

Education Requirements:

- 2 year Associate Degree, you can work as a lab technician in a few science areas.
- 4 year Bachelor Degree, you can work as a technician in most science areas, including forensic science, in both the lab and field.
- 6 year Bachelor and Masters Degrees, you can work in research as an assistant or technician in the lab and field, genetics counseling, forensic science, pharmaceuticals, and law.
- 10+ year Bachelor, Masters, and Ph.D. or M.D., you can work in any career including:

- Research
 - Molecular Biology
 - Biochemistry
 - Microbiology
 - Virology
 - Evolutionary Biology
 - Cancer Biology
 - Pharmacy
 - Plant Biology
 - Anatomy and Physiology
 - Neurobiology
 - Entomology
 - Genetic Counseling
- Forensics
- Health Worker
 - Medicine
 - Pharmaceuticals
 - Law
 - Patent law and ethics
 - Anthropology
 - Neanderthal DNA analysis

10+ years of education is rather scary. With every degree you earn, though, the more you focus on what you are interested in doing. It is an investment, and you are worth it!

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- <https://sites.google.com/a/luther.edu/genetics/students/tyler-foster-stavneak/electrophoresis>

4-H Projects:

- Any project in 4-H that deals with living organisms:
 - Animals—livestock, pets, entomology, sport fishing, wildlife
 - Plants—forestry, weeds, range management, gardening
 - Food—nutrition, bread project, preservation, cake decorating

STEM Connections

Connecting Science, Technology, Engineering, and Math concepts to our everyday lives.

Crime Scene DNA

Dr. Barbara J. Shaw



Over the past 4 newsletters, we have focused on the science behind DNA. The directions on the right will guide you through the steps you need to take to solve the mysteries below. If you have any questions about how electrophoresis works to make the distinct bands of DNA, please revisit those articles.

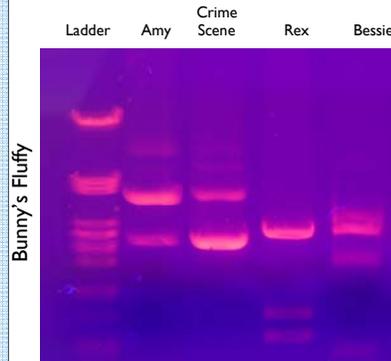
EXPLORE IT - DESIGN IT - DO IT

#1: The Case of Bunny's Fluffy

A prize angora rabbit, Fluffy, was stolen by person or persons unknown from a 4-Her, Bunny, just before fair day. There are three suspects:

- Bessie, the jealous older sister—her rabbits were always inferior to her younger sister, and she had been overheard that she would be taking matters into her own hands.
- Amy, the best friend—she loves Fluffy. Every day, she visits, and spends 99% of her time with Fluffy rather than playing with Bunny.
- Rex, the kid next door—he often threatened that he wanted to steal Fluffy, because fried rabbit was his favorite food. Yummy!

Forensic scientists collected hair evidence, extracted the DNA, and ran electrophoresis. Can you tell who stole Fluffy from the results below on the left?



Bunny's Fluffy



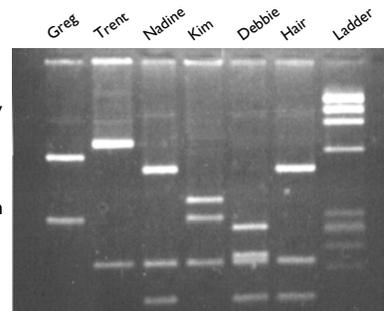
Whose Your Daddy?

#2: The Case of "Whose Your Daddy?"

Norma, a 3 year old heifer, broke through the fence and mingled with the boys late one fall evening. Nine months later, she dropped her first calf, Nessie. Amanda, Norma's 4-H owner, wants to know which bull, Caesar (Bull 1), Augustus (Bull 2), or Poindexter (Bull 3) is the father of the calf. She collected cheek swabs for each of the 5 animals and with the help of her biology teacher, extracted the DNA, added a restriction enzyme, and ran the DNA results on an electrophoresis gel. The results are above on the right. Who is Nessie's father?

#3 The Case of the Candy Consumption

Andrea was holding her 4-H meeting, and as a treat, had candy for each of her club members. When the meeting was over, she found an empty candy bag with a single hair with a tag still attached. Declaring in a loud and firm voice that the culprit would be found, she collected cheek swabs for each of her members. She ran PCR on the hair sample to get enough DNA, and then ran all the DNA on an electrophoresis gel. The results are on the right. Who took the candy?



Materials:

- This article

Directions:

• #1: The Case of Bunny's Fluffy. To solve this case, you are looking to match the DNA from the hair found at the crime scene with DNA samples from the three suspects. The DNA used is "junk" DNA, or those sequences that do not code for proteins. They can mutate without harming the individual. Forensic scientists use a ladder, which is a known number of nucleotide pairs for each band of DNA. When testing DNA, the approximate length of each band can be very important.

• #2: The Case of Whose Your Daddy?. To solve this case, we need to discuss the DNA contributions of parents to their offspring. Every cell in Nessie's body has a 23 chromosomes from her mom, Norma and 23 chromosomes from her dad except her egg cells. Instead, each egg cell gets only 23 chromosomes, some from her mom and some from her dad. How the one set of DNA separates into the egg cell is totally random. That is why you look like both your parents, and you look similar to your siblings, but different. To identify Nessie's dad, you first need to eliminate the bands of DNA that are the same as her mom, Norma. Nessie's remaining DNA should match half of one of the bulls, Nessie's dad.

• #3: The Case of the Candy Consumption is another DNA mystery solved by matching the identical DNA from the hair with one of the 5 suspects. Because a single hair was found in the candy bag, the first thing Andrea had to do was make multiple copies of DNA by using a technique called PCR, or polymerase chain reaction. That technique can take a single copy of DNA and make billions of copies in a matter of hours! Dr. Kary Mullis figured out in 1983 that he could make DNA copies using bacteria molecules. He received a Chemistry Nobel Prize in 1996.