# Unit 2: Analysis of Hair, Fiber, and Trace Evidence

Content Area: **Science**
Course(s):
Time Period: **MP1**
Length: **29 days**
Status: **Published**

## NJSLS - Science

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| 9-12.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. |

## Science and Engineering Practices

**Constructing Explanations and Designing Solutions**

Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' investigations, models, theories, simulations, and peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS1-1)

## Disciplinary Core Ideas

**LS1.A: Structure and Function**

Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)

All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1)

## Crosscutting Concepts

**Structure and Function**

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

## Rationale and Transfer Goals

Once evidence is collected from the crime scene it must be analyzed at the crime lab. Microscopy is used to identify and classify different hairs and fibers. The student will describe the proper technique for proper collection and preservation of hairs and fibers, along with being able to describe the differences between animal, human, and synthetic hair and fibers. With a focus on the training they have received in general chemistry, students will exercise chemical methods that are used to separate and identify components of metals and paints. Soil contains inorganic crushed rocks and minerals and organic decayed plant matter and animal material (much of which has been studied in general biology). These components can help identify a location. Glass can be classified by its components which include color, dimension and thickness, density, and refractive index. The direction of force and determination of sequence can also be analyzed for glass. The student will demonstrate proper techniques for the collection and preservation of glass evidence. All techniques will focus on proper laboratory training and safety.

## Enduring Understandings

Class Evidence such as hair and fiber is used to match individuals to crime scenes. Class evidence is not unique to individuals but is used with statistical analysis to place individuals at the crime scene.

Hair can be used to analyze for drugs and poisons

Fibers can be identified and characterized by chemical and physical processes

## Essential Questions

Can class evidence alone identify a criminal? What other types of evidence may be helpful?

What information can hair provide?

How are fibers used to link suspects to the crime scene or victims?

## Content - What will students know?

- Trace evidence is any evidence that is too small to make physical matches but large enough to be analyzed (i.e. powders, metals, paint, lipstick).
- The use of Qualitative analysis can be used to identify unknown powders. Hair is one type of class evidence
- Based on the Locard Exchange Principle, hair (and other materials) can be directly transferred to other materials.
- Hair can differ among individuals and animals based on texture, color, and cuticle scale patterns.
- Drugs and other chemicals can be deposited into hair through the blood system.
- Fibers can be identified using microscopes and by observing their chemical properties.

- Certain properties of fibers help investigators determine their origins.

## Skills - What will students be able to do?

- Perform tests to identify chemicals
- Practice safety in the science laboratory
- Analyze trace evidence from case studies and devise a plan to examine it to solve a crime
- Use a compound microscope
- Record observations
- Make a conclusion that will help to further students' investigations
- Create arguments in support of or opposition to the use of specific forensic procedures and types of evidence
- Use fiber analysis data to support a claim

## Activities - How will we teach the content and skills?

- Acvity 9.1: How well can you Identify trace evidence
- Lab Acvity: Analysis of white powders
- Lab acvity: The case of the purloined pennies
- Case Study 9.2
- Lab activity: Observations of hair
- Class discussion: Using fibers as evidence
- Lab Activity: Fabric Observations
- Lab Activity: Burn Tests
- Lab Activity: Chemical Tests
- Lab Activity: Thermal Decomposition

## Evidence/Assessments - How will we know what students have learned?

- Quizzes
- Forensics Benchmark #1

## Spiraling for Mastery

| Content or Skill for this Unit | Spiral Focus from Previous Unit | Instructional Activity |
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| • Perform tests to identify chemicals<br>• Analyze trace evidence from case studies and devise a plan to examine it to solve a crime<br>• Use a compound microscope | • Physical evidence is an object or material relevant to the crime that can link a suspect or identify a person involved in a crime.<br>• Class data can be used to narrow a suspect down to one person out of a large group of people based on known characteristics.<br>• Information at a crime scene must be gathered systematically.<br>• Chemical methods for developing latent prints by reacting with the residue left by the finger create a visible mark | • Lab acvity: Observations of hair<br>• Class discussion: Using fibers as evidence<br>• Lab Acvity: Fabric Observaons<br>• Lab Acvity: Burn Tests |

## Key Resources

Trace evidence Slide Set (Ward's Natural Science)

Hair and Fiber Analysis Kit

Wards Fiber Kit

## Career Readiness, Life Literacies, & Key Skills

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| 9.4.12.CT.3 | Enlist input from a variety of stakeholders (e.g., community members, experts in the field) to design a service learning activity that addresses a local or global issue (e.g., environmental justice). |
| 9.4.12.CT.4 | Participate in online strategy and planning sessions for course-based, school-based, or other project and determine the strategies that contribute to effective outcomes. |
| 9.4.12.GCA.1 | Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political. economic, cultural) may work better than others (e.g., SL.11-12.1., HS-ETS1-1, HS-ETS1-2, HS-ETS1-4, 6.3.12.GeoGI.1, 7.1.IH.IPERS.6, 7.1.IL.IPERS.7, 8.2.12.ETW.3). |
| 9.4.12.IML.2 | Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources (e.g., NJSLSA.W8, Social Studies Practice: Gathering and Evaluating Sources. |
| 9.4.12.IML.3 | Analyze data using tools and models to make valid and reliable claims, or to determine |

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| | optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8). |
| 9.4.12.IML.4 | Assess and critique the appropriateness and impact of existing data visualizations for an intended audience (e.g., S-ID.B.6b, HS-LS2-4). |
| 9.4.12.IML.5 | Evaluate, synthesize, and apply information on climate change from various sources appropriately (e.g., 2.1.12.CHSS.6, S.IC.B.4, S.IC.B.6, 8.1.12.DA.1, 6.1.12.GeoHE.14.a, 7.1.AL.PRSNT.2). |
| 9.4.12.IML.6 | Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity (e.g., NJSLSA.SL5). |

## Interdisciplinary Connections/Companion Standards

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| LA.RST.11-12.1 | Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions. |
| LA.WHST.11-12.2 | Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. |