

# Unit 3: Blood, DNA & Blood Spatter Analysis

Content Area: **Science**  
Course(s): **Forensics**  
Time Period: **2nd Marking Period**  
Length: **10 Weeks**  
Status: **Published**

## Unit Overview

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Introduction to the composition of blood, the function of blood cells and blood typing. The composition of DNA, DNA fingerprinting and DNA databses. Blood spatter analysis and crime scene reconstruction.

## Transfer

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Students will be able to independently use their learning to...

What kinds of long term, independent accomplishments are desired?

Describe how whole blood is typed.

List forensic tests used to identify a stain as blood or semen.

Explain how blood and semen evidence are preserved for laboratory examination.

Determine the contents of a rape kit.

Understand the use of DNA analysis in identify or excluded suspects associated with a criminal investigation.

List the procedures for preserving biological evidence for DNA analysis.

Use blood spatter analysis to recreate the events of a crime scene.

Describe the methods for documenting bloodstain patterns at a crime scene.

## Meaning

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## **Understandings**

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Students will understand that...

What specifically do you want students to understand?

What inferences should they make/grasp/realize?

The composition of blood and the functions of blood cells.

The forensic tests used to characterize blood or semen.

The collection of physical evidence in a rape investigation.

How crime scene evidence is collected and processed for DNA analysis.

DNA analysis can identify or exclude an individual from a criminal investigation.

The use of DNA databases in criminal investigation.

The use of blood and blood spatter analysis in forensics.

The use of blood spatter analysis in crime scene reconstruction.

The angle of impact and how it is determined.

The area of convergence and area of origin and how they are determined.

Blood spatter evidence is used to recreate the events at a crime scene.

## **Essential Questions**

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Students will keep considering...

What thought provoking questions will foster inquiry, meaning making and transfer?

How is blood typing used to identify an individual?

What laboratory tests are used to characterize blood and semen?

What is included in a rape kit?

Explain the double-helix structure of DNA?

How are computerized DNA databases used in criminal investigation?

How is DNA evidence obtained and extracted?

How is DNA analysis used to identify or exclude an individual from a criminal investigation?

How to examine blood spatter and determine the nature of the weapon?

How is bloodstain pattern analysis used to recreate events involved in a violent crime?

## **Application of Knowledge and Skill**

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### **Students will know...**

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Students will know...

What facts and basic concepts should students know and be able to recall?

The composition of blood and the function of blood cells.

How blood is typed.

The forensic tests used to characterize a stain as blood.

How to use a Punnett square to determine genotype and phenotype.

The proper collection of physical evidence in a rape investigation.

The parts of a nucleotide and how they are linked to form DNA.

The concept of base pairing as it relates to the double-helix.

How crime scene evidence is collected and processed for DNA analysis.

How DNA fingerprinting is compared for matching.

How DNA fingerprinting is used to identify or exclude individuals in an investigation.

The procedure for proper preservation of biological evidence for DNA analysis.

The information that can be gained from bloodstain pattern analysis about events involved in a violent crime.

That surface texture, directionality and angle of impact affect the shape of bloodstains.

The angle of impact of bloodstains.

The classification of low, medium and high velocity impact spatter.

The methods used to determine the area of convergence and area of origin for blood spatter.

How blood pattern types are created and which features of each pattern can be used to aid in reconstructing events at a crime scene.

### **Students will be skilled at...**

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Students will be skilled at...

What discrete skills and processes should students be able to use?

Identifying the composition of blood.

Blood typing.

Understanding the forensic tests used to characterize a stain as blood or semen.

Using Punnett squares to determine genotype and phenotype.

Describing the proper collection of rape evidence.

Explain how DNA evidence is collected and processed for DNA analysis.

Explain how DNA analysis can be used to identify or exclude an individual from a criminal investigation.

Understanding the use of DNA databases in criminal investigations.

Calculating angle of impact from blood spatter analysis.

Determine the area of convergence and point of origin from blood spatter analysis.

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

### **Academic Vocabulary**

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agglutination, allele, angle of impact, antibody, antigen, antiserum, area of convergence, area of origin, arterial, spray, cast-off, deoxyribonucleic acid, DNA fingerprinting, drip trail pattern, enzyme, erythrocyte, flow patterns, forward spatter, gene, genotype, hemoglobin, heterozygous, high velocity spatter, homozygous, impact spatter, lines of convergence, low-velocity spatter, luminol, medium-velocity spatter, plasma, precipitin, satellite spatter, serology, serum, sperm, transfer pattern, X

chromosome, Y chromosome, zygote,

## **Learning Goal 1**

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Students will be able to explain the composition of blood and describe the function of blood cells.

### **NGSS Science and Engineering Practices Standards**

- 1: Asking questions and defining problems.
- 2: Developing and using models.
- 3: Planning and carrying out investigations.
- 4: Analyzing and interpreting data.
- 5: Using mathematics and computational thinking.
- 6: Constructing explanations and designing solutions.
- 7: Engaging in argument from evidence.
- 8: Obtaining, evaluating, and communicating information.

SCI.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.
SCI.HS-LS1-3	Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

## **Target 1**

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SWBAT list the A-B-O antigens and antibodies found in blood for the four blood types and describe how blood is typed.

## **Target 2**

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SWBAT list and describe forensic tests used to characterize a stain as blood or semen.

## **Target 4**

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SWBAT describe the proper collection of physical evidence in a rape investigation.

## **Learning Goal 2**

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Students will be able to explain how crime scene evidence is collected and processed for DNA analysis.

### **NGSS Science and Engineering Practices Standards**

- 1: Asking questions and defining problems.
- 2: Developing and using models.
- 3: Planning and carrying out investigations.
- 4: Analyzing and interpreting data.
- 5: Using mathematics and computational thinking.
- 6: Constructing explanations and designing solutions.
- 7: Engaging in argument from evidence.
- 8: Obtaining, evaluating, and communicating information.

SCI.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.

SCI.HS-LS1-3

Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

## **Target 1**

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SWBAT name the parts of a nucleotide and explain how they are linked to form DNA.

## **Target 2**

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SWBAT understand the concept of base pairing as it relates to the double-helix structure of DNA.

## **Target 3**

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SWBAT explain how DNA typing used to identify and exclude individuals.

## **Target 4**

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SWBAT understand the use of DNA computerized databases in criminal investigation.

## **Learning Goal 3**

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Students will be able to discuss the information that can be gained from bloodstain pattern analysis about the events in a violent crime.

### **NGSS Science and Engineering Practices Standards**

- 1: Asking questions and defining problems.
- 2: Developing and using models.
- 3: Planning and carrying out investigations.
- 4: Analyzing and interpreting data.

- 5: Using mathematics and computational thinking.
- 6: Constructing explanations and designing solutions.
- 7: Engaging in argument from evidence.
- 8: Obtaining, evaluating, and communicating information.

SCI.HS-LS1-3

Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

### **Target 1**

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SWBAT explain how surface texture, directionality and angle of impact affect the shape of individual bloodstains.

### **Target 2**

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SWBAT describe the different classifications of low, medium and high velocity impact spatter.

### **Target 3**

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SWBAT discuss the methods to determine the area of convergence and the area of origin for impact spatter patterns.

### **Target 4**

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



## **Formative Assessment and Performance Opportunities**

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Oral question & answer discussion, in-class observation, written exercises, classwork & homework assignments, power point w/ notes, lab reports, projects, portfolios, quizzes and tests.

## **Summative Assessment**

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Unit assessment, project based assessments, lab reports, tests and quizzes.

## **Accommodations/Modifications**

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Specific to this unit, students will be able to review topics covered in Biology pertaining to DNA and genetics. Videos modeling lab investigations will be available.

Ex.

[What is DNA and How does it work?](#)

[Catching Killers: Blood Spatter](#)

All instruction, labs, activities, and assessments will be modified and enhanced to adhere to individual student's IEPs and 504s. Differentiated classroom management strategies will be utilized as to adhere to these students individual plans.

## **Unit Resources**

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- Textbook - Forensic Science: An Introduction – 2nd Edition
- supplemental textbook materials
- Internet resources
- teacher generated power points & notes and lab materials.

## **21st Century Life and Careers**

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CAEP.9.2.12.C.1	Review career goals and determine steps necessary for attainment.
CAEP.9.2.12.C.2	Modify Personalized Student Learning Plans to support declared career goals.
CAEP.9.2.12.C.3	Identify transferable career skills and design alternate career plans.

## **Interdisciplinary Connections**

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LA.RST.11-12.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
LA.WHST.11-12.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
LA.WHST.11-12.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
MA.K-12.2	Reason abstractly and quantitatively.