Course: Human Biology **Unit #:2 Anatomy & Physiology: Form and Function**	**Year of Implementation:** 2025-2026
Curriculum Team Members: Kellie Balkus (kbalkus@lrhsd.org), Kelly Banks (kbanks@lrhsd.org), Nicole Lum (nicolelum@lrhsd.org) , Dana Matusov (dmatusov@lrhsd.org)	

Stage One - Desired Results

Link(s) to New Jersey Student Learning Standards for this course:
https://www.nj.gov/education/standards/

- **Unit Standards:**

Content Standards

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) (Note: This Disciplinary Core Idea is also addressed by HS-LS3-1.)
- 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 sugar molecules thus formed contain carbon, hydrogen, and oxygen: their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells. (HS-LS1-6)
- As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. (HS-LS1-6), (HS-LS1-7)

Science and Engineering Practices
The content of this unit will strengthen student skills in the following SEPs.

- Practice 1 Ask Questions
- Practice 2 Developing and Using Models
- Practice 3 Planning and Carrying Out Investigations
- Practice 4 Analyzing and Interpreting Data
- Practice 5 Using Mathematics and Computational Thinking
- Practice 6 Constructing Explanations and Designing Solutions
- Practice 7 Engaging in Argument from Evidence
- Practice 8 Obtain, Evaluate and Communicate Information

21st Century Life & Career Standards

- 9.4.12.CI.1 - Demonstrate the ability to reflect, analyze and use creative skills and ideas
- 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 (e.g., NJSLSA.W8, Social Studies Practice: Gathering and Evaluating Sources.
- 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.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience (e.g., S-ID.B.6b, HS-LS2-4).

English Companion Standards

WHST.9-12.2

- Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-LS1- 1),(HS-LS1-6) (SEP 3, 4, 6)

WHST.9-12.7

- Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-LS4-6) (SEP 1, 4, 6,7,8)

WHST.11-12.8

- Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate

Interdisciplinary Content Standards

- Psychology: *APA National Standards for Psychology:* Standards Area: Biological Bases of Behavior 1.1, 1.2, 1.3, 1.4, 1.5, 2.1, 3.2, 4.1
- Visual Art Standard: 1.2.2.Crla
- Health - Standard: 2.1.12.PP.1, 2.1.12.PP.2
- Physical Education - Standard: 2.2.12.MSC.2, 2.2.12.PF.1
- Engineering - Standard: 9.3.12.AC.6; Standard: 9.3.12.AC-DES.6
- Literature - Standard: NJSLSA.W6
- MP.2 - Reason abstractly and quantitatively.
- MP.4 - Model with mathematics.
- HSN-Q.A.1 - Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
- HSN-Q.A.2 - Define appropriate quantities for the purpose of descriptive modeling.
- HSN-Q.A.3 - Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

- ***NJ Statutes:*** NJ State law mandates the inclusion of the following topics in lesson design and instruction as aligned to elementary and secondary curriculum.

  Amistad Law: N.J.S.A. 18A 52:16A-88 Every board of education shall incorporate the information regarding the contributions of African-Americans to our country in an appropriate place in the curriculum of elementary and secondary school students.

  Holocaust Law: N.J.S.A. 18A:35-28 Every board of education shall include instruction on the Holocaust and genocides in an appropriate place in the curriculum of all elementary and secondary school pupils. The instruction shall further emphasize the personal responsibility that each citizen bears to fight racism and hatred whenever and wherever it happens.

  LGBT and Disabilities Law: N.J.S.A. 18A:35-4.35 A board of education shall include instruction on the political, economic, and social contributions of persons with disabilities and lesbian, gay, bisexual, and transgender people, in an appropriate place in the curriculum of middle school and high school students as part of the district's

implementation of the New Jersey Student Learning Standards (N.J.S.A.18A:35-4.36) A board of education shall have policies and procedures in place pertaining to the selection of instructional materials to implement the requirements of N.J.S.A. 18A:35-4.35.

Diversity and Inclusion (N.J.S.A. 18A:35-4.36a) A board of education shall incorporate instruction on diversity and inclusion in an appropriate place in the curriculum of students in grades kindergarten through 12 as part of the district's implementation of the New Jersey Student Learning Standards.

Asian American and Pacific Islanders (AAPI) P.L.2021, c.410 Ensures that the contributions, history, and heritage of Asian Americans and Pacific Islanders (AAPI) are included in the New Jersey Student Learning Standards (NJSLS) for Social Studies in kindergarten through Grade 12 (P.L.2021, c.416)

For additional information, see

NJ Amistad Curriculum: ***https://www.nj.gov/education/amistad/about/***

Diversity and Inclusion: ***https://www.nj.gov/education/standards/dei/index.shtml***

- *(Sample Activities/ Lessons):* ***https://www.nj.gov/education/standards/dei/samples/index.shtml***

Asian American and Pacific Islanders:

- ***Asian American and Pacific Islander Heritage and History in the U.S.***
  A Teacher's Guide from EDSITEment offering a collection of lessons and resources for K-12 social studies, literature and arts classrooms that center around the experiences, achievements and perspectives of Asian Americans and Pacific Islanders across U.S. history.

Transfer Goal: Students will be able to independently use their learning to analyze how all body systems work in correlation to maintain homeostasis.

As aligned with LRHSD Long Term Learning Goal(s): https://www.lrhsd.org/academics/program-of-studies/curriculum

- design, critique, and carry out experiments in order to investigate scientific questions and/or propose solutions
- collect, interpret, and analyze data in order to solve a defined problem
- apply mathematics to express relationships efficiently and accurately
- draw evidence-based conclusions from data in order to make informed decisions;

- construct, interpret, and refine models (scientific and mathematical) to explain the physical and natural world
- effectively communicate scientific ideas and evidence-based arguments to an appropriate audience through written and oral means
- evaluate for their validity arguments that rely on scientific reasoning presented in the popular press and informational sources

Enduring Understandings	*Essential Questions*
EU 1 The body's tissues and organ systems work together to maintain homeostasis, facilitate communication, and support life processes such as growth, development, energy balance, and nutrient exchange. EU 2 There is a coordination of physiological responses through body systems that regulate the activity of body cells, maintaining homeostasis.	• How do the structure of the body's tissues relate to the function of the organ system? • How do systems interact with other body systems to regulate physiological responses, maintain homeostasis, and ensure coordinated functioning of the human body?
Knowledge *Students will know . . .* *EU 1* • The four main tissues' structure relate to function in the body. (LS1.A) • Scientists effectively communicate the location of one part of the body in relation to the location of other parts of the body. (LS1.A) • The body is composed of systems with structures and functions that are related. (LS1.A) • Homeostatic mechanisms contribute to human energy balance. (LS1.A) • Feedback loops maintain the internal environment of the human body. (LS1.A)	*Skills* *Students will be able to. . .* *EU 1* • Site evidence to show how the structure of the main tissues relates to the function in the body. (LS1.A) (WHST.9-12.2) (SEP 3, 4, 6) (CCC: Structure & Function HS-LS1-1) • Evaluate how scientists effectively communicate the location of one part of the body in relation to the location of other parts of the body. (LS1.A) (WHST.9-12.2) (SEP 3, 4, 6) • Model the body and its systems with structures and functions that are related. (LS1.A) (SEP 2,3,6) (CCC: Structure & Function HS-LS1-1)

• Hormones and other signaling molecules trigger specific response pathways. (LS1.A) *EU 2* • Integumentary, muscular, and skeletal systems act in coordination of movement, temperature and protection of the human body (HS-LS1-3; HS-LS-1-4) • The endocrine and nervous systems act individually and together in regulating human physiology (HS-LS1-3; HS-LS-1-4) • The nervous system maintains homeostasis by controlling and regulating the other parts of the body. (HS-LS1-3; HS-LS-1-4) • The circulatory system links exchange surfaces with cells throughout the body. (HS-LS1-3; HS-LS-1-4) • The structures of the cardiovascular and respiratory systems facilitate gas exchange. (HS-LS1-3; HS-LS-1-4) • The respiratory system functions in coordination with other systems of the body. (HS-LS1-3; HS-LS-1-4) • The organs of the digestive and excretory systems aid in transferring nutrients from the external environment to the internal environment. (LS1.C)	• Collect data to show that homeostatic mechanisms contribute to human energy balance. (LS1.A) (WHST.9-12.7) (SEP 1, 4, 6,7,8) • Create an experiment to model feedback loops and how they maintain the internal environment of the human body. (LS1.A) (WHST.9-12.7)(SEP 1, 4, 6,7,8) • Develop and carry out an experiment to demonstrate how hormones and other signaling molecules trigger specific response pathways. (LS1.A) (WHST.9-12.7) **(**SEP 1, 4, 6,7,8) *EU 2* • Create a model of the three layers of the integumentary system. (HS-LS1-3; HS-LS-1-4; HS-LS1-7) (SEP 2) (CCC: System & System Models HS-LS1-2 HS-LS1-4) • Identify bones and major muscle groups of the human body. (HS-LS1-3; HS-LS-1-4; HS-LS1-7) (SEP 2) • Demonstrate how the endocrine and nervous systems act individually and together in regulating human physiology. (HS-LS1-3; HS-LS-1-4) (SEP 1, 4) • Analyze how the nervous system maintains homeostasis by controlling and regulating the other parts of the body (LS1.A) (WHST.9-12.2) (SEP 3, 4, 6) (SEP , 4) • Create a model of the organs of the digestive and excretory systems demonstrating how they aid in transferring nutrients. (LS1.C) (SEP 2,3,4)(CCC: System & System Models HS-LS1-2 HS-LS1-4) • Create a flowchart showing how nutrients from a recently ingested meal are not “really” inside your body prior to the absorption stage of food processing. (LS1.C) (WHST.11-12.8) (SEP 4, 6, 8) • Design an experiment to show surface area to volume ratio to demonstrate gas exchange. WHST.9-12.7 (SEP 1, 4, 6,7,8) • Represent as a model the structures of the cardiovascular and respiratory systems and how they

	facilitate gas exchange. (HS-LS1-3; HS-LS-1-4) (SEP 1,2,6,8) (CCC: System & System Models HS-LS1-2 HS-LS1-4) • Draw evidence to show that the respiratory system functions in coordination with other systems in the body. (HS-LS1-3; HS-LS-1-4) (SEP 1,2,6,8) (CCC: Structure & Function HS-LS1-1) • Dissect a fetal pig and perform practical demonstrating skills learned. (HS-LS1-3; HS-LS-1-4) (SEP 1,2,6,8) (CCC: Structure & Function HS-LS1-1)

Stage Two - Assessment

Performance Task:

Stage Three - Instruction

Learning Plan: **Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections: Each learning activity listed must be accompanied by a learning goal of A= Acquiring basic knowledge and skills, M= Making meaning and/or a T= Transfer.** *{place A, M and/or T along with the applicable EU number in parentheses after each statement} All knowledge and skills must be addressed in this section with a corresponding lesson/activity which teaches each concept. The following color codes are used to notate activities that correspond with interdisciplinary connections and 21st Century Life & Career Connections (which involves Technology Literacy): Red = Interdisciplinary Connection; Purple = 21st Century Life & Career Connection*

PHENOMENON: How does long term space travel affect the human body?

Link: View the following TED Talk about Humans Colonizing Mars - https://www.youtube.com/watch?v=YzhSmnGcSkE

GOAL: Students will explore how long term space travel affects the human body and the human body systems and relate that to the effects of various phenomena that occur on Earth to the human body and human body systems.

Activity 1: How does Outer Space Affect the Human Body and Human Body Systems? (EU1, EU2)

Show video link: https://www.youtube.com/watch?v=ZC0bYFCUcTQ

a. Paired discussion about observations from the video (A/M)
b. Use QFT (Question Formulation Technique) to generate a class discussion to determine driving questions for the lesson based upon observations from the video (A/M) - for more detailed information on the QFT technique please click this link: http://rightquestion.org/what-is-the-qft/

Activity 2: NASA Twin Study

a. Read article:https://www.nasa.gov/humans-in-space/twins-study/about/
b. Generate a class discussion to determine the comparisons between the brothers bodies during the NASA experiment

Activity 3: Why is Air Pressure Necessary for Life

a. (Article) Why is Air Pressure Necessary for Life_.pdf
b. Discuss the requirements for body systems to maintain homeostasis.

Activity 4: Deeper Dive into how does outer space affect the human body and ONE of the human body systems

a. Divide students into small groups and assign each group one body system to research.
b. Provide resources for students to gather information.
c. Ask each group to create an informal presentation (using posters or digital slides) on how their assigned body system is affected by space travel.
d. Discuss the measures taken to counteract the negative effects of space travel such as: Exercise routines and resistance training on the ISS, Nutritional adjustments and supplements, Use of suits and devices to simulate gravity, or Medical monitoring and countermeasures.

Culminating Activity: Synthesis and Reflection (M/T) (EU1, EU2)

a. Assign an individual or group project where students synthesize their learning from the previous activities.
b. Incorporate reflective prompts to encourage students to analyze their own perspectives and insights gained throughout the learning process.

Supporting Instructional Framework:

- Discuss the 4 types of tissues - epithelial, connective, muscle, nervous - (A) (EU1)
- Histology Webquest - (A,M) (EU1)
- Draw the different types of tissues found in the human body - (M) (EU1)
- Histology practicum with microscope/slides - (M) (EU1)

- HHMI Classroom Activity How do Fibers Form? http://www.hhmi.org/biointeractive/how-do-fibers-form (A) (EU1)
- Discuss Homeostasis - (A) (EU1)
- Homeostasis Interactive (Fever) - (A,M,T) (EU1)
- Interactive Simulation of Human Homeostasis https://www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=519 (A,M) - (EU1)
- Feedback Mechanism Lab to demonstrate the regulation of hormones in the body - (M) (EU1)
- HHMI Neurophysiology virtual lab-http://media.hhmi.org/biointeractive/vlabs/neurophysiology/index.html?_ga=2.204843027.228014891.1498139177-37658674.1498139177 - (M,T) (EU2)
- Enzymes and Cellular Regulation POGIL (Digestive Enzymes) - (A,M) (EU1)
- Discuss parts and functions of the digestive system and excretory system - (A) (EU2)
- Design a Digestive System Interactive - (M) (EU2) https://www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=1050
- Investigate nutrient absorption/dysfunction - (A) (EU2)
- Use spectrophotometer/pH meter/microscope to analyze urine - (M,T) (EU2)
- Discuss body planes and terms of dissection - (A) (EU1, EU2)
- Chordate Comparative Anatomy Lab - (A,M) (EU1, EU2)
- Discuss the parts and functions of the Circulatory and Respiratory Systems - (A) (EU2)
- Sheep/Cow Heart dissection - (M) (EU2)
- HHMI Cardiology virtual lab - (M,T) (EU2)
- Human Physiology with Vernier “Heart Rate and Exercise” - (M,T) (EU2)
- Human Physiology with Vernier “Heart Rate Response to Baroreceptor Feedback” - (M,T) (EU2)
- Human Physiology with Vernier “Blood Pressure and Exercise” - (M,T) (EU2)
- Human Physiology with Vernier “Heart Rate and Blood Pressure as Vital Signs” - (M,T) (EU2)
- Human Physiology with Vernier “Analyzing the Heart with EKG” - (M,T) (EU2)
- Human Physiology with Vernier “Respiratory Response to Physiologic Challenges” - (M,T) (EU2)
- Human Physiology with Vernier “Lung Volumes and Capacities” - (M,T) (EU2)
- Fetal pig dissection / Autopsy - (M,T) (EU2)
- Pig Practical - (M) (EU2)
- Field trip in coordination with sports medicine to cadaver lab - (M) (EU1, EU2)
- Utilize proficiently a stethoscope, and blood pressure cuff. – (M) (EU2)
- Analyze an EKG - (M) (EU2)
- Create Career Project on Medical Professions - (A,M) (EU1, EU2)

Pacing Guide

Unit #	*Title of Unit*	*Approximate # of teaching days*
1	Advanced Cellular Processes	40
2	Anatomy and Physiology	65
3	Pathology	30

Instructional Materials

- *Graduated cylinders*
- *Microscopes*
- *Prepared slides*
- *Building Model Kits*
- *Various lab kits/perishables (*see learning plan for specific kit numbers/vendors)*
- *Large Post-It Note Presentation boards*
- *Fetal pigs*
- *Various Organ Dissection Kits*
- *Dissection materials/kits*
- *Modeling clay*
- *Skeleton models*

Accommodations

Special Education: The curriculum will be modified as per the Individualized Education Plan (IEP). Students will be accommodated based on specific accommodations listed in the IEP.
Students with 504 Plans: Students will be accommodated based on specific accommodations listed in the 504 Plan.
English Language Learners: Students will be accommodated based on individual need and in consultation with the ELL teacher.
Students at Risk of School Failure: Students will be accommodated based on individual need and provided various structural supports through their school.
Gifted and Talented Students: Students will be challenged to enhance their knowledge and skills through acceleration and additional independent research on the subject matter.