

**PCR Virtual Lab** <http://learn.genetics.utah.edu/content/labs/pcr/>

Before you start, what do the following things do in a PCR reaction?

- Primers \_\_\_\_\_
- DNA polymerase \_\_\_\_\_
- Nucleotides \_\_\_\_\_

What is PCR used for? \_\_\_\_\_

What do you add to the PCR tube? \_\_\_\_\_

Explain the temperature changes that you go through with the thermocycler and their purpose:

	temperature	purpose
step 1		
step 2		
step 3		

When do your desired products begin to appear? \_\_\_\_\_

At the end of four cycles, how many desired fragments will you have? \_\_\_\_\_

How about at the end of five cycles? \_\_\_\_\_

When will you have a billion fragments? \_\_\_\_\_

**DNA Extraction** (<http://learn.genetics.utah.edu/content/labs/extraction/>)

1. List three reasons for extracting DNA from a human subject.

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2. Describe in detail where DNA is found in the cell: \_\_\_\_\_

3. In our virtual test subject, where did we get cells from? \_\_\_\_\_

4. List the 4 steps needed to extract DNA

- 1) \_\_\_\_\_
- 2) \_\_\_\_\_
- 3) \_\_\_\_\_
- 4) \_\_\_\_\_

5. The lysis solution contains detergent, the detergent will do what to the cell? \_\_\_\_\_

6. What does the salt do to the cellular mixture? \_\_\_\_\_

7. The centrifuge causes the debris to do what? \_\_\_\_\_

8. Isopropyl alcohol causes DNA to do what? \_\_\_\_\_

<http://www.mmu.k12.vt.us/teachers/abbottk/Honors%20Bio/Microsoft%20Word%20-%20PCR%20Virtual%20Lab.pdf>

### Gel Electrophoresis (<http://learn.genetics.utah.edu/content/labs/gel/>)

1. a) Electrophoresis is used to sort DNA by \_\_\_\_\_
- b) What is placed into the holes at the end of the gel? \_\_\_\_\_
- c) By adding electric current, we can make the DNA \_\_\_\_\_
- d) Shorter strands of DNA move [ farther / slower ] than longer strands.

2. Place the steps in the correct order.

- \_\_\_\_\_ Load DNA sample into the gel.
- \_\_\_\_\_ Stain the gel and analyze results
- \_\_\_\_\_ Make the gel
- \_\_\_\_\_ Hook up the electrical current
- \_\_\_\_\_ Set up gel apparatus

3. In the “Gel Electrophoresis Laboratory” follow the steps to make your own gel, answer the questions as you go.

- a) What is agarose made from? \_\_\_\_\_
- b) Melted agarose is poured into a \_\_\_\_\_
- c) Buffer \_\_\_\_\_ electric current in the electrophoresis box.
- d) In real life, loading samples into the gel wells takes \_\_\_\_\_
- e) The black end generates a \_\_\_\_\_ charge, the red end a \_\_\_\_\_ charge.
- f) The bubbles in the electrophoresis box are \_\_\_\_\_ that your current is running.
- g) Staining the DNA will make it show up under a \_\_\_\_\_ light.
- h) What are your estimates for the number of base pairs in the three bands? \_\_\_\_\_



DNA Fingerprinting <http://www.pbs.org/wgbh/nova/sheppard/analyze.html>

*Objective: Students will learn the steps of DNA fingerprinting by creating a fingerprint in a virtual lab. They will use this fingerprint to solve a virtual crime. The virtual lab is interactive and goes through the step-by-step process of DNA fingerprinting*

**Create a DNA Fingerprint** (<http://www.pbs.org/wgbh/nova/sheppard/analyze.html>)

#### Introduction:

1. DNA is unique for everyone. The only exception is if a person has what?
2. What are DNA fingerprints used for?

## Part 1 “It Takes a Lickin”

3. What “crime” was committed?
4. What bodily fluid was removed from the “crime scene” to get DNA?

## Part 2 “DNA Fingerprinting at the NOVA Lab”

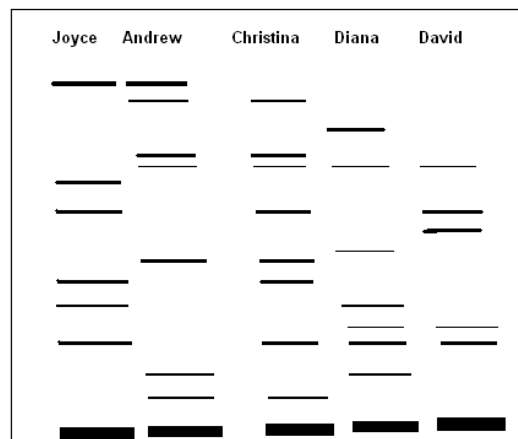
5. What does a restriction enzyme do?
6. What is agarose gel?
7. What is electrophoresis?
8. Smaller fragments of DNA move \_\_\_\_\_ than longer strands?
9. Why do you need to place a nylon membrane over the gel?
10. Probes attach themselves to \_\_\_\_\_
11. Which chemical in your "virtual lab" is radioactive?
12. Sketch your DNA fingerprint.
13. Based on your DNA fingerprint, who licked the lollipop?

# Kim Brown - DNA Mysteries

# The Case of the Mystery Baby

Following 911 reports of a domestic violence, police responded to an apartment in south Miami where they found two women beating each other with pots and spatulas with a two month old infant girl laying on the floor nearby. When the women were questioned, each stated that the baby was hers and the other woman was trying to steal it. None of the neighbors knew anything about the infant, and both husbands corroborated their wives stories. Neither woman claimed to have used a doctor in the delivery, and neither claimed to have any prenatal care which would verify the pregnancy. An examination by a doctor revealed that both women had recently given birth. Police concluded that one woman must have lost her baby during the non-medically supervised delivery, and was attempting to steal a baby from another mother. The police decided to use DNA fingerprinting to determine the parentage of the baby, whom they nick-named Christina. The following diagram shows the results of the two sets of parents: Jo

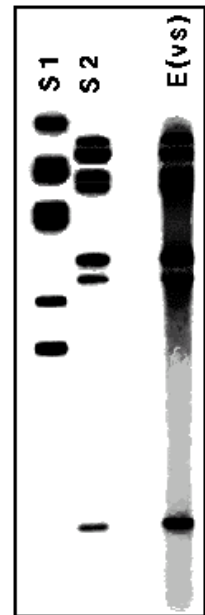
Which did they conclude was the actual parents of the baby?



# The Case of the Cowardly Rapist

Taylor, a 10<sup>th</sup> grader at Vermont Acres High School, was working on a science project one evening with her two partners, Chris Reesh and Randall Jones, at her home. Her parents were out for the evening at the movies, but had given permission for the three students to use their home while working on their project. When the parents arrived home later that evening, they found their daughter unconscious on the floor with her clothing laying beside her on the floor. They called an ambulance and had her rushed to the hospital. The ER physician determined that the girl had been raped, and a blood test showed that she had ingested a large quantity of the date rape drug. Police search the residence and found a glass of water and traces of the drug. They also found fingerprints from Taylor and both boys in the room. A rape test produced a semen sample. Both boys were interviewed, and stated that they had left when Taylor became sleepy. Each boy claimed to be the first to leave, and neither would admit to giving her the drug. A sample of DNA was obtained from each boy, and a DNA fingerprinting test was done.

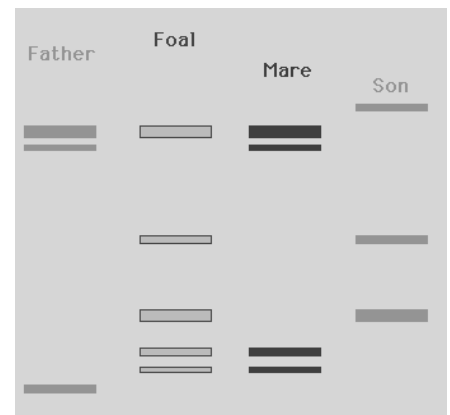
Which boy was guilty of the rape?



## Case of the Broken Fence

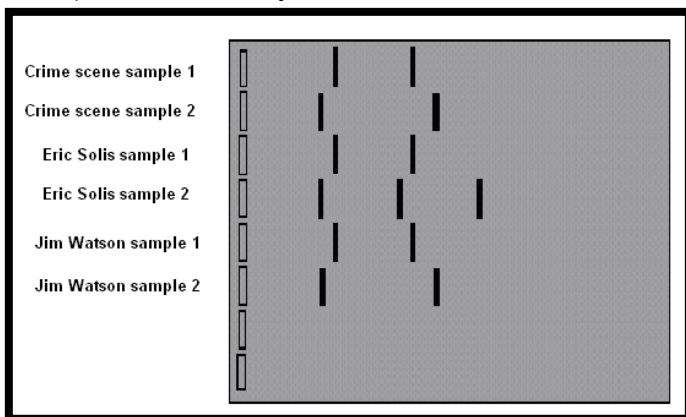
A quarter horse mare is separated from two stallions by a wooden fence. The stallions are a bay quarter horse stallion named Prince and his sorrel son, Nugget. One day, the owner came home to find that the fence separating the mare from the stallions has been broken down, and both stallions are in the pasture with the mare. The owner removes the stallions, hoping that neither has impregnated the mare. Two months later, the owner notices behavioral changes in the mare and calls his vet to request a pregnancy test. Tests by the vet confirm that the mare is pregnant. Nine months later, the mare delivers a foal. To register and pedigree the foal, the owner must know the parentage, so he requests a DNA test to determine which stallion is the sire. A sample of blood is obtained and is cut with restriction enzymes. The sample is placed in a gel electrophoresis chamber. The following diagram shows the results of the test:

Who is the father of the foal?



## THE MOODY BLUES MURDER

Moody Blues Waters, a jazz musician, was found murdered late one night in the club at which he was headlining.



Moody was a talented musician, but was dealing drugs to make some extra cash. He often carried large sums of money as well as drugs wherever he went. When Moody was found, there were no drugs or money on him.

The police suspect that Moody was killed by his drug supplier, Eric Solis. However, several people, coming back from a late night of partying in the jazz district remember seeing a man running from the club just about the time of the murder. The man was picked up by police several blocks away. His name is Wild Jim Watson, a small time thief with a long criminal

history. Police speculate Moody may have caught him in the club after hours, and Wild Jim may have panicked and killed Moody. Wild Jim was carrying over \$1000 when the police picked him up. The only evidence found at the club was some blood stains near Moody's body. Preliminary testing showed that Moody had a different blood type than the blood found at the scene. Therefore, police believe the stains were from the murderer. DNA was isolated from the blood stain, and samples of DNA were obtained from Eric Solis (suspect 1), and from Wild Jim Watson (suspect 2).

Who is the murderer based on the DNA evidence?