit from, and demonstrate knowledge and application of the New Jersey Student Learning Standards in one or more content areas at the instructional level of the student, not just the student's grade level.

Identifying gifted and talented students: The focus of identification is to provide programming and services in which students' specific learning needs and potential are appropriately addressed and met. In every New Jersey school district, there are students who require modifications to the general education curriculum if they are to achieve in accordance with their abilities. By identifying a student's general intellectual ability, creativity, or specific academic area aptitudes, we are acknowledging that they need programming and services outside of the general education/grade level curriculum to advance their learning.

[NJDOE Fast Facts](#)

<https://www.nj.gov/education/standards/gifted/>

<https://www.nj.gov/education/standards/gifted/legislation.shtml>

Supplemental Resources/Programming for Gifted Students

Edward V. Walton

- PETS Program – Primary Education Thinking Skills
- Group Solutions/Group Solutions 2 – Cooperative Logic Activities
- Lollipop Logic
- Beginning Thinking Skills
- AIMS Education Programming

James Caldwell and Thelma L. Sandmeier

Math/ELA

- Project M3: Mentoring Mathematical Minds
- Junior Great Books
- AIMS Education Programming
- Borenson Hands on Equations
- BizWorld
- Perplexors
- Advanced Math Explorations grade 3-5
- Challenging Units for Gifted Learners (ELA and Math)
- Creative Curriculum Extenders
- Differentiated Lessons & Projects
- Challenge Math Grades 4+
- Differentiating Instruction with Menus (All Content Areas)
- Jacob's Ladder
- Genius Hour/Passion Project
- Spatial Reasoning
- Logic Puzzles, Brain Games, Analogies

STEM

- Engineering is Elementary
- Engineer Throughout the Year
- PBS Design Squad
- DefinedSTEM
- Project Lead the Way (PLTW)

Enrichment Events

Experience for all students to be enriched through events related to the curricular or extracurricular activities. Examples include after school clubs, PTA-sponsored events, leadership opportunities, visual and performing arts, and community service opportunities.