SI Forensics - Full Discipline Demo

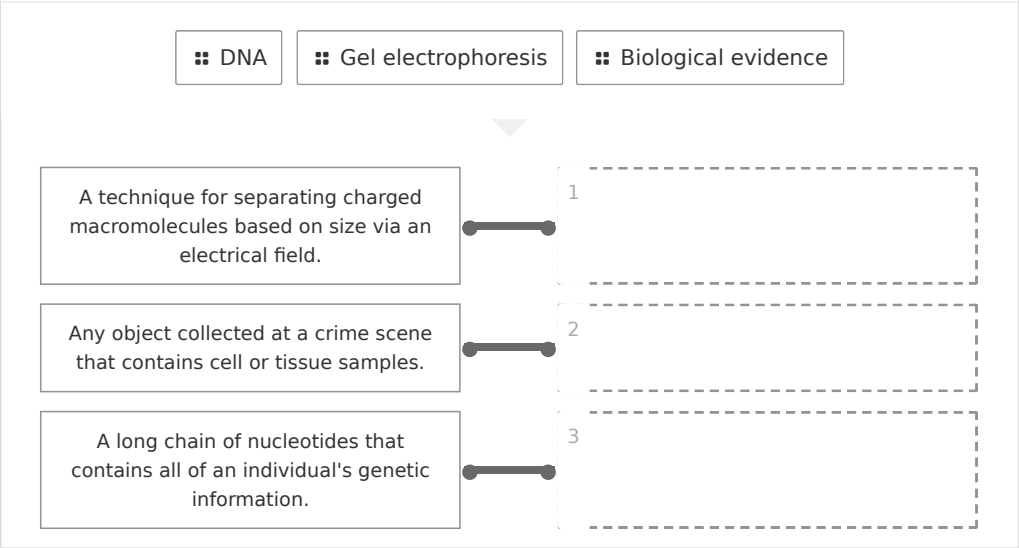
DNA

Final Report - Answer Guide

Institution	Science Interactive University
Session	SI Forensics - Full Discipline Demo
Course	SI Forensics - Full Discipline Demo
Instructor	Sales SI Demo

Test Your Knowledge

Match each term with the best definition.



Correct answers:

1 Gel electrophoresis 2 Biological evidence 3 DNA

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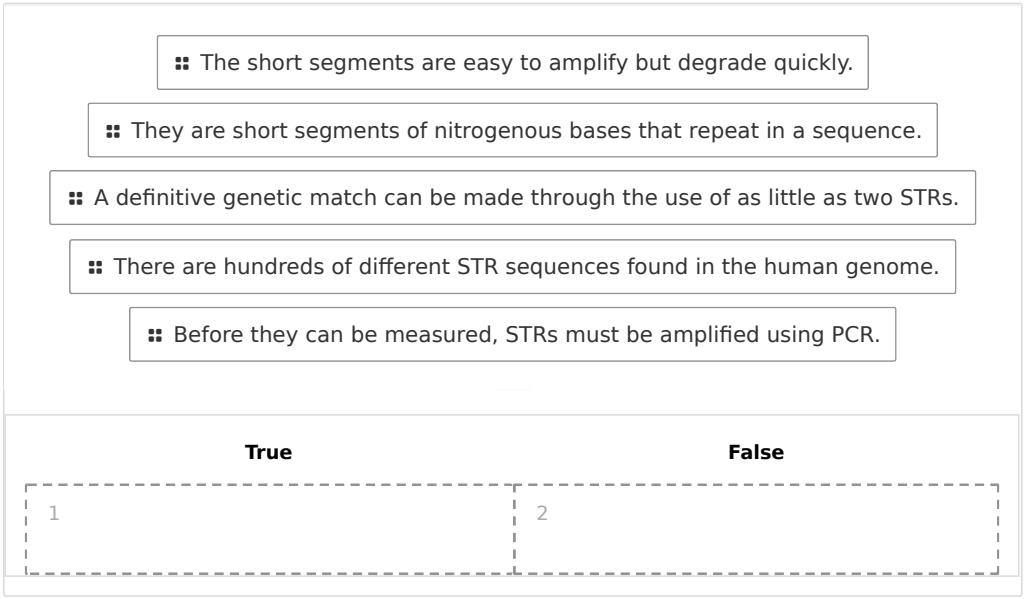
Classify each statement about short tandem repeats as true or false.



Correct answers:

1 They are short segments of nitrogenous bases that repeat in a sequence.

Before they can be measured, STRs must be amplified using PCR.

There are hundreds of different STR sequences found in the human genome.

2 The short segments are easy to amplify but degrade quickly.

A definitive genetic match can be made through the use of as little as two STRs.

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Put the steps of DNA analysis in order with the first step on the top and the last step at the bottom.

≡ Alcohol is added, causing the DNA to precipitate.

1 **Correct answer:** Biological evidence is collected.

≡ The molecular weight of each band is measured and compared to other samples.

2 **Correct answer:** Cells are concentrated using a centrifuge.

≡ Electrical current is passed through the gel, separating the DNA molecules by molecular weight.

3 **Correct answer:** The cells are lysed using a solution of soap and salt, extracting the DNA.

≡ Biological evidence is collected.

4 **Correct answer:** Alcohol is added, causing the DNA to precipitate.

≡ Short tandem repeats are amplified using PCR.

5 **Correct answer:** Short tandem repeats are amplified using PCR.

≡ Cells are concentrated using a centrifuge.

6 **Correct answer:** DNA samples are loaded into the wells of an electrophoresis gel.

≡ The cells are lysed using a solution of soap and salt, extracting the DNA.

7 **Correct answer:** Electrical current is passed through the gel, separating the DNA molecules by molecular weight.

≡ DNA samples are loaded into the wells of an electrophoresis gel.

8 **Correct answer:** The molecular weight of each band is measured and compared to other samples.

Exploration

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Which of the following items found at a crime scene would be least likely to contain biological evidence?

- A bloodstain
- A shoeprint in mud ✔
- A smoked cigarette butt
- A used fork

DNA is soluble in alcohol but not in water.

- True
- False ✔

Which of the following is not a reason STRs are used in DNA analysis?

- They are easier to amplify.
- They do not degrade easily.
- They are easier to visualize. ✔
- They vary greatly among the population.

Larger molecules migrate through an electrophoresis gel at a slower rate than the smaller molecules.

- True ✔
- False

Exercise 1

What would be your next step if you were performing DNA analysis in a forensics laboratory?

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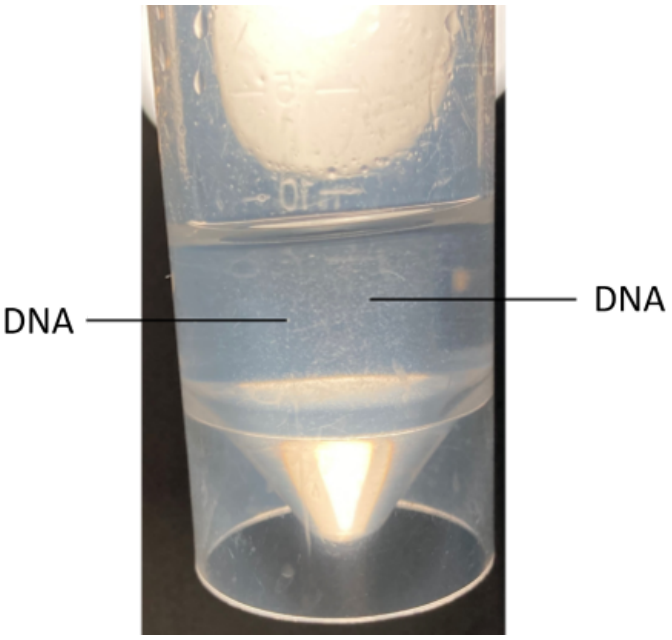
What are some advantages to using a buccal swab to obtain a DNA sample over other potential methods, such as drawing blood?

Based on your knowledge of DNA extraction, what do you think the DNA extraction solution was most likely composed of?

Why was your DNA only visible after the addition of ethanol?

Photo 1: Extracted DNA
(SAMPLE ANSWER BELOW)



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Exercise 2

Did either of the suspects match the sample found at the crime scene? If yes, which one?

What purpose does a standard serve when performing gel electrophoresis?

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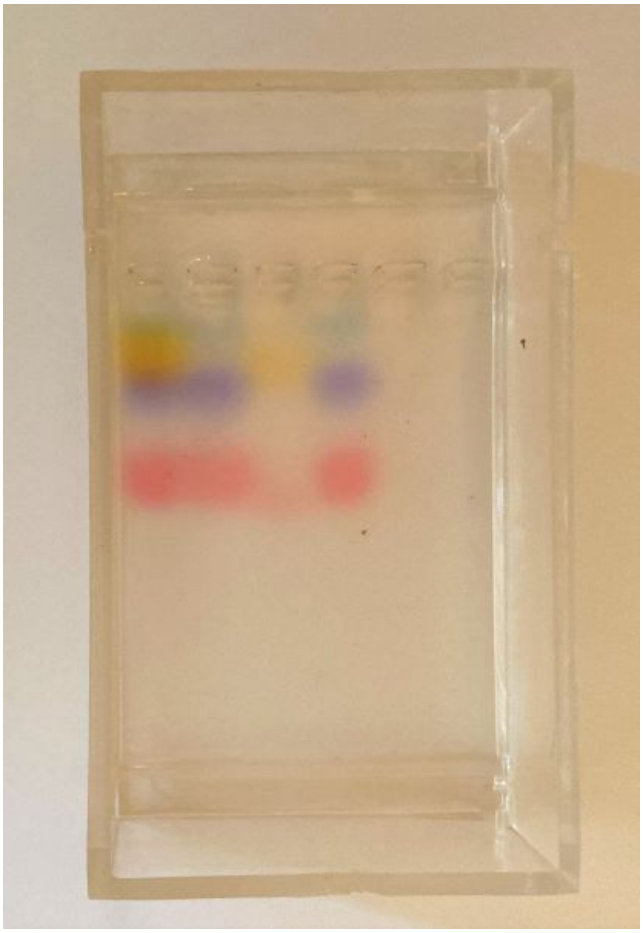
What are some differences between the dyes used to model DNA analysis in this experiment compared to running gel electrophoresis on a sample containing actual DNA?

Photo 2: Gel Electrophoresis Results
(SAMPLE ANSWER BELOW)



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Data Table 1: Gel Electrophoresis Measurements
(SAMPLE ANSWER BELOW)

Sample	Number of Bands	Distance of Each Band (mm)
Standard	4	5; 9; 14; 25
Suspect 1	3	5; 14; 25
Suspect 2	2	9; 25
Crime Scene	3	5; 14; 25

Competency Review

_____ is only located in the nucleus and in the mitochondria.

- DNA ✔
- PCR
- STR
- None of the above

_____ separates DNA molecules by molecular weight using electrical current.

- PCR
- Gel electrophoresis ✔
- Detergent
- Alcohol

Short tandem repeats are typically 1-6 base pairs long.

- True ✔
- False

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DNA is often mixed with dye to visualize it during DNA extraction.

- True
- False ✔

The bands at the top of the gel are composed of DNA molecules of a larger molecular weight then the bands of DNA molecules at the bottom of the gel.

- True ✔
- False

A buccal swab is used to collect cells from the _____ as a source of DNA.

- blood
- cheek ✔
- hair
- nose

When performing gel electrophoresis, the carbon fiber fabric should not touch the TBE buffer.

- True
- False ✔

When performing your gel electrophoresis, the dye (representing DNA) moved toward which type of charge?

- Positive ✔
- Negative

Extension Questions

In 2018, Joseph DeAngelo was positively identified as the Golden State Killer through genetic analysis. The Golden State Killer committed at least 13 murders and over 50 rapes across California during the 1970s and the 1980s. Although he had left behind DNA at some of his crime scenes, it never led to a

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positive ID until it was uploaded to a personal genomics website, which turned up matches for several people who only partially matched the DNA from the crime scene.

Use what you know about genetic analysis to describe how this would have led to the identification of Joseph DeAngelo as the Golden State Killer.

(SAMPLE ANSWER BELOW)

The partial matches on the personal genomics website indicated that all of these people were somehow related to the Golden State Killer. The investigators were able to construct a family tree and by finding the common ancestor to all of the relatives found on the genomics website they could determine who was most likely the Golden State Killer. A DNA sample could then be taken from anyone deemed a likely suspect to confirm who the killer was.

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