## Chapter 9: Biotechnology

#### **Restriction Enzymes**

- Like "molecular scissors," they cut DNA
  Hundreds of different ones have been isolated from hundreds of bacteria
  - Bacteria use them to attack viruses
  - Each restriction enzyme has a different restriction site
    - Place where the cut is made

#### **Restriction Enzymes**

- Some leave "sticky ends"
  - Good for creating recombinant DNA
- Some leave "blunt ends"
- Example pg 266 (Figure 9.2)

What are some day-to-day applications of DNA (other than being the basis of all life on the planet)? How can it be used/manipulated?

- CSI
- GMO
- Paternity tests
- Cloning
- Etc
- But how?....

#### Let's use an example:

# Investigating A Robbery at Freeport's Convenience Store

#### **Example: A Robbery at Freeport's**

## A store owner, Ed Freeport, calls 911 to report a burglary



Help! Someone just robbed my store! I've been stabbed!" Ed shouts into the phone.

#### A Robbery at Freeport's

- Police and paramedics arrive on the scene quickly.
- Multiple blood samples are collected at the scene



#### A Robbery at Freeport's

Mr. Freeport explains that he engaged the robber in a fight so detectives take samples from beneath his fingernails, hands and clothes while also getting a physical description of the assailant.





#### A Robbery at Freeport's

- Over the next 12 hours, police take 6 suspects into custody
- Sadly, Mr. Freeport dies due to complications during surgery to treat his injuries and is obviously unable to help police by viewing a line up of suspects. DNA evidence is all that can be relied on to solve this case of armed robbery and now, murder. How do we do it?

## Solving the crime at Freeport's

- Step 1- Polymerase Chain Reaction (PCR)
  - Some of the samples collected at the scene were very small
    - PCR is used to quickly amplify small samples of DNA
  - What are the steps of PCR?
    - 1. Heat to separate stands
    - 2. Cool so primers can bind
    - 3. Heat so polymerase can add nucleotides and perform replication

#### Quiz (pages 270-271 in your book)

- I) Briefly describe the function of PCR.
- 2) Summarize the cycle involved in the PCR process.
- 3) Describe how heating double-stranded DNA separates the strands. Why does heating also inactivate DNA polymerases from many organisms?
- 4) Explain two reasons why primers are important in PCR?

#### **PCR vs Replication**

- Similarities: both use DNA polymerases to make copies of DNA
- Differences
  - Replication occurs in cells where enzymes separate DNA strands to be copied <u>what is the</u> <u>name of one of those enzymes?</u>
  - PCR is the artificial copying of DNA in a laboratory with heat used to separate the strands

#### Solving the crime at Freeport's

#### ✓ Step 1: PCR

- Step 2: Create DNA fingerprints
  - Now that there is plenty of DNA to work with, we need to create individual DNA fingerprints.
    - DNA fingerprint: representation of an individual's DNA that can be used to identify a person a t a molecular level
    - How? <u>Gel electrophoresis</u> (ee-lec-tro-for-rhee-sis)

#### Step 2: What is Gel Electrophoresis?

- Restriction enzymes used to cut DNA samples into fragments based on certain nucleotide sequences
- 2. Fragments are stained with special dye so they will be visible
- 3. Sample loaded into gel
- **4**. Electricity turned on
  - DNA has negative charge so fragments will move toward positive end
- 5. Smaller fragments move further down gel than larger fragments creating series of bands

#### Images of gel electrophoresis



# Let's practice making DNA fingerprints

- file:///Users/channelle/Documents/Teaching/Union%20Grove/Bio%20labs/DNA%20fingerprinting/tdco2 \_\_int\_creatednafp2.html
- DNA fingerprinting can be trickier to figure out when it comes to paternity



#### Solving the crime at Freeport's

#### ✓ Step 1: PCR

- Step 2: Create DNA fingerprints using gel electrophoresis
- Step 3: Analyze results...

#### Analyzing DNA finger print results

Three unique samples were taken from the crime scene. Identify who they belong to.



#### **Based on the DNA Evidence...**

What can you conclude about the suspects?What about DNA sample #1?

#### An important note

- DNA evidence is much better used as a means to exonerate (set free, eliminate as a possibility) than as a means to convict (prove guilt). Why do you think this is so?
- Read Marilyn Sheppard background info, watch video, answer questions