Theme

How can citizens innovate, manage, and use technology in ways that are socially responsible?

STEM Innovation Academy Unit 2 Plan

Subject: Human Body Systems Unit Title: Communication Grade: 10th	Teacher: Andrea Henry Duration: 7-8 weeks; October 12- December 14

Summary of Unit

Communication in the human body takes many forms. Our nervous system communicates with our organs and tissues using electrical signals. Endocrine glands secrete chemical messengers called hormones that travel through the blood to a target and bring about change. Our special senses and our skeletal and muscular systems allow us to move, gesture and speak, to communicate our ideas, and to interact with the world around us. A breakdown in communication would disrupt the body's overall homeostasis or internal balance. In this unit, students will explore the concept of communication as it applies to everyday life, machines and technology, and as it applies to their own body. In the next lesson, students will explore how the brain sends and receives electrical signals and how electricity is generated and propagated through human systems. In the third lesson, students will examine chemical communication in the human body. Students will investigate the components of the endocrine system, the mechanisms of hormone action and the regulatory power of feedback. They will show, using a feedback loop, how the body uses chemicals to maintain healthy blood sugar levels. Finally, students will explore how the body communicates with the outside world by examining the structure of an eye and completing an eye dissection. They will investigate the many aspects of visual perception by completing station exercises and by interpreting results for tests in visual acuity, depth perception, peripheral vision, color vision, accommodation, optical illusions, and afterimages. Students will use an eye model to investigate the function of the lens in the eye and will use this model to explore the power of corrective lenses.

Standards/Outcomes/ PARCC Related items:

NGSS and CCSS standards covered in each lesson
included in this link

HS.LS1.2 - From Molecules to Organisms: Structures and Processes Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function 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)

DCI - PS3.A - Energy - Definitions of Energy "Electrical energy" may mean energy stored in a battery or energy transmitted by electric currents. (secondary to HS-PS2-5)

DCI - PS3.A - Energy - Definitions of Energy Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. (HSPS3-1), (HS-PS3-2)

DCI - PS3.A - Energy - Definitions of Energy At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy . (HSPS3-2), (HS-PS3-3)

DCI - PS3.B - Energy - Conservation of Energy and Energy Transfer Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. (HS-PS3-1), (HS-PS3-4)

HS.LS1.3 - From Molecules to Organisms: Structures and Processes Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis

DCI - LS1.A - From Molecules to Organisms: Structures and Processes - Structure and Function 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

Stage 1 – Desired Results

Essential Questions:

2.1 - 1 What are the consequences of miscommunication in the human body?
2.1 - 2 How does understanding the structure and function of the human brain help with diagnosis of disease?
2.2 - 1 What would happen in the body if the action of neurotransmitters was impaired?
2.2 - 2 Why does reaction time typically differ in reflex and voluntary actions?
2.3 - 1 How do hormones and feedback mechanisms maintain homeostasis in the human body?
2.3 - 2 How can improper levels of a hormone lead to disease or dysfunction in the human body?
2.4 - 1 How do the eye and the brain work together to process what we see?
2.4 - 2 How does an error in the structure or function of the eye relate to disease or dysfunction?
2.4 - 3 How does information received through sight initiate a response in other body systems?
2.4 - 4 How can new technology improve human vision?

Enduring Understandings:
1.The human body is made up of complex systems functioning together to maintain homeostasis.

2. Human body systems depend upon electrical and chemical signaling as a means of sending messages between and within systems.

3. Disruptions to a signaling mechanism within a body system may initiate a complex cascade of events consequential to many physiological processes that are directly or indirectly dependent on the malfunctioning process.

Stage 2 – Assessment Evidence

Unit Pre-Assessment:

1. Blood sugar homeostasis quiz
2. Membrane transport graphic organizer/ assessment

Performance Task(s):

The Brain

Communication Activity: Introduce unit with TED talk video and block activity- Students sit back to back, and one student builds a structure out of legos. Without speaking or turning around, they message instructions to their partner who attempts to replicate the structure based on the instructions provided. Each group assigned one of the conclusion questions and shares with the class.

Maniken Build: Students follow procedure to build basic brain structure on their mannequin and practice using anatomical terms

Brain map: Students read the case study of Phineas Gauge. They develop a brain map linking region to location and function to be used in later activities. The draw the structures (external and internal view) on a swim cap or model the structures in 3D by carving a foam head model.

Dissection: Students use their brain map to locate the structures in a sheep brain (uses anatomical terminology from last unit). They mark these structures with the icons they choose to represent their function.

Electrical Communication

Neural structures: Students create a model of either a sensory neuron, interneuron, or motor neuron. They label key structures and define their functions. They participate in a gallery walk and take notes on the other types.

Action Potential: Students review membrane transport from PBS. Students complete playposit crash course video and CFU questions related to action potential. They use models and resources provided by teacher to model action potential along an axon using the 3D molecular designs kit and by acting out the process

Reflex response lab: Students attach accelerometers to reflex hammers and use EKG electrodes on thigh muscles. They collect data using logger pro and compare the difference in reaction time between voluntary and involuntary patellar reflex. Next, they test the impact of thought on reaction time by participating in a series of Donder's experiments.

Independent investigation: Students develop their own experimental question and design using one of the dependent variables from the previous lesson. They write a full lab report from their results.

Diagnostic Skits: Each group is provided with a patient case file. Students research neurological disorders to diagnose patient. Students must create a skit involving the patient and doctor that addresses the following: Diagnostic questions, differential diagnosis, prognosis, additional lab testing, and physiology of the disease. Rubric

Brain and Electrical Signaling Quiz

Chemical Communication

Endocrine Concept map: Students create a concept map with vocabulary related to the endocrine system and define connections between terms. They map an example of endocrine response to blood glucose on a body graphic organizer utilizing new vocabulary terms.

Diagnosing Lincoln Grant: Students read a case profile about a man experiencing a variety of symptoms. They research the role of relevant hormones to come to a diagnosis that explains how all of the symptoms are being caused via endocrine malfunction

Authentic assessment- Independent diagnostic research task

Communication with the Outside World

Eye dissection: Engage students with "magic eye" photos. Discuss ways the nervous system allows organisms to communicate with the outside world. Students dissect cow eyeballs and link structure with function

Visual Perception: Students will rotate among stations to take measurements that assess visual perception (visual acuity, blind spot assessment, astigmatism, color blindness, etc.) and follow a procedure to explore retinal stimulation using a 3D eye model

Extensions (Tier I):	Differentiation (Tiers 2 and 3)
• Choice in process/ product/ ways to access content (Tier 1 students encouraged to build their own model of action potential rather than use the one provided) • Students can explore action of neurotransmitters and effects of drugs/ toxic substances on their function • Options for potential research websites/ videos/ animations provided (Tier one students encouraged to use peer reviewed articles)	• Group work • Study skills (Self-assessment quizzes embedded in curriculum, regular quizzes) • Options for potential research websites/ videos/ animations provided • Hands on models • Choice in process/ product/ ways to access content (action potential project)

Stage 3 – Learning Plan

Human Body Systems Unit I Digital Access (Password Required):
https://pltw.read.inkling.com/a/b/8e22fd7ebe0d495a9597588bba11b214/p/5669cf431a4e47bdb47197be8824bbf1
The HBS curriculum linked above includes laboratory procedures, project requirements, presentations, modeling instructions, and research resources used in the design of the learning tasks described in the stage 2 section of this unit plan.

Vocabulary

• Brain Stem • Central Nervous System • Cerebellum • Cerebrum • Gyrus • Limbic System • Lobe • Peripheral Nervous System • Phrenology • Sulcus	• Reflex • Synapse • Endocrine Gland • Endocrine System • Exocrine Gland • Glucagon • Hormone • Hypothalamus • Insulin • Pituitary Gland

• Action Potential • Axon • Dendrite • Ion • Myelin Sheath • Neurologist • Neuron • Neurotransmitter • Reaction Time • Rod • Retina • Refraction	• Accommodation • Astigmatism • Blind Spot • Cone • Cornea • Depth Perception • Hyperopia • Iris • Lens • Myopia • Optic Nerve • Pupil

Expert/Field Experience(s)

Guest Speaker- Dr. Tutella: Dr. Tutella is a local Ophthalmologist who has volunteered to speak with our HBS students. His presentation focuses on his experiences training for a career in ophthalmology as well as an overview of the the eye disorders he evaluates and treatments he offers within his independent practice.

Neurologist /endocrinologist (if available)

Literacy Connections/Research

Reflex response lab report: Students generate an APA formatted scientific lab report based on the EKG and accelerometer data collected during an independent investigation related with involuntary reflex response time.

Endocrine diagnoses: Students will evaluate a patient report which includes reference to symptoms and hormone level data. The will apply their understanding of thyroid hormone regulation and independent research skills to write an explanation of the pathology and prognosis associated with their diagnosis.

Modifications

Special Education/ 504:	English Language Learners:
-Adhere to all modifications and health concerns stated in each IEP. -Accommodate Instructional Strategies: reading aloud text, graphic organizers, one-on-one instruction, class website (Google Classroom), handouts, definition list with visuals, extended time -Provide breaks between tasks, use positive reinforcement, use proximity -Assure students have experiences that are on the Concrete- Pictorial- Abstract spectrum by using manipulatives -Implement supports for students with disabilities (click here) - Make use of strategies imbedded within lessons -Common Core Approach to Differentiate Instruction: Students with Disabilities (pg 17-18)	- Use manipulatives to promote conceptual understanding and enhance vocabulary usage - Provide graphic representations, gestures, drawings, equations, realia, and pictures during all segments of instruction - Utilize graphic organizers which are concrete, pictorial ways of constructing knowledge and organizing information - Utilize program translations (if available) for L1/ L2 students - Reword questions in simpler language -Scaffolding instruction for ELL Learners -Common Core Approach to Differentiate Instruction: Students with Disabilities (pg 16-17)

Gifted and Talented:	Students at Risk for Failure:
- Elevated contextual complexity - Inquiry based or open ended assignments and projects - More time to study concepts with greater depth - Promote the synthesis of concepts and making real world connections - Provide students with enrichment practice that are imbedded in the curriculum such as: ● Application / Conceptual Development ● Are you ready for more? - Provide opportunities for science competitions - Alternative instruction pathways available	- Assure students have experiences that are on the Concrete- Pictorial- Abstract spectrum - Modify Instructional Strategies, reading aloud text, graphic organizers, one-on-one instruction, class website (Google Classroom), inclusion of more visuals and manipulatives, Peer Support - Parental/ guardian contact - Provide academic contracts to students & guardians - Create an interactive notebook with samples, key vocabulary words, student goals/ objectives. - Plan to address students at risk in your learning tasks, instructions, and directions. Anticipate where the needs will be, then address them prior to lessons. -Common Core Approach to Differentiate Instruction: Students with Disabilities (pg 19)

21st Century Life and Career Skills:

Career Ready Practices describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

https://www.state.nj.us/education/cccs/2014/career/9.pdf

- **CRP1**. Act as a responsible and contributing citizen and employee.
- **CRP2**. Apply appropriate academic and technical skills.
- **CRP3**. Attend to personal health and financial well-being.
- **CRP4**. Communicate clearly and effectively and with reason.
- **CRP5**. Consider the environmental, social and economic impacts of decisions.
- **CRP6**. Demonstrate creativity and innovation.
- **CRP7**. Employ valid and reliable research strategies.
- **CRP8**. Utilize critical thinking to make sense of problems and persevere in solving them.
- **CRP9**. Model integrity, ethical leadership and effective management.
- **CRP10**. Plan education and career paths aligned to personal goals.
- **CRP11**. Use technology to enhance productivity.
- **CRP12**. Work productively in teams while using cultural global competence.

Students are given an opportunity to communicate with peers effectively, clearly, and with the use of technical language. They are encouraged to reason through experiences that promote critical thinking and emphasize the importance of perseverance. Students are exposed to various mediums of technology, such as digital learning, calculators, and educational websites.