Theme

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

STEM Innovation Academy Unit 1 Plan

Subject: Human Body Systems Unit Title: Identity Grade: 10th	Teacher: Andrea Henry Duration: 4 weeks; September 8-October 2

Summary of Unit

In Unit 1, students will explore the idea of identity. They will move from general to specific as they first explore commonalities between all humans and then move on to explore the individual differences in tissues and cells. In the course, students will work with a two-foot skeletal model produced by Anatomy in Clay® Learning System. Students will work in pairs on an assigned Maniken® and use clay to build various organs, tissues, and vessels on the skeletal frame. Students will review the types of human tissue and look deeper at bone, muscle and fat, all types of tissue that contribute to the framework of the human body. Students will then play the role of forensic anthropologists to examine skeletal remains and analyze four bones to determine as much as possible about the person's gender, race, age, and height. They will use what they have learned about human skeletal structure to take qualitative and quantitative measurements and analyze their findings to provide a preliminary identification of the deceased. Finally, students will use theoretical equations to predict their own height from the length of their bones and will then explore how scientists can come up with these equations by using class data to generate an equation for a line. Using simulated DNA samples collected from the bones of the skeleton, students will now use molecular techniques to determine identity. Students have explored the tools of molecular biology in PBS, but they have yet to explore restriction enzymes as a tool for cutting DNA. In this lesson, students will run restriction analysis on simulated DNA samples from the skeleton and from missing persons who match the physical description provided by the bone analysis. Since each person has a unique genetic code, these enzymes will make a different number of cuts in the DNA, leaving a varying number of fragments. These restriction fragments will be separated via gel electrophoresis and the resulting restriction fragment length polymorphisms (RFLPs) will be compared. Students will add to their case report from Lesson 2 and make a final conclusion regarding the identity of the skeleton. Students will also investigate the various career areas they have worked through in the unit.

To wrap up the unit, students will explore the technology being used to secure and verify identity. Biometrics is the field of science dedicated to using physical characteristics, such as facial features or patterns in the eyes, and behavioral characteristics, such as voice or handwriting, to determine or confirm identity. Students will propose a biometric method to solve various identification related problems presented to them.

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

DCI - LS3.A - Heredity: Inheritance and Variation of Traits - Inheritance of Traits
Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. (HS-LS3-1)

DCI - LS3.B - Heredity: Inheritance and Variation of Traits - Variation of Traits
In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, and viable mutations are inherited. (HS-LS3-2)

Stage 1 – Desired Results

Essential Questions:

1. How do different body systems work together to complete specific functions, such as movement and communication?
2. What is the advantage of using regional and directional terms when discussing location in the body?
3. How does the structure of specific human tissue provide clues to its function in the human body?
4. How do all tissues in the body contribute to the identity of a person?
5. What role does DNA play in human identity?
6. How can molecular biology techniques be used to compare the DNA of two individuals?

Enduring Understandings:

7. The human body is made up of many systems that work in conjunction with one another to perform specialized tasks
8. Identifying characteristics within the skeleton can be used to infer information about height, gender, ethnicity, and age when data is collected and compared with a standard measurement
9. DNA contains unique sequences that can be used to identify an individual

Stage 2 – Assessment Evidence

Unit Pre-Assessment:

1. Last lab report from freshman year
2. Human body graphic organizer labeling activity
3. PBS EOC scores
4. pre assessment based on PBS knowledge (micropipetting/ vocabulary/ molecular biology etc.)

Performance Task(s):

Amazing facts/ 3 truths and a lie- PBS connection; Student groups are assigned a body system. They draw the organs involved on a body system graphic organizer and research 3 surprising facts about their system. Each student group also makes up one false statement. During presentations, the audience votes on which statement was the lie. Students take pre assessment at this time.

Orientation of mannequin/ anatomical regions/ Pickle lab practical; Students identify list of directional and regional terms on their mannequin by conducting independent research. They use flags to mark these locations and quiz one another. The following class, students complete the pickle lab practical, and photograph their "pickle person" for a quiz score.

Identity of mannequin (human tissue concept map/ facial bones and muscle quiz); Students create a concept map using draw.io to graphically represent the connections between various tissue types and their functions. They then use an interactive tutorial to identify and label the skull bones and facial muscles on their mannequin. Students build face of mannequin using this knowledge and teacher directions for manipulating clay.

Skeletal scavenger hunt; Students label bones, quiz group members on bone names/ locations, and complete the list of tasks from the skeletal scavenger hunt

Bone detectives case report; Students complete procedure to take various bone measurements and compare them to known ranges in an effort to estimate sex, ethnicity, age, height and gender of their skeleton. They write a case report describing their findings and offer explanations for conflicting data. The construct an argument based on their data for which missing person they believe the skeleton belongs to.
Rubric
Bone measurements how to guide
Exemplar

Height estimation from bone formula derivation
Students use Dr. Trotters formulas to estimate height from bone length specific to sex and ethnicity. They calculate the error. Next, students use class height/ tibia length data to generate their own height estimation equations using a linear regression.
Quiz

Restriction enzyme lab
Students review DNA knowledge and genetic analysis procedures. Students digest DNA isolated from 2 missing persons using 2 restriction enzymes. Students visualize banding pattern by conducting gel electrophoresis and determine whose skeleton was most likely found at the crime scene. Students add these findings to case report.

DNA analyst mock interview
Students will research professionals who are involved in analyzing DNA evidence for missing persons' cases or crime scene investigations and use research to create a mock interview with a DNA analyst.

Design a security plan using biometric technology- Students will pitch a biometric based security plan to address one of the following issues:

- An airport interested in increasing overall security measures
- A hospital interested in a better way to link new mothers and fathers with their newborn babies
- A popular theme park interested in a way to ensure that visitors do not share admissions passes
- A bank interested in securing access to accounts, inside the building, over the phone, and at ATMs

Extensions (Tier I):	Differentiation (Tiers 2 and 3)
Choice in process/ product/ ways to access content (Biometric security plan) 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 (security plan)

Stage 3 – Learning Plan

Human Body Systems Unit I Digital Access (Password Required):
https://pltw.read.inkling.com/a/b/8e22fd7ebe0d495a9597588bba11b214/p/5669cf431a4e47bdb47197be8824bbf1

Vocabulary

abdominal- stomach	agarose-jelly like substance DNA can be placed in gel electrophoresis-electricity is added to the agarose to separate the DNA
antecubital- forearm	biometrics-form of science that uses DNA for identification
axillary- armpit	restriction enzymes-Proteins that cut pieces of DNA
brachial- upper arm	DNA-double helix shaped molecule that gives instructions to a cell
carpal- wrist	skeletal system-included all the joints and bones in the body
cephalic-head	muscular system-responsible for the movement of the human body
digital-toes/fingers	cardiovascular system-consists of the heart, blood vessels, and the blood the vessels transport
femoral-femur/upper leg	
gluteal-butt	
inguinal-groin	
lumbar-middle back	
nasal-nose	
occipital- back of head	
orbital-eye	
popliteal-back of the knee	

thoracic-chest umbilical-navel anterior-front side posterior-towards the back dorsal-top ventral-bottom medial-toward the center lateral-away from the middle superficial-towards the surface deep-below the surface superior-above inferior-below proximal-close distal-far away adipose tissue-fat tissue with fat soluble vitamins appendicular tissue-bones of the limbs that are attached to the axial skeleton axial skeleton-the skeleton of the trunk and head connective tissue-binds and supports other tissue epithelial tissue-lining of organs and body cavities that "protects it" tibia-inner, larger leg bone; shin femur-largest bone; hip to knee humerus-largest arm bone in the upper arm radius-thumb side arm bone ulna-pinky side arm bone restriction fragment length polymorphism (RFLP)-the piece of DNA cut from the restriction enzyme; similar to a fingerprint	digestive system-group of organs working together to convert food into energy and basic nutrients to feed the entire body endocrine system-includes all the glands and hormones of the body respiratory system-provides oxygen to the body's cells while removing carbon dioxide immune system-fights pathogenic viruses, bacteria, etc. urinary system-consists of kidneys, ureters, urinary bladder, and urethra; the plumbing system integumentary system-consists of skin, hair, nails, and exocrine glands
Expert/Field Experience(s)	
Center for Human Anatomical Studies- Cadaver lab at Rutgers University with program for high school outreach Guest speaker from the Criminal Investigations Division of the West Orange Police Department	
Literacy Connections/Research	
DNA analyst mock interview Students will research professionals who are involved in analyzing DNA evidence for missing persons' cases or crime scene investigations and use research to create a mock interview with a DNA analyst. This assignment could be extended into a panel presentation; Students could come prepared with resumes and interview for the position and demonstrate lab skills relevant to the position. Design a security plan using biometric technology- Students will pitch a biometric based security plan to address the needs of a client of their choice Bone detectives case report; Students complete procedure to take various bone measurements and compare them to known ranges in an effort to estimate sex, ethnicity, age, height and gender of their skeleton. They write a case report describing their findings and offer explanations for conflicting data. The construct an argument based on their data for which missing person they believe the skeleton belongs to.	
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.	