Paper = DNA
Scissors = Restriction Enzyme
Desktop = Electrophoresis

OBJECTIVES*:* To help you understand how DNA is analyzed for forensics, diseases, paternity, species comparison, ancient DNA, mutations, and preparing a DNA sequence for recombinant work. Keep in mind, this simulation is meant to give you the basic idea of how fragments of DNA can be separated into pieces and studied.

MATERIALS: A half sheet of 1/4inch graph paper, scissors and tape (or glue).

GET READY: (ISOLATING YOUR PAPER DNA)

1. On your half sheet of graph paper, write a sentence that only you will know. Put each letter or punctuation mark in a square, and use a square for a space between each word. The sentence should be no more than two lines in length.
2. Make a second copy of your sentence, but in this one, make a change by adding or omitting a word. Try to make this sentence still make sense like: "My dog has fleas" and "My dog has many fleas."
3. Using scissors cut the **first** sentence into strips and carefully tape or glue the ends together so that it is one long strip. Now, this sentence pieced together end-to-end will be used to represent a unique strand of DNA that might be isolated from a tissue sample.

PART 1

THE RESTRICTION DIGEST: Cut up the DNA into fragments

Endonucleases occur naturally in most bacteria, and act as the bacteria's defense system to "restrict" the growth of invading viruses by breaking apart the virus' DNA. Scientists have learned to isolate these "restriction enzymes" and use them to cut desirable DNA into smaller pieces. When these pieces are loaded into the well of an agarose gel and electrophoresed, the fragments will move through the gel at different rates and become separated.

1. The scissors represent the endonuclease. Use them to cut the DNA sentence after every letter "a."

THE ELECTROPHORESIS: Separate the fragments by size

2. Now, turn the sentence fragments over--printed side down-- and arrange them from largest (on your left) to the smallest (on your right).
3. Big fragments do not electrophorese very well—they get "stuck" in the gel, whereas little fragments are able to move great distances. Now, walk around the room, and observe other students' banding patterns and compare yours to theirs by looking at
    - the SIZE of the fragments
    - the NUMBER of fragments (bands) that show up on the tabletop "gel."

CLASS DISCUSSION: PART 1

4. Did anyone in the room have the same banding pattern as you? Why or why not?

PART 2

FINDING POLYMORPHISMS

1. Leave your first set of strips on the table, and repeat the process with your **second** copy—attaching the ends together into one long strip.
2. Now cut the second strip again after every letter "a," line them up from largest (on your left) to smallest, right next to your previous set of fragments.

CLASS DISCUSSION: PART 2

3. Describe HOW your second banding pattern is different from your first banding pattern, even though you cut the strips with the same endonuclease. What caused the differences between these two patterns?