EGG HARBOR TOWNSHIP PUBLIC SCHOOLS
CURRICULUM

MEDICAL SCIENCE ACADEMY: FORENSICS
High School

Length of Course:	Full Year
Elective / Required:	Refer to Program of Studies
Schools:	High School
Student Eligibility:	Grade 12
Credit Value:	5 credits
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DISTRICT MISSION STATEMENT

Our mission in the Egg Harbor Township School District is to partner with the student, family, school, and community to provide a safe learning environment that addresses rigorous and relevant 21st Century standards and best practices which will develop academic scholarship, integrity, leadership, citizenship, and the unique learning style of students, while encouraging them to develop a strong work ethic and to act responsibly in their school community and every day society.

SCIENCE – PHILOSOPHY

We believe that ALL students regardless of race, ethnicity, socio-economic status, religious background, and/or any other classification are deserving of a holistic science education. This holistic approach would include an education that will allow them to fully discover themselves, their strengths and weaknesses, and benefit from science instruction.

> Scientific literacy assumes an increasingly important role in the context of globalization. The rapid pace of technological advances, access to an unprecedented wealth of information, and the pervasive impact of science and technology on day-to-day living require a depth of understanding that can be enhanced through quality science education. In the 21st century, science education focuses on the practices of science that lead to a greater understanding of the growing body of scientific knowledge that is required of citizens in an ever-changing world (NJCCCS-Science).

Science curricula are designed to reinforce 21st Century Learning, to maximize rigor, relevance, and relationships, and to engage students individually through differentiated instruction.

SCIENCE - STATEMENT OF PURPOSE

Education exists for the purpose of enabling each individual to realize and maintain her/his full potential. Scientifically literate students possess the knowledge and understanding of scientific concepts and processes required for personal decision-making, participation in civic and cultural affairs, and economic productivity.

> Science, engineering, and technology influence and permeate every aspect of modern life. Some knowledge of science and engineering is required to engage with the major public policy issues of today as well as to make informed everyday decisions, such as selecting among alternative medical treatments or determining how to invest public funds for water supply options. In addition, understanding science and the extraordinary insights it has produced can be meaningful and relevant on a personal level, opening new worlds to explore and offering lifelong opportunities for enriching people's lives. In these contexts,

> learning science is important for everyone, even those who eventually choose careers in fields other than science or engineering (NJSLS-Science)
>
> All students engage in science experiences that promote the ability to ask, find, or determine answers to questions derived from natural curiosity about everyday things and occurrences. The underpinning of the revised standards lies in the premise that science is experienced as an active process in which inquiry is central to learning and in which students engage in observation, inference, and experimentation on an ongoing basis, rather than as an isolated a process. When engaging in inquiry, students describe objects and events, ask questions, construct explanations, test those explanations against current scientific knowledge, and communicate their ideas to others in their community and around the world. They actively develop their understanding of science by identifying their assumptions, using critical and logical thinking, and considering alternative explanations (NJCCCS-Science).

Our school district provides an extensive science program, which will enable students to succeed and compete in the global marketplace using the New Jersey Student Learning Standards in Science as well as the Next Generation Science Standards.

INTRODUCTION

The most precious resource teachers have is time. Regardless of how much time a course is scheduled for, it is never enough to accomplish all that one would like. Therefore, it is imperative that teachers utilize the time they have wisely in order to maximize the potential for all students to achieve the desired learning.

High quality educational programs are characterized by clearly stated goals for student learning, teachers who are well-informed and skilled in enabling students to reach those goals, program designs that allow for continuous growth over the span of years of instruction, and ways of measuring whether students are achieving program goals.

THE EGG HARBOR TOWNSHIP SCHOOL DISTRICT CURRICULUM TEMPLATE

The Egg Harbor Township School District has embraced the backward-design model as the foundation for all curriculum development for the educational program. When reviewing curriculum documents and the Egg Harbor Township curriculum template, aspects of the backward-design model will be found in the stated enduring *understandings/essential questions, unit assessments,* and *instructional activities*. Familiarization with backward-design is critical to working effectively with Egg Harbor Township's curriculum guides.

GUIDING PRINCIPLES: WHAT IS BACKWARD DESIGN?
WHAT IS UNDERSTANDING BY DESIGN?

"Backward design" is an increasingly common approach to planning curriculum and instruction. As its name implies, "backward design" is based on defining clear goals, providing acceptable evidence of having achieved those goals, and then working 'backward' to identify what actions need to be taken that will ensure that the gap between the current status and the desired status is closed.

Building on the concept of backward design, Grant Wiggins and Jay McTighe (2005) have developed a structured approach to planning programs, curriculum, and instructional units. Their model asks educators to state goals; identify deep understandings, pose essential questions, and specify clear evidence that goals, understandings, and core learning have been achieved.

Programs based on backward design use desired results to drive decisions. With this design, there are questions to consider, such as: What should students understand, know, and be able to do? What does it look like to meet those goals? What kind of program will result in the outcomes stated? How will we know students have achieved that result? What other kinds of evidence will tell us that we have a quality program? These questions apply regardless of whether they are goals in program planning or classroom instruction.

The backward design process involves three interrelated stages for developing an entire curriculum or a single unit of instruction. The relationship from planning to curriculum design, development, and implementation hinges upon the integration of the following three stages.

Stage I: Identifying Desired Results: Enduring understandings, essential questions, knowledge and skills need to be woven into curriculum publications, documents, standards, and scope and sequence materials. Enduring understandings identify the "big ideas" that students will grapple with during the course of the unit. Essential questions provide a unifying focus for the unit and students should be able to answer more deeply and fully these questions as they proceed through the unit. Knowledge and skills are the *"stuff"* upon which the understandings are built.

Stage II: Determining Acceptable Evidence: Varied types of evidence are specified to ensure that students demonstrate attainment of desired results. While discrete knowledge assessments (e.g.: multiple choice, fill-in-the-blank, short answer, etc…) will be utilized during an instructional unit, the overall unit assessment is performance-based and asks students to demonstrate that they have mastered the desired understandings. These culminating (summative) assessments are authentic tasks that students would likely encounter in the real-world after they leave school. They allow students to demonstrate all that they have learned and can do. To demonstrate their understandings students can explain, interpret, apply, provide critical and insightful points of view, show empathy and/or evidence self-knowledge. Models of student

performance and clearly defined criteria (i.e.: rubrics) are provided to all students in advance of starting work on the unit task.

Stage III: Designing Learning Activities: Instructional tasks, activities, and experiences are aligned with stages one and two so that the desired results are obtained based on the identified evidence or assessment tasks. Instructional activities and strategies are considered only once stages one and two have been clearly explicated. Therefore, congruence among all three stages can be ensured and teachers can make wise instructional choices.

At the curricular level, these three stages are best realized as a fusion of research, best practices, shared and sustained inquiry, consensus building, and initiative that involves all stakeholders. In this design, administrators are instructional leaders who enable the alignment between the curriculum and other key initiatives in their district or schools. These leaders demonstrate a clear purpose and direction for the curriculum within their school or district by providing support for implementation, opportunities for revision through sustained and consistent professional development, initiating action research activities, and collecting and evaluating materials to ensure alignment with the desired results. Intrinsic to the success of curriculum is to show how it aligns with the overarching goals of the district, how the document relates to district, state, or national standards, what a high quality educational program looks like, and what excellent teaching and learning looks like. Within education, success of the educational program is realized through this blend of commitment and organizational direction.

INTENT OF THE GUIDE

This guide is intended to provide teachers with course objectives and possible activities, as well as assist the teacher in planning and delivering instruction in accordance with the New Jersey Core Curriculum Content Standards. The guide is not intended to restrict or limit the teacher's resources or individual instruction techniques. It is expected that the teacher will reflectively adjust and modify instruction and units during the course of normal lessons depending on the varying needs of the class, provided such modified instruction attends to the objectives and essential questions outlined below.

N.J.A.C. 6A:8-3.1 Required Curriculum Components

Code Language	Evident in Curriculum YES/NO	Comments
Interdisciplinary Connections	**Yes**	**Via lab activities. STEM units in development 1 per marking period**
A pacing guide	**Yes**	**By Unit approximately 2-4 units per marking period**
A list of core instructional materials, including various levels of text at each grade level	**Yes**	**Suggested Activities Labs**
Benchmark assessments	**Yes**	**Teacher-developed and common via pre/post and benchmark assessments**
Modifications for special education students, for ELLs in accordance with N.J.A.C. 6A:15, and for gifted students. (As appropriate) – See Appendix A	**Yes**	**As directed by student's Individual Education Plan**

Unit Name: Securing and Processing the Scene **Time Frame: 3 weeks**
Author: Egg Harbor Township High School Science Department

Subject: **Forensic Science** Country: **USA**

Course/Grade: **Honors** State/Group: **NJ**

School: **Egg Harbor Township High School**

UNIT SUMMARY

Students must understand that a crime scene is a complicated system of variables that is constantly changing. Evidence is found in all shapes, sizes, forms and by many chemical processes. Additionally, students will understand the importance of proper evidence collection and accurate analysis. Students must realize that forensic science seeks to catalog and document evidence left at the scene of a crime which can later be used to aid further, more in depth investigation.

UNIT RESOURCES

Online Textbook, Chapter Reviews / Worksheets, PowerPoint presentations, educational videos, Textbook Chapter 1 & 2, Labs

Internet Resource Links:

www.school.cengage.com/forensicscience

GOALS AND STANDARDS

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. [*Assessment Boundary: Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.*]

ENDURING UNDERSTANDINGS

An investigator must have practice disregarding bias' both personal and societal, to be open-minded and inclusive in evidence collection. Crime scenes are complicated and evolving areas, which must be secured for fear of contamination or omission.

ESSENTIAL QUESTIONS

What is observation?

How is observation shaped?

What are the best techniques for improving your observational ability?

How does your observational ability impact your job directly?

What are the two main types of evidence? What do their subgroups contain?

Why are the 7 S's of crime scene investigation important? How do they create a system of checks and balances?

Why is the chain of custody of evidence as important, if not more important, than actually analyzing the evidence?

KNOWLEDGE AND SKILLS

Vocabulary:

Analytical skills, deductive reasoning, eyewitness, fact, forensic, logical, observation, opinion, perception, chain of custody, circumstantial evidence, class evidence, crime-scene investigation, crime-scene reconstruction, direct evidence, first responder, individual evidence, paper bindle, primary crime scene, secondary crime scene, tertiary crime scene, trace evidence

Students will be able to:

Define observation and describe what changes occur in the brain.

Describe examples of factors influencing eyewitness accounts of events.

Compare the reliability of eyewitness testimony to what actually happened.

Relate observation skills to their use in forensic science

Define forensic science

Practice and improve your own observational skills

Summarize Locard's exchange principle.

Identify four examples of trace evidence

Distinguish between direct and circumstantial evidence

Identify the type of professionals who are present at a crime scene

Summarize the seven step process of crime scene investigation

Explain the importance of securing the crime scene

Identify the methods by which a crime scene is documented

Demonstrate proper technique in collecting and packaging trace evidence

Describe how evidence from a crime scene is analyzed

PERFORMANCE TASKS

Discuss what observation is and how bias can skew observation

In Class activity gauging how deeply you perceive your surroundings an in what kind of detail (worksheet & computer animation)

Short case studies on the potential inaccuracy of witness testimony (buddy discussion after reading)

Design and carry out an observational analysis of various crime scene, both individually and collectively

Use knowledge of information processing in the brain to improve observational techniques and methods

Understand Locard's exchange principle and accept it as a constant variable

In-class activity comparing and contrasting direct evidence, circumstantial evidence, class evidence and individual evidence using a flow chart

Securing, Collecting and Documenting Evidence Lab

Review game

Vocabulary Quizzes

Chapter tests

OTHER EVIDENCE

Homework/Classwork:

Vocabulary flash cards or map (word, picture, sentence, example)

Chapter Review Questions

Case Studies

Exit Cards (answer to daily objective questions)

Study Guide Packets

Visual Quiz

LEARNING PLAN

Activities, experiences, and lessons:

PowerPoint presentation of material

Group discussion

Think, pair, share (read assigned section of text individually, discuss with a partner, present material in pairs to class – use PowerPoint as a reference)

Flow Chart analysis - information processing in the brain

Innocence Project, various short videos

Activity 1-1 and 1-3.

Trace evidence chart, in-or-out activity

Crime scene photo/illustration discussionDesign your own experiment

Crime Scene Reconstruction Lab

Misconceptions/Teaching Tips:

Repeatedly cover 7 S's to a secure crime scene.

Use many examples of experiments to indicate all steps of crime scene observation and evidence collecting scientific students can readily identify the steps

Use student examples and ideas to extend learning outside of the classroom

Allow students to critique other students' ideas until experiment is scientifically sound

Provide multiple examples of direct evidence and circumstantial evidence in different experimental situations

Remind students of the difference between securing, collecting, documenting and analyzing evidence, and actually solving the crime.

Use visual representation of the various steps of securing and processing a crime scene and obtaining and cataloging evidence.

peer teaching is beneficial to assist in wording to students who may have trouble connecting the given information to relevant and current real-world situations.

Student progress will be measured by formative and summative assessments. To maximize student understanding current and cumulative topics will be assessed weekly.

This unit is sequenced to begin with an informal assessment of prior knowledge of topics within the unit and determine any misconceptions. Students will then build small concrete blocks of information pertinent to mastery of this unit. Finally, students will be asked to use this information to evaluate higher level problems. This unit will end with a formal assessment common to all forensic science students.

Unit Name: Hair, Fibers and Textiles: Physical Evidence vs. Biological Evidence
Time Frame: 3-4 weeks
Author: Egg Harbor Township High School Science Department

Subject: **Forensic Science** Country: **USA**

Course/Grade: **Honors** State/Group: **NJ**

School: **Egg Harbor Township High School**

UNIT SUMMARY

Living things are made of chemical elements and chemical compounds that occur rather consistently in species in relation to their habitats. Hair is a material very commonly found throughout Earth's history and contains loads of information about its creator. Analyzing hair is a very complicated process. Depending on the amount of hair obtained a forensic analyst could reveal information relating to a specific individual or narrow down a field to a specific species. Fibers and textiles can be classified by many characteristics. The amount of measurable characteristics make a fiber/textile either very generic or very specific. Natural fibers have some stark differences from man-made fibers, while textiles are actually a collection of programmed and orderly patterned materials. All types of fibers can be classified as a piece of **class evidence**.

UNIT RESOURCES

Online Textbook, Chapter Reviews / Worksheets, PowerPoint presentations, educational videos, Textbook Chapter 3 & 4, Labs

Internet Resource Links:

www.school.cengage.com/forensicscience

GOALS AND STANDARDS

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. [*Assessment Boundary: Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.*]

HS-LS4-1.

Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. [Clarification Statement: Emphasis is on a conceptual understanding of the role each line of evidence has relating to common ancestry and biological evolution. Examples of evidence could include similarities in DNA sequences, anatomical structures, and order of appearance of structures in embryological development.]

ENDURING UNDERSTANDINGS

Hair is great evidence because is includes lots of information about its host

The characteristics of animal hair can give details that are very specific or very broad, it depends on the age of the specimen and the amount.

Hair can be a fairly accurate record of consumed and digested material and molecules.

Fibers and textiles are very important to collect early in an investigation.

Fibers and textiles are transferred in two ways, direct and secondary transfer.

Fibers are divided into two categories: natural and synthetic.

Textiles are fibers that are generally machine made these days which leaves its own set of "fingerprints" on each piece analyzed.

ESSENTIAL QUESTIONS

What is a hair follicle made of?

What do the characteristics of hair follicles tell you about the individual organism it came from?

What is hair, direct or circumstantial evidence? Class or individual? Both?

How is hair collected and analyzed?

What is the difference between natural and synthetic fibers?

What characteristics do forensic scientists look for in every fiber sample?

How are fibers and textiles transferred?

What process do textiles endure that make them unique and distinguishable?

KNOWLEDGE AND SKILLS

Vocabulary:

class evidence, comparison microscope, cortex, cuticle, hair follicle, individual evidence, keratin, medulla, melanin granules, neutron activation analysis, trace evidence, amorphous, crystalline, direct transfer, fiber, mineral fiber, monomer, natural fiber, polymer, synthetic fiber, secondary transfer, textile, yarn

STUDENTS WILL BE ABLE TO…

Identify the various parts of the hair

Describe variations in the structure of the medulla, cortex, and cuticle

Distinguish between human and non-human hair

Determine if two examples of hair are likely to be from the same person

Explain how hair can be used in a forensic investigation

Calculate the medullary index for a hair

Distinguish hairs from individuals belonging to the broad racial categories

Identify and describe common weave patterns of textile samples

Compare and contrast various types of fibers through physical and chemical analysis

Describe principle characteristics of common fibers used in their identification

Apply forensic science techniques to analyze hair and fibers

PERFORMANCE TASKS

Hair type is figured out by comparing and contrasting different types while looking for certain characteristics

Hair texture comparison lab

In-class activity clarifying parts of the hair follicle and the qualities of human hair

Comparison Lab, Natural vs. Dyed/Bleached hair

Class discussion on relevancy and usefulness of testing hair for certain substances

Growth phases and the hair life cycle, video

Brain worm video, to reinforce Locard's exchange principle

Fiber classification in-class group activity

Graphic organizer centered discussion about the pro's and con's of natural fibers and synthetic fibers

Hypothetical crime scene emphasizing the importance of identifying textile samples

Review game

Vocabulary Quizzes

Chapter test

OTHER EVIDENCE

Homework:

Vocabulary flash cards or map (word, picture, sentence, example)

Section Review Questions

Exit Cards (answer to daily objective questions)

Do Nows

Study Guide Packets

Visual Quiz Worksheet

LEARNING PLAN

Activities, experiences, and lessons:

PowerPoint presentation of material

Group discussion

Think, pair, share (read assigned section of text individually, discuss with a partner, present material in pairs to class – use PowerPoint as a reference)

Illustration of human hair follicle in skin

Compare and contrast activity, animal vs. human and race separation

Article Review of hair testing (digging deeper)

Case studies

Creating slides and constant analysis of varying types of hair and fibers

Independent case study, What cases have been solved or aided by fiber and textile analysis?

Misconceptions/Teaching Tips:

Collection methods for hair, fibers, and textiles

Practice making slides to analyze hair follicles must be correct

Use demonstrations to introduce and reinforce properties natural and synthetic fibers

Student progress will be measured by formative and summative assessments. To maximize student understanding current and cumulative topics will be assessed weekly.

This unit is sequenced to begin with an informal assessment of prior knowledge of topics within the unit and determine any misconceptions. Students will then build small concrete blocks of information pertinent to mastery of this unit. Finally, students will be asked to use this information to evaluate higher level problems. This unit will end with a formal assessment common to all general biology students.

Unit Name: Individual / Biological Evidence **Time Frame: 5 weeks**
Author: Egg Harbor Township High School Science Department

Subject: **Forensic Science** Country: **USA**

Course/Grade: **Honors** State/Group: **NJ**

School: **Egg Harbor Township High School**

UNIT SUMMARY

Fingerprints and DNA Fingerprinting are two ways in which biological material can be documented and catalogued. This are processes that confirm identities and act as a virtual net for offenders, both past/present. Your fingerprints are one of a kind, just like your DNA fingerprint. There are three kinds of fingerprint patterns: arches, whorls, and loops. Despite what type of pattern you have for your fingerprints, all fingerprints can be split up into three broader categories: patent, plastic, and latent fingerprints (cyber fingerprints gaining relevancy). Method of fingerprint removal is dictated by conditions of the crime scene. New methods are being created continuously. Your DNA fingerprint is a collection of your genetic material that is contained in many substances and fluids. Saliva, blood, hair follicle, and skin cells etc. etc. DNA collection an preservation are complicated processes in and of themselves. PCR - Polymerase Chain Reaction - has really improved police investigations by allowing small amounts of DNA to be replicated and tested without restriction. Applications for DNA analysis is centered mostly on preventative medicine.

UNIT RESOURCES

Online Textbook, Chapter Reviews / Worksheets, PowerPoint presentations, educational videos, Textbook Chapter 6 & 7, Labs

Internet Resource Links:

www.school.cengage.com/forensicscience

GOALS AND STANDARDS

HS-LS3-1.

Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. [*Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.*]

HS-LS3-2.

Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. [Clarification Statement: Emphasis is on using data to support arguments for the way

variation occurs.] [Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.]

HS-LS3-3.

Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. [Clarification Statement: Emphasis is on the use of mathematics to describe the probability of traits as it relates to genetic and environmental factors in the expression of traits.] [*Assessment Boundary: Assessment does not include Hardy-Weinberg calculations.*]

HS-LS4-1.

Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. [Clarification Statement: Emphasis is on a conceptual understanding of the role each line of evidence has relating to common ancestry and biological evolution. Examples of evidence could include similarities in DNA sequences, anatomical structures, and order of appearance of structures in embryological development.]

ENDURING UNDERSTANDINGS

Fingerprints are an identifying characteristic that identifies somebody beyond a reasonable doubt

The history of fingerprinting extends far earlier than most people believe, as fingerprinting was a method of purchase and status in ancient times

Characteristics of fingerprints fall into three main categories: arches (5%), whorls (30%), and loops (65%)

Correctly classifying a particular fingerprint will allow for more quality removal and/or more accurate analysis of said fingerprints

As newer and newer methods of collecting/exposing fingerprints become more readily available, the types of surfaces where we can find fingerprints is continuing to grow in number as well.

Matching fingerprints in a universal database is far more time consuming than people are led to believe (depending on the method of retrieval)

DNA fingerprinting is a process that matches offenders, victims, and mystery perpetrators to circumstantial biological evidence.

Modern technology like DNA extraction, electrophoresis, and PCR are allowing investigators and forensic technicians to analyze and cross reference genetic in an assortment of way with complicated procedures.

DNA fingerprint analysis is used to exonerate offenders in the same manner it is used to put offenders behind bars. DNA fingerprinting is truly a two-way street in forensic science.

ESSENTIAL QUESTIONS

How long have fingerprints been studied in scientific history?

Why does your body continuously leave genetic matter behind that can be analyzed?

What characteristics make your fingerprints unique to you? Can they be duplicated or removed?

How does the type of fingerprint influence the process of extracting/removing the print?

What are the challenges inherent in trying to create a universal fingerprint database?

What is DNA and how is it specific to each individual?

What material makes up the universal code of DNA?

How accurate is DNA fingerprinting? What function does it serve?

Which methods are most commonly used to collect and preserve DNA evidence for fingerprinting?

How are IAFIS and CODIS the same, but different?

KNOWLEDGE AND SKILLS

Vocabulary

Arch, core, delta, fingerprint, latent fingerprint, loop, minutiae, patent fingerprint, plastic fingerprint, ridge pattern, ten card, whorl, allele, chromosome, DNA fingerprint, DNA probe, electrophoresis, gene, PCR, restriction enzyme, STR, VNTR

STUDENTS WILL BE ABLE TO…

Discuss the history of fingerprinting

Describe the characteristics of fingerprints

Identify the basic types of fingerprints

Describe how criminals attempt to alter their fingerprints

Determine the reliability of fingerprints as a means of identification

Explain how fingerprint evidence is collected

Describe the latest identification technologies

Determine if a fingerprint matches a fingerprint on record

Use the process of lifting a latent print

Explain how crime-scene evidence is collected for DNA analysis

Describe how crime-scene evidence is processed to obtain DNA

Describe how radioactive probes are used in DNA fingerprinting

Explain how DNA evidence is compared for matching

Explain how DNA fingerprinting is used to determine if specimens come from related or unrelated individuals

Explain how to use DNA fingerprinting to identify DNA from a parent, child, or relative of another person

PERFORMANCE TASKS

Create a historical fingerprint timeline

Compare and Contrast the types of fingerprints in relation to their frequency

Create your own "Ten Card" (evaluate your fingerprint pattern)

Exoneration Project: students will research instances where offenders were exonerated due to fingerprint or DNA fingerprinting evidence be reanalyzed.

Fact From Fiction in-class activity (how real is NCIS?)

Virtual crime-scenes pertaining to latent fingerprints and finding their owner

Population Genetics Activity

Collection and Preservation of genetic material partner activity

Case Studies

Review game

Vocabulary Quizzes

Chapter Test

OTHER EVIDENCE

Homework:

Vocabulary flash cards or map (word, picture, sentence, example)

Chapter Review Questions

Exit Cards (answer to daily objective questions)

Study Guide Packets

Visual Quiz

Multiple Labs

LEARNING PLAN

Activities, experiences, and lessons:

PowerPoint presentation of material

Group discussion

Think, pair, share (read assigned section of text individually, discuss with a partner, present material in pairs to class – use PowerPoint as a reference)

Foldables – distinguishing patent fingerprint, plastic fingerprints, and latent fingerprints

Identify methods of bringing latent fingerprints to life

Individual Fingerprint Lab

Class Fingerprint Data Lab

Construct DNA molecule (partner)

Explaination of DNA Fingerprinting Techniques (group)

Real life applications of DNA fingerprinting (current events)

Misconceptions/Teaching Tips:

Fingerprints and a DNA fingerprint are NOT the same thing

Fingerprints have been around a LOT longer than DNA Fingerprints

Fingerprints and an organisms' DNA fingerprint remain the same and unique to that organism throughout its lifecycle

Patent fingerprints are VISIBLE, while latent fingerprints are not visible with the naked eye

Fingerprint technology is a swiftly changing and growing field of scientific technology making future convictions and exonerations always possible

IAFIS is the database most used in the United States to store, document, compare, and contrast fingerprint data

DNA fingerprinting is biological matter left behind by a living organism, occurs in many forms

Different sources of DNA call for different methods/processes of analysis

PCR - Polymerase Chain Reaction - is the process technicians complete BEFORE they begin to run tests to create and match a DNA Fingerprint

Applications for DNA fingerprint technology is expanding exponentially

Student progress will be measured by formative and summative assessments. To maximize student understanding current and cumulative topics will be assessed weekly.

This unit is sequenced to begin with an informal assessment of prior knowledge of topics within the unit and determine any misconceptions. Students will then build small concrete blocks of information pertinent to mastery of this unit. Finally, students will be asked to use this information to evaluate higher level problems. This unit will end with a formal assessment common to all general biology students.

Unit Name: Crime Scene Recreation and Evidentiary Analysis

Time Frame: 13-14 weeks
Author: Egg Harbor Township High School Science Department

Subject: **Forensic Science** Country: **USA**

Course/Grade: **Honors** State/Group: **NJ**

School: **Egg Harbor Township High School**

UNIT SUMMARY

This unit will include how to properly collect and secure evidence, review evidence, and attempt to recreate the crime scene.

The presence of blood can never be dismissed from a crime scene. No matter how significant or insignificant, it should be collected, documented, and analyzed. Blood has been a substance, that over the course of human history, remains valuable and identifying. Blood types are divided into four groups: Type A, Type B, Type AB, and Type O. As technology increases in terms of quality of blood analysis and speed of analysis, blood splatter evidence became a quantifiable and measurable reconstruction tool.

Glass can be easily collected. Analysis of glass happens in two stages: identifying characteristics and components of THIS piece of glass AND comparison measurements and analysis. Understanding glass fragmentation due to force is essential to get the most out of the evidence.

Using materials to create casts and impressions of footprints, tires, shoes prints, points of impact, etc. is invaluable. These methods allow a number of processes to happen, most commonly tire impressions and shoe impressions. These articles can be processed and identified to be related to either the offender(s) or the victim(s). Impressions can be made in a variety of situations which calls for a variety of methods of casting. The information gathered from casting impressions allows accident deconstructionists and crime-scene investigators to develop a more orderly timeline. Dental indentations and puncture marks can also be matched to a specific individual from an entire population.

Tool marks at crime scenes need to be carefully documented and carefully collected. A forensic photographer would be responsible for photographing the tool in question and the mark that was made with the tool (abrasion, indentation, cutting marks). Precise measurements are made of the tool and compared to measurements and characteristics of the tool mark(s).

Ballistics is a type of retro-active evidence. It is always done after the commission of the crime with guns suspected to be involved in the crime. There are a number of different methods to compare and contrast bullets fired from the same guns and different

guns/calibers. The wounds created by a variety of caliber of bullets is also a noticeable characteristic. Gun-shot residue is a substance that is discharged when the gun is fired, which happens to spray backwards onto the person firing the gun. This is not a visible form of evidence, but it is a crucial piece to any investigation. Understanding trajectory and simple physics an individual can actually hypothesize when the shooter fired from, JUST by using evidence gathered after the gunshot happened.

UNIT RESOURCES

Online Textbook, Chapter Reviews / Worksheets, PowerPoint presentations, educational videos, Textbook Chapter 8, 14, 15, 16, 17, Labs

Internet Resource Links:

www.school.cengage.com/forensicscience

GOALS AND STANDARDS

HS-PS1-3.
Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles. [Clarification Statement: Emphasis is on understanding the strengths of forces between particles, not on naming specific intermolecular forces (such as dipole-dipole). Examples of particles could include ions, atoms, molecules, and networked materials (such as graphite). Examples of bulk properties of substances could include the melting point and boiling point, vapor pressure, and surface tension.] [*Assessment Boundary: Assessment does not include Raoult's law calculations of vapor pressure.*

HS-PS2-1.
Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. [Clarification Statement: Examples of data could include tables or graphs of position or velocity as a function of time for objects subject to a net unbalanced force, such as a falling object, an object rolling down a ramp, or a moving object being pulled by a constant force.] [*Assessment Boundary: Assessment is limited to one-dimensional motion and to macroscopic objects moving at non-relativistic speeds.*]
HS-LS1-4.
Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. [*Assessment Boundary: Assessment does not include specific gene control mechanisms or rote memorization of the steps of mitosis.*]
HS-LS3-1.
Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. [*Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.*]

ENDURING UNDERSTANDINGS

Blood and all of it components can be used to help possibly recreate a crime scene.

Blood can be detected in a variety of ways and seen through a variety of light spectrums

Blood spatter is a very useful type of evidence, which can be used to calculate a number of factors in the crime.

Glass is a material that is very specifically made for a variety of reasons

Glass can be matched to like pieces of glass by performing a number of simple chemical steps.

Different types of glass are required for different tasks and to uphold different security standards

Impressions can be classified into three categories: patent, latent, and plastic

Wear patterns and track/tread consistency vary in relation to subject and type of track.

Accident reconstruction is a method of connecting as many dots as possible, WHILE using sound scientific data to explain each step.

Dental patterns are mostly used in cases where the subjects are no longer living

Tools are pieces of crime scenes that are overlooked by new investigators

Tool marks and impressions are able to give information through comparison and detailed analysis.

Ballistics can be used to determine many things about a murder weapon or a potential murder weapon

Type of ammunition absolutely matters

New tests such as shell casing analysis and gun powder residue can be used to attach a certain weapon to a certain individual

Evidence is very different for bullet wounds depending on distance from target.

ESSENTIAL QUESTIONS

What is blood made out of?

How does blood spatter analysis tell the story of a crime scene?

Does blood always convict its owner?

What is glass made out of?

Why are different types of glass required for construction of different materials?

How do fracture patterns differ in relation to caliber and impacted surface?

How can you distinguish between the different types of impressions?

Why are qualitative and quantitative data both equally as important in terms of impressions and casts?

Why do these small cursory pieces of evidence matter to an investigation?

What are the three main types of tool marks found at crime scenes?

What does analyzing the results of a tools use tell you about the weapon?

Why does the type of fire-arm used matter?

How does the damage from different caliber bullets differ?

What are some of the methods used to compare and contrast ballistic evidence?

KNOWLEDGE AND SKILLS

Vocabulary:

Agglutination, antibodies, antigen-antibody response, antigens, cell-surface protein, lines of convergence, point of origin, red blood cells, satellite drop of blood, white blood cells, amorphous, Becke line, density, glass, leaded glass, normal line, obsidian, refractive index, silicon dioxide, latent impressions, patent impressions, plastic impressions, sole, tire groove, tire rib, tire ridge, track width, tread pattern, turning diameter, wheelbase, abrasion mark, cutting mark, indentation mark, tool mark, ballistics, barrel, breech, bullet, caliber, cartridge, firearm, full automatic, gunshot residue, muzzle, pistol, revolver, rifle, rifling, semiautomatic, shell casing, trajectory.

STUDENTS WILL BE ABLE TO…

Explain the composition of blood

Describe the functions of blood cells

Describe a brief history of the use of bluff and blood-spatter analysis in forensics

Describe how to determine the blood type of a samlpe blood

Describe how to screen for the presence of human blood

Calculate the probability of certain blood types within a population

Conduct blood spatter analysis

Examine stab wounds and describe the nature of the weapon

Use blood spatter evidence to recreate the events at a crime scene.

Explain how glass is formed

List some of the characteristics of glass

Provide examples of different types of glass

Calculate the density of glass

Use the refractive index to identify different types of glass

Describe how glass fractures

Analyze glass fracture patterns to determine how glass was broken

Explain how glass is used as evidence

Distinguish between latent, patent, and plastic impressions

Explain how various types of impressions can be used as trace evidence

Describe how to make foot, shoe, and tire impressions

Use track width and wheelbase information to identify vehicles

Prepare dental impressions and attach them with bite marks

Discuss the significance of tool mark impressions in criminal investigations

Describe three major types of tool mark impressions

Describe variations in tool surface characteristics that are used to identify individual tools

Summarize the steps of a tool mark examination and analysis

Match tool mark with the instrument that produced them

Describe how took mark evidence is collected, preserved, and documented

Discuss the differences between a handgun, a rifle, and a shotgun

Distinguish between a bullet and a cartridge

Discuss rifling on a gun barrel and how it affects the flight of the projectile

Explain the relationship between barrel size and caliber

Explain how bullets are test-fired and matched

Discuss the role of of ballistics recovery and examination at the crime scene

Determine the position of the shooter based on bullet trajectory

PERFORMANCE TASKS

Blood Spatter simulation activity

Microscope Lab: analyzing different blood samples

Independent Blood Spatter Case Study Analysis

"Digging Deep" online activity and response

Glass Density Lab

Shattered glass activity with student explanation section

Characteristics of impressions activity

Impression Collection and Latent Impression Lab

TEETH! What can we tell by analyzing the evidence? (group activity)

Comparing and Contrasting types of tool marks + practicing measurements

Digging Deeper with forensic anthropologist William Maples

Tool Marks: Documenting and Casting Lab

Firearm Timeline: Group Project

Virtual Lab on Characteristics of Guns and their Ammo

Unseen Bullet Evidence discussion and questions

Review game

Vocabulary Quizzes

Chapter Tests

OTHER EVIDENCE

Homework:

Case Studies

Field Trips

Vocabulary flash cards or map (word, picture, sentence, example)

Section Review Questions

Exit Cards (answer to daily objective questions)

Study Guide Packets

Visual Quiz

LEARNING PLAN

PowerPoint presentation of material

Group discussion

Think, pair, share (read assigned section of text individually, discuss with a partner, present material in pairs to class – use PowerPoint as a reference)

Traceables - Directionality of blood spatter / lines of convergence activity

Evidence determination activities: blood, glass, tools and impressions

Compare and contrast evidence and identify distinguishing characteristics

Explanation of evidence being relevant and useful compared to unusable and inconclusive

Misconceptions/Teaching Tips:

Students should be sure not to assert evidentiary qualities and characteristics to be absolute or guarantees

Explanation that evidence can't be presented with any bias or point of view, it simple does not make/prove a case, it supports a case and can lead to indictment or even conviction

Attention to detail and accuracy in measurement could mean the difference between a conviction and an acquittal, so be precise and professional

Advocating for a victim by doing the best job possible is your best case scenario,

emotion is not a welcome attribute in this field of study

Student progress will be measured by formative and summative assessments. To maximize student understanding current and cumulative topics will be assessed weekly.

This unit is sequenced to begin with an informal assessment of prior knowledge of topics within the unit and determine any misconceptions. Students will then build small concrete blocks of information pertinent to mastery of this unit. Finally, students will be asked to use this information to evaluate higher level problems. This unit will end with a formal assessment common to all general biology students.

Unit Name: How Nature and Mineral Cycling and Distribution Can Contribute Measurable Genetic Material

Time Frame: 5 weeks

Author: Egg Harbor Township High School Science Department

Subject: **Forensic Science** Country: **USA**

Course/Grade: **Honors** State/Group: **NJ**

School: **Egg Harbor Township High School**

UNIT SUMMARY

Plants go through a process of reproduction which causes the plant to generate pollen in order to reproduce. This process slightly differs depending on the type of plant and conditions the plants are exposed to. The pollen and spores begin to spread through the air with the change of the seasons. This material can narrow down a time frame or separate theories that could span quite some time. This analysis is a very helpful method of linking multiple scenes together.

Soil examination has just as many layers as pollen examination. The soils from around the world are extremely different from each other. This causes regions of the world to produce certain crops depending on non-living factors, such as the weather and precipitation. Depending on the amount of nutrients and vegetation present in a given soil many inferences could be made.

Forensic Anthropology discusses clues left on/in aging carbon based matter. These clues could detail the type of weapon, type of struggle, order of struggle, reorganization of remains, and calculation of traumatic damage, By knowing how skeletal systems are set up, there can be accurate measurements that would produce information such as force and directionality. These bones can be used in reconstruction, DNA analysis, carbon dating etc.

UNIT RESOURCES

Online Textbook, Chapter Reviews / Worksheets, PowerPoint presentations, educational videos, Textbook Chapter 5, 12, and 13 (Labs).

Internet Resource Links:

www.school.cengage.com/forensicscience

GOALS AND STANDARDS

HS-LS1-1. **Construct an explanation based on evidence for howthe structure of DNA determinesthe structure of proteins which carry out the essential functionsof life through systems of specialized cells.**[*Assessment Boundary: Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.*]

HS-LS2-3. **Construct and revise an explanation based on evidence forthe cycling of matterand flow of energy in aerobic and anaerobic conditions.[Clarification Statement: Emphasis is on conceptual understanding of the role of aerobic and anaerobic respiration in different environments.] [Assessment Boundary: Assessment does not include the specific chemical processes of either aerobic or anaerobic respiration.]**

HS-LS2-4. **Use mathematical representations to support claims forthe cycling of matter and flow of energyamong organisms in an ecosystem.[Clarification Statement: Emphasis is on using a mathematical model of stored energy in biomass to describe the transfer of energy from one trophic level to another and that matter and energy are conserved as matter cycles and energy flows through ecosystems. Emphasis is on atoms and molecules such as carbon, oxygen, hydrogen and nitrogen being conserved as they move through an ecosystem.] [Assessment Boundary: Assessment is limited to proportional reasoning to describe the cycling of matter and flow of energy.]**

HS-LS3-1. **Ask questions to clarify relationships aboutthe role of DNA and chromosomes in codingthe instructions for characteristic traits passed from parents to offspring.**[*Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.*]

ENDURING UNDERSTANDINGS

Gymnosperms and Angiosperms are the two categories of pollinating plants

Types of pollination are related to different seasons and climatic conditions

The history of soil examination is very extensive

Without healthy soil an ecosystem and its inhabitants will not survive

Soil is separated into three main categories: composition, consistency, and coloration

Chemistry of an area of soil could determine if certain plants would have survivability concerns in that area

Distinguish between primary and secondary succession

Many important factors can be determined by simply analyzing the bones of a victim/specimen

Skeletal structure is a never-ending process of regeneration and growth

Certain characteristics are found exclusively in the male skeleton at certain measurable ratios, same for women

Bone examination is done for current cases and ancient cases in the same manner

ESSENTIAL QUESTIONS

What are the main types of pollination?

How can a forensic analyst avoid contaminating a pollen/spore sample during collection?

Why can pollen/spores be useful long term?

What makes the different horizons of the soil different from each other?

How do the different types of soil form?

What is the correct collection process to be sure you are not contaminating your soil sample?

Why is soil evidence an important form of circumstantial evidence?

When did forensic scientists begin using anthropology as a tool in criminal cases?

What qualities of bones can you extrapolate more information from (male/female, age, ethnicity)?

How does mitochondrial DNA help you identify the age of a skeleton and determine next of kin etc?

KNOWLEDGE AND SKILLS

Vocabulary:

Angiosperm, exine, forensic palynology, gymnosperm, palynology, pistil, pollen "fingerprint" of Pollen profile, pollen grain, pollination, spore, stamen, clay, geology, humus, leaching, mineral, rock, sand, silt, soil, soil profile, weathering, anthropology, epiphysis, forensic anthropology, joints, mitochondrial DNA, ossification, osteobiography, osteoblast, osteoclast, osteocyte, osteoporosis, and skeletal trauma

STUDENTS WILL BE ABLE TO…

Distinguish between pollen and spores

Define a pollen "fingerprint"

Classify the different organisms that produce pollen and spores

Summarize the different methods of pollination in plants and the relevanmce I solving crimes

Identify the different ways that spores are dispersed

State characteristics of pollen and spores that are important for identification in forensic studies

Summarize how pollen and spore evidence is collected as a crime scene

Describe how pollen and spore samples are analyzed and evaluated

Recognize various soil types and describe some methods for examining soil samples

Distinguish sand samples by size, color, and composition

Perform a soil analysis, including macroscopic and microscopic examination, as well as chemical and physical analysis

Explain how soil evidence can link suspects to crime scenes

Describe how bone is formed

Distinguish between male and female skeletal remains based on skull, jaw, brow, ridge, pelvis, and femur

Describe how bones contain a record of injuries and disease

Describe how a person's approximate age could be determined by examining his or her bones

Explain the differences in facial structures among different races

Describe the role of mitochondrial DNA in bone identification

PERFORMANCE TASKS

Pollen and Grain comparison lab.

Venn Diagram Comparison of Gymnosperms and Angiosperms

Spores and pollen analysis (virtual lab).

Differentiating Soils Lab (sifting and analysis).

What's the perfect soil for "(student chosen organism)"? Research paper.

Casting Lab (footprints – 2 student groups)

Independent Forensic Anthropology Case Study

Review game

Vocabulary Quizzes

Chapter Tests

OTHER EVIDENCE

Homework

Vocabulary flash cards or map (word, picture, sentence, example)

Chapter Review Questions

Exit Cards (answer to daily objective questions)

Study Guide Packets

Visual Quiz

LEARNING PLAN

PowerPoint presentation of material

Group discussion

Think, pair, share (read assigned section of text individually, discuss with a partner, present material in pairs to class – use PowerPoint as a reference)

Foldables – comparison of angiosperms/gymnosperms

Student will graphically draw a variety of impressions found while investigating

Calculating and inferring information from a set of bones, create a graphic sketch of an individual as well as give particular reasons for your present features for your recreation.

Misconceptions/Teaching Tips:

Pollen and spores are obsolete and not worthy of collection.

Soil is not all the same, given the time to analyze and cross reference samples, learners will easily be able to distinguish between different mediums.

Forensic Anthropology is much more about piecing together the past and trying to reconstruct things from the clues left behind.

Student progress will be measured by formative and summative assessments. To maximize student understanding current and cumulative topics will be assessed weekly.

This unit is sequenced to begin with an informal assessment of prior knowledge of topics within the unit and determine any misconceptions. Students will then build small concrete blocks of information pertinent to mastery of this unit. Finally, students will be asked to use this information to evaluate higher level problems. This unit will end with a formal assessment common to all general biology students.

Curriculum Resources - Differentiated Instruction

Special Education Interventions in General Education

Visual Supports
Extended time to complete tests and assignments
Graphic Organizers
Mnemonic tricks to improve memory
Study guides
Use agenda book for assignments
Provide a posted daily schedule
Use of classroom behavior management system
Use prompts and model directions
Use task analysis to break down activities and lessons into each individual step needed to complete the task
Use concrete examples to teach concepts
Have student repeat/rephrase written directions
Heterogeneous grouping

Resources:

Do to Learn:
http://www.do2learn.com/

Sen Teacher:
http://www.senteacher.org/

Intervention Central:
http://www.interventioncentral.org/

Learning Ally:
https://www.learningally.org/

English Language Learners Interventions in Regular Education
Resources:

FABRIC - Learning Paradigm for ELLs (NJDOE)
www.nj.gov/education/bilingual/pd/**fabric**/**fabric**.pdf

Guide to Teaching ELL Students
http://www.colorincolorado.org/new-teaching-ells

Edutopia - Supporting English Language Learners
https://www.edutopia.org/blog/strategies-and-resources-supporting-ell-todd-finley

Reading Rockets
http://www.readingrockets.org/reading-topics/english-language-learners

Gifted and Talented Interventions in Regular Education
Resources:

Who are Gifted and Talented Students
http://www.npr.org/sections/ed/2015/09/28/443193523/who-are-the-gifted-and-talented-and-what-do-they-need

Hoagies Gifted Education Page
http://www.hoagiesgifted.org/programs.htm

21st Century Learning
Resources:

Partnership for 21st Century Learning
http://www.p21.org/

Career Ready Practices (NJDOE)
http://www.nj.gov/education/cte/hl/CRP.pdf