

# DNA Analysis

**Media Type:** Video

**Duration:** 71 minutes

**Goal:** To introduce the structure and function of DNA, as well as to explain the process of DNA analysis and profiling.

**Description:** DNA analysis has opened up new potential for forensic analysis. The presentation begins by introducing the forensic applications of DNA. Then, explains the structure and function of DNA in the body. Finally, three methods of DNA analysis are presented, including methods of using restriction fragment length polymorphisms, short tandem repeats and single nucleotide polymorphisms.

**Objectives:**

1. To describe the structure of a DNA molecule and its function.
2. To describe the steps used in extraction of DNA.
3. To explain the analytical procedure for DNA typing including: electrophoresis, restriction fragment length polymorphisms, polymerase chain reaction and short tandem repeats.



Health Science Career Cluster (HL)

Cluster	Standard
Biotechnology Research & Development Career Pathway (HL-BRD)	Demonstrate basic knowledge of recombinant DNA, genetic engineering, bioprocessing, monoclonal antibody production, nanotechnology, bioinformatics, genomics, proteomics and transcriptomics to conduct biotechnology research and development.

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College & Career Readiness Anchor Standards for Reading

Reading Standards for Literacy in Science & Technical Subjects	
Key Ideas & Details	Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
	Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
	Analyze how and why individuals, events, and ideas develop and interact over the course of a text.
	<i>9-10.1</i> Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
	<i>9-10.2</i> Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
	<i>9-12.3</i> Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
Integration of Knowledge & Ideas	<i>11-12.1</i> Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
	<i>11-12.2</i> Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
	Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.
	<i>9-10.7</i> Translate quantitative or technical information expressed in words in a text into visual form and translate information expressed visually or mathematically into words.
	<i>11-12.7</i> Integrate and evaluate multiple sources of information presented in diverse formats and media in order to address a question or solve a problem.

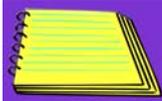
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## Writing Standards for Literacy in History/Social Studies & Technical Subjects

Text Types & Purposes	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.	
	Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.	
	9-12.1	Write arguments focused on discipline-specific content.
	9-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
Production & Distribution of Writing	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.	
	Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.	
	9-12.4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
	9-10.6	Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
	11-12.6	Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.
	Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.	
Research to Build & Present Knowledge	9-12.7	Conduct short as well as more sustained research projects to answer a 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.
Range of Writing	Write routinely over extended time frames and shorter time frames for a range of tasks, purposes, and audiences.	
	9-12.10	Write routinely over extended time frames and shorter time frames for a range of discipline-specific tasks, purposes, and audiences.

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## Lesson Plan

 **Video**  
6 min.

**Class 1:** Begin class by passing out the *DNA Analysis Vocabulary Handout* and *Worksheet* for students to reference during the presentation. Show the *Introduction to DNA* segment and administer the corresponding *Assessment*. Have students begin the *CODIS Project* and assign any remaining work on the *Project* as homework.

 **Video**  
5 min.

**Class 2:** Remind students to continue using the *Vocabulary Handout* and *Worksheet*. Show the *What is DNA?* segment and administer the corresponding *Assessment*. Have students begin the *DNA Model Project*.

**Class 3:** Have students complete the *DNA Model Project*.

**Class 4:** Allow students to present their *DNA Model Project*. Go over the *Punnett Squares Handout* with students.

 **Video**  
15 min.

**Class 5:** Remind students to continue using the *Vocabulary Handout* and *Worksheet*. Show the *Extracting DNA* segment and administer the corresponding *Assessment*.

**Class 6:** Have students complete the *Strawberry Extraction Activity*.

 **Video**  
4 min.

**Class 7:** Remind students to continue using the *Vocabulary Handout* and *Worksheet*. Show the *Restriction Fragment Length Polymorphisms* segment and administer the corresponding *Assessment*. Have students begin the *RFLP Activity*.

 **Video**  
14 min.

**Class 8:** Remind students to continue using the *Vocabulary Handout* and *Worksheet*. Show the *Electrophoresis* segment and administer the corresponding *Assessment*.

**Class 9:** Remind students to continue using the *Vocabulary Handout* and *Worksheet*. Show the *DNA Replication & Polymerase Chain Reaction* segment and administer the corresponding *Assessment*. Have students begin the *Replication Cut-Out Activity*.

 **Video**  
5 min.

**Class 10:** Remind students to continue using the *Vocabulary Handout* and *Worksheet*. Show the *Short Tandem Repeat* segment and administer the corresponding *Assessment*. Have students begin the *Codon Wheel Activity*.

 **Video**  
9 min.

**Class 11:** Remind students to continue using the *Vocabulary Handout* and *Worksheet*. Show the *Single Nucleotide Polymorphisms* segment and administer the corresponding *Assessment*. Assign the *Future of DNA Project*.

**Class 12:** Students should share their *CODIS Projects* with the class.

**Class 13:** Distribute the *DNA Analysis Final Assessment* and allow time for students to complete it. Students should turn in their *Activities* and share their *DNA Model Projects* with the class.



### Forensic Science Simplified

- [www.forensicsciencesimplified.org](http://www.forensicsciencesimplified.org)

### GeneEd

- [www.gened.nlm.nih.gov](http://www.gened.nlm.nih.gov)



### SkillsUSA

- Crime Scene Investigation
- Criminal Justice

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## Career Connections

Using the *Career Connections Activity*, allow students to explore the various careers associated with this lesson. See the *Activity* for more details. *If student licenses have been purchased:* Students will select the interviews to watch based on your directions. *If only a teacher license is purchased:* Show students all the career interviews and instruct them to only complete the interview form for the required number of interviews.

- iCEV51176, Sparks Veasey, MD, JM, Clinical Professor, Sam Houston State University



## Lab Activities

### Strawberry Extraction

#### Directions:

Students will be extracting DNA from a strawberry. *Materials Needed:* rubbing alcohol, cheese cloths, strawberries, plastic bags, funnels, test tubes, measuring cylinders, scales, wooden skewers, salt, water, liquid dish soap.

### RFLP

#### Directions:

Students will be given DNA sequences and using the sequences will cut the DNA and predict how it would appear after being subjected to electrophoreses.

### Replication Cut Outs

#### Directions:

Students will cut out a DNA strip in order to act out the process which polymerase takes to replicate DNA.

### Codon Wheel

#### Directions:

Students will be using two tools scientists use to study how DNA translates to protein synthesis. Students will translate DNA codons into amino acids using a Codon Wheel and will look up the amino acid sequence to determine the protein created by the sequence.



## Projects

### CODIS

#### Directions:

Students will create a poster which either promotes or discourages the use of CODIS after researching the effects CODIS has had on criminal investigations.

### DNA Model

#### Directions:

Students will create 3-D models of the DNA molecule.

### Future of DNA

#### Directions:

Students will summarize and critique an article about the future of DNA.