



Beyond Reasonable Doubt?????
Gel Electrophoresis in Criminal Forensics

DNA profiling is becoming much more common as an investigative tool in solving criminal cases. Currently, two techniques are widely used to analyze DNA in criminal cases -- RFLP (restriction length fragment polymorphisms) and PCR (polymerase chain reaction). RFLP's have the advantage of possessing a greater number of variants (approximately 30) per locus, whereas the typical PCR locus only has 3-4 variants. RFLP analysis, however, requires large amounts of DNA, whereas PCR can be performed on minute quantities of DNA or very old and degraded DNA. The results of RFLP analysis are typically visualized using the southern blot technique, whereas PCR results are visualized using gel electrophoresis. RFLP analysis is also more time-consuming than PCR. In this case, you will be analyzing PCR results when comparing samples from the crime scene with those of possible suspects.

In the following activity, you will be given samples from a crime scene as well as from possible suspects to analyze and compare. It will be your job to report the results and testify before the jury if necessary.

The facts of the case are as follows....

The famous painting *The Library* by noted African American artist Jacob Lawrence* was stolen from the National Museum of American Art.

The Library --
Jacob Lawrence
1960



The thief was exceptionally careful in removing this piece of artwork from the museum, but not careful enough. The crime scene investigators found several human hairs caught between a window and its frame in one of the museum administrator's offices. They speculate that the thief must have crawled in through the window and caught his or her hair in the frame. There is just enough of the follicle left on some of the hairs to perform PCR analysis on the DNA they contain.

You are given samples of DNA from four sources:

- 1) Evidence - the hair found in the window frame
- 2) the administrator who works in the office where the hair was found
- 3) Suspect 1 -- a renowned art thief who has been out of prison for the past six months and whose former heists include Da Vinci's *Mona Lisa* and Monet's *Water Lilies*.
- 4) Suspect 2 -- a private art collector and dealer, who has been suspected of stealing highly sought after works in the past

You performed a PCR analysis of 3 different loci for each sample. Hence you will have 12 different reactions to run on your electrophoresis gel (Sample 1, locus 1; Sample 1, locus 2; Sample 1, locus 3; Sample 2, locus 1; etc.)

Set up two gels and gel boxes according to the instructions for "Kitchen Electrophoresis".

Load the gels with 6 reactions in one gel and 6 in the other.

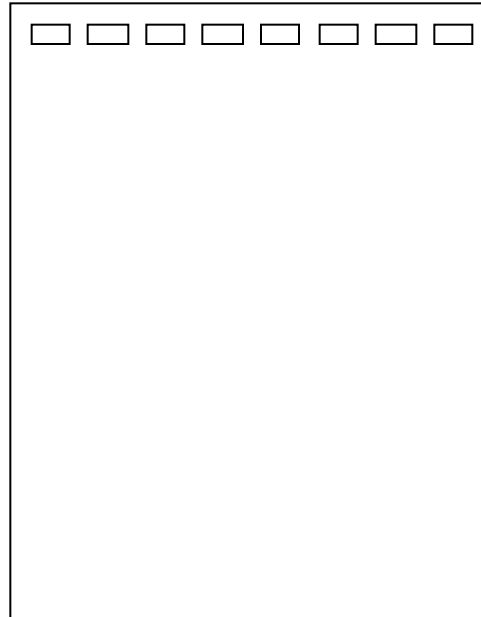
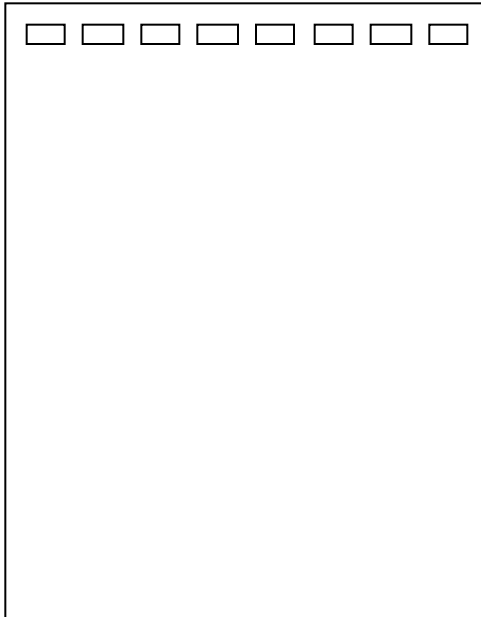
Label your gels so that you know which sample is in each well.

Run the gels at 100 volts for approximately 20 minutes.

Sketch the results from both gels below.

Gel 1

Gel 2



Based on your analysis, do you believe the evidence shows that either suspect 1 or suspect 2 or the administrator can be excluded as the source of the hair found in the window frame?

Do you think you have enough evidence to convince a jury that an exact match between one of the suspects and the sample of hair, according to the results of your analysis so far, is enough to convict that suspect? If not, what additional analysis would you like to perform?

on a separate page, write a brief statement that you would submit to the district attorney's office regarding your findings in this investigation.

*Jacob Lawrence is a renowned American artist born in 1917. He is a member of the National Institute Of Arts And Letters and has taught at Pratt Institute in New York City. He served as head of the Art Department at the University of Washington in Seattle and is presently Professor Emeritus there. His works are probably known by more museums than any other African-American visual artist. Today, his works are among the collections found in the Metropolitan Museum of Art, the Museum of Modern Art, and the Whitney Museum of Art.