Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Hour \_\_\_\_\_\_\_\_\_\_\_\_

**Analyzing DNA Fingerprints**

**Problem:**

How can the analysis of DNA fragments be used as a tool for identifying individuals?

**Background:**

The technique of DNA fingerprinting is a way to determine the identity or relationships of individuals. Except identical twins, no two people have the same DNA and the same DNA fingerprint. The technique of DNA fingerprinting is very reliable and requires only a small sample of DNA.

The following laboratory exercises will introduce the methods and principles of DNA fingerprinting. In the first part you will be give the results of a simulated criminal investigation in which you will determine the identity of criminals. In the second part you will be provided with sequences of DNA from three different individuals. You will analyze the samples with different probes and restriction enzymes to see the effects that they have on DNA banding patterns.

**Objectives:**

* Explain how DNA fingerprinting is used for identification (Part I)
* Interpret the results of hypothetical DNA fingerprinting analyses in order to identify likely suspects in a crime (Part I)
* Find the size of DNA fragments after treatment of DNA sequences from three individuals with two different restriction enzymes (Part II)
* Find the DNA banding patterns caused by two different DNA probes (Part II)

**Materials:**

Pencil, Ruler, Calculator

**Part I:**

1. Using record sheet 11-1, review the DNA fingerprint patterns for Case 1. Determine the guilt or innocence of the three suspects.

2. Using record sheet 11-1, review the DNA fingerprint patterns for Case 2. Determine the guilt or innocence of the three suspects.



**Part II:**

1. Restriction enzymes recognize specific DNA sequences. In this exercise, two different restriction enzymes have been applied to the DNA of three individuals.

* Enzyme 1 recognizes the DNA sequence 5’ AATT 3’ and cuts between the middle A and T.
* Enzyme 2 recognizes the DNA sequence 5’ ATCGAT 3’ and cuts between the middle C and G.

2. On the pages following, notice that the DNA of the three individuals has been marked with the locations of the cuts of both restriction enzymes as well as both probes.

3. On Data Sheet 1, fill in the charts with the required information. Once you have done this, you are ready to construct a DNA fingerprint that results from ***using restriction enzyme 1***.

4. On Data Sheet 2, fill in the charts with the required information. Once you have done this, you are ready to construct a DNA fingerprint that results from ***using restriction enzyme 2***.







**DATA SHEET 1 --** Fill in the following chart **for Enzyme 1 (AATT)** – Part of it is completed for you

**Individual #1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Fragment #** | **Ending b.p. #****(where the restriction enzyme cuts)** | **Beginning b.p. #** | **Length of fragment (subtract beginning # from ending #)** | **Is there a probe in front of this fragment?**  **A, B or Both?** |
| **1** |  | **0** |  |  |
| **2** |  | **47** |  |  |
| **3** |  | **125** |  |  |
| **4** |  | **242** |  |  |

**Individual #2**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Fragment #** | **Ending b.p. #****(where the restriction enzyme cuts** | **Beginning b.p. #** | **Length of fragment (subtract beginning # from ending #)** | **Is there a probe in front of this fragment?**  **A, B or Both?** |
| **1** | **124** |  |  |  |
| **2** | **241** |  |  |  |
| **3** | **364** |  |  |  |

**Individual #3**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Fragment #** | **Ending b.p. #****(where the restriction enzyme cuts** | **Beginning b.p. #** | **Length of fragment (subtract beginning # from ending #)** | **Is there a probe in front of this fragment?**  **A, B or Both?** |
| **1** | **69** |  |  |  |
| **2** |  | **70** |  |  |
| **3** | **241** |  |  |  |
| **4** |  | **242** |  |  |

Using the data from the ‘**length of fragment’** column, mark a corresponding band on each of the DNA fingerprints below. Then to the right of each fingerprint, label the markers that have probes (A, B or Both)

***Individual #1***  ***Individual #2***  ***Individual #3***

150 150 150

\_\_\_ \_\_\_ \_\_\_

130 130 130

\_\_\_ \_\_\_ \_\_\_

110 110 110

\_\_\_ \_\_\_ \_\_\_

90 90 90

\_\_\_ \_\_\_ \_\_\_

70 70 70

\_\_\_ \_\_\_ \_\_\_

50 50 50

**DATA SHEET 2 --**Fill in the following chart for **Enzyme 2(ATCGAT)**

**Individual #1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Fragment #** | **Ending b.p. #****(where the restriction enzyme cuts** | **Beginning b.p. #** | **Length of fragment (subtract beginning # from ending #)** | **Is there a probe in front of this fragment?**  **A, B or Both?** |
| **1** |  |  |  |  |
| **2** |  |  |  |  |
| **3** |  |  |  |  |
| **4** |  |  |  |  |

**Individual #2**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Fragment #** | **Ending b.p. #****(where the restriction enzyme cuts** | **Beginning b.p. #** | **Length of fragment (subtract beginning # from ending #)** | **Is there a probe in front of this fragment?**  **A, B or Both?** |
| **1** |  |  |  |  |
| **2** |  |  |  |  |
| **3** |  |  |  |  |
| **4** |  |  |  |  |

**Individual #3**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Fragment #** | **Ending b.p. #****(where the restriction enzyme cuts** | **Beginning b.p. #** | **Length of fragment (subtract beginning # from ending #)** | **Is there a probe in front of this fragment?**  **A, B or Both?** |
| **1** |  |  |  |  |
| **2** |  |  |  |  |
| **3** |  |  |  |  |

Using the data from the ‘**length of fragment’** column, mark a corresponding band on each of the DNA fingerprints below. Then to the right of each fingerprint, label the markers that have probes (A, B or Both).

***Individual #1***  ***Individual #2***  ***Individual #3***

150 150 150

\_\_\_ \_\_\_ \_\_\_

130 130 130

\_\_\_ \_\_\_ \_\_\_

110 110 110

\_\_\_ \_\_\_ \_\_\_

90 90 90

\_\_\_ \_\_\_ \_\_\_

70 70 70

\_\_\_ \_\_\_ \_\_\_

50 50 50

**Part II Analysis and Conclusion:**

1. What are restriction enzymes? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. What are DNA probes? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. Did the result that you obtained in Part II allow you to clearly distinguish among the three individuals? If not, explain why not. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. To produce a DNA fingerprint, other techniques are required. Put the following procedures in the correct order and then give a definition of each: Gel electrophoresis, DNA fingerprinting, Apply Radioactive Probe, Polymerase Chain Reaction, Obtain DNA sample

 1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ -

 2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ -

 3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ -

 4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ -

 5. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ -