



DNA: The Indispensable Forensic Science Tool

Forensic Science

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DNA In Forensic Science

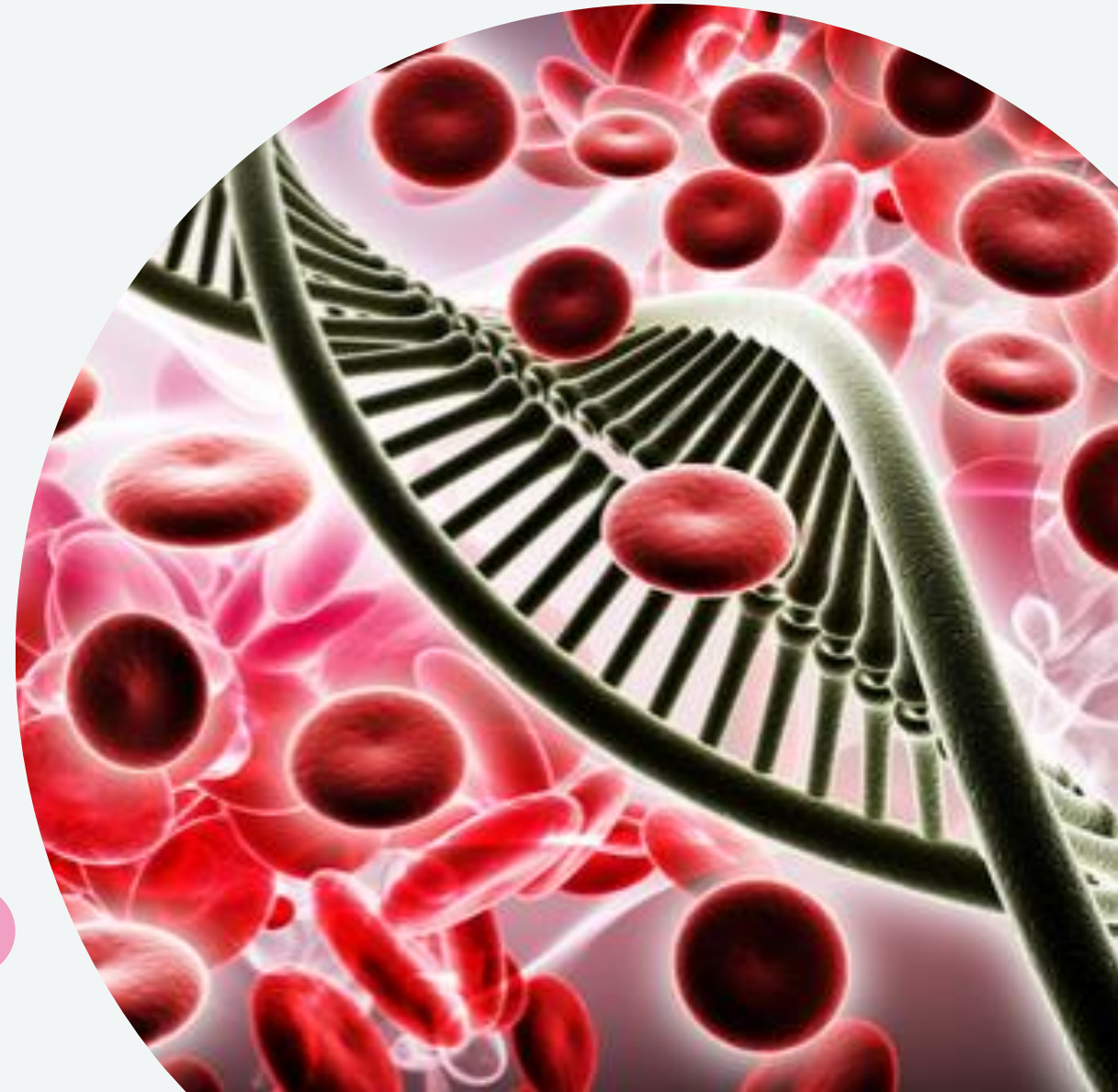
Blood of the victim

Semen recovered from the victim

Blood taken from Suspect A

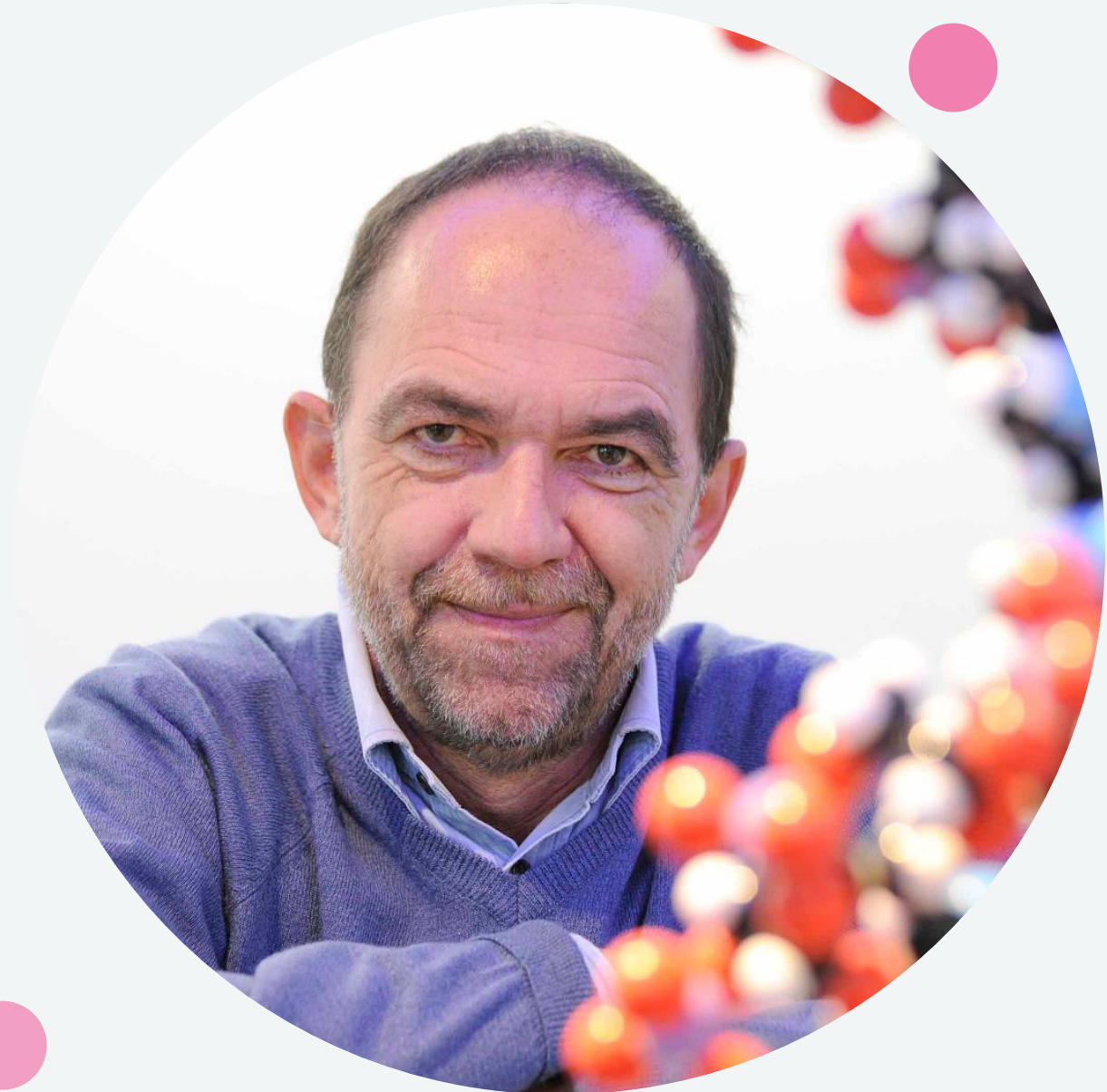
Blood taken from Suspect B

Blood taken from Suspect C



Sir Alec Jeffreys

- Jeffreys and his colleagues were responsible for the process of identifying and reading DNA Markers....DNA Fingerprinting!
- Biological Link
- Blood, Semen, Hair and Tissue form a single individual



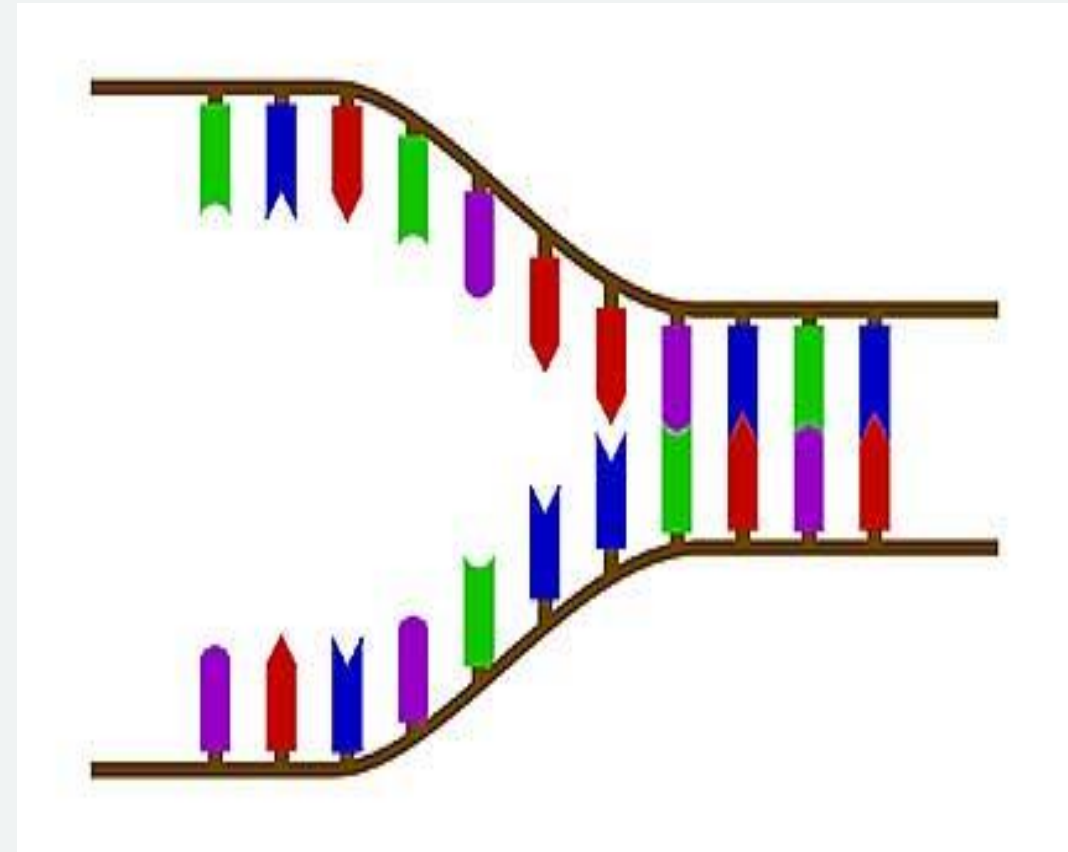
DNA

- DNA was discovered in the 1950's based on the work of Dr. Franklins technique of X-Ray crystallography!
- Watson and Crick capitalized on Dr. Franklin's discovery to identify the actual DNA structure as a Double Helix!
- DNA is a POLYMER!
- A polymer is a very large molecule made by linking a series of repeating units, or monomers.....in this case NUCLEOTIDES!



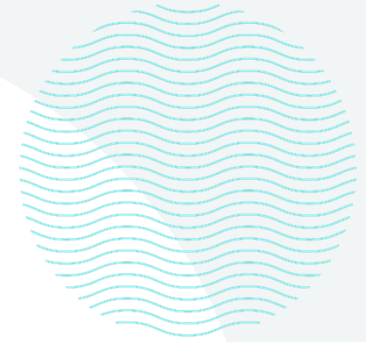
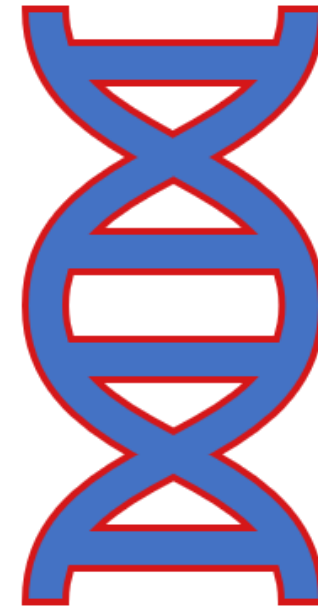
PCR: Polymerase Chain Reaction

- In PCR, small quantities of DNA or broken pieces of DNA identified at a crime scene can be COPIED with the aid of DNA Polymerase
- The copying process is accomplished by the use of a DNA Thermal Cycler
- Each cycle of the PCR technique results in doubling of the DNA Sample
- 30 Cycles can multiply DNA a billion fold
- Sample size is no longer a limitation in characterizing DNA recovered at crime scenes



DNA Typing with Tandem Repeats

- DNA molecules contain sequences of letters that are frequently repeated
- 30% of the Human Genome is composed of repeating DNA Sequences called Tandem Repeats
- Tandem Repeats allow Forensic Scientists the ability to distinguish one DNA sample from another through DNA Typing

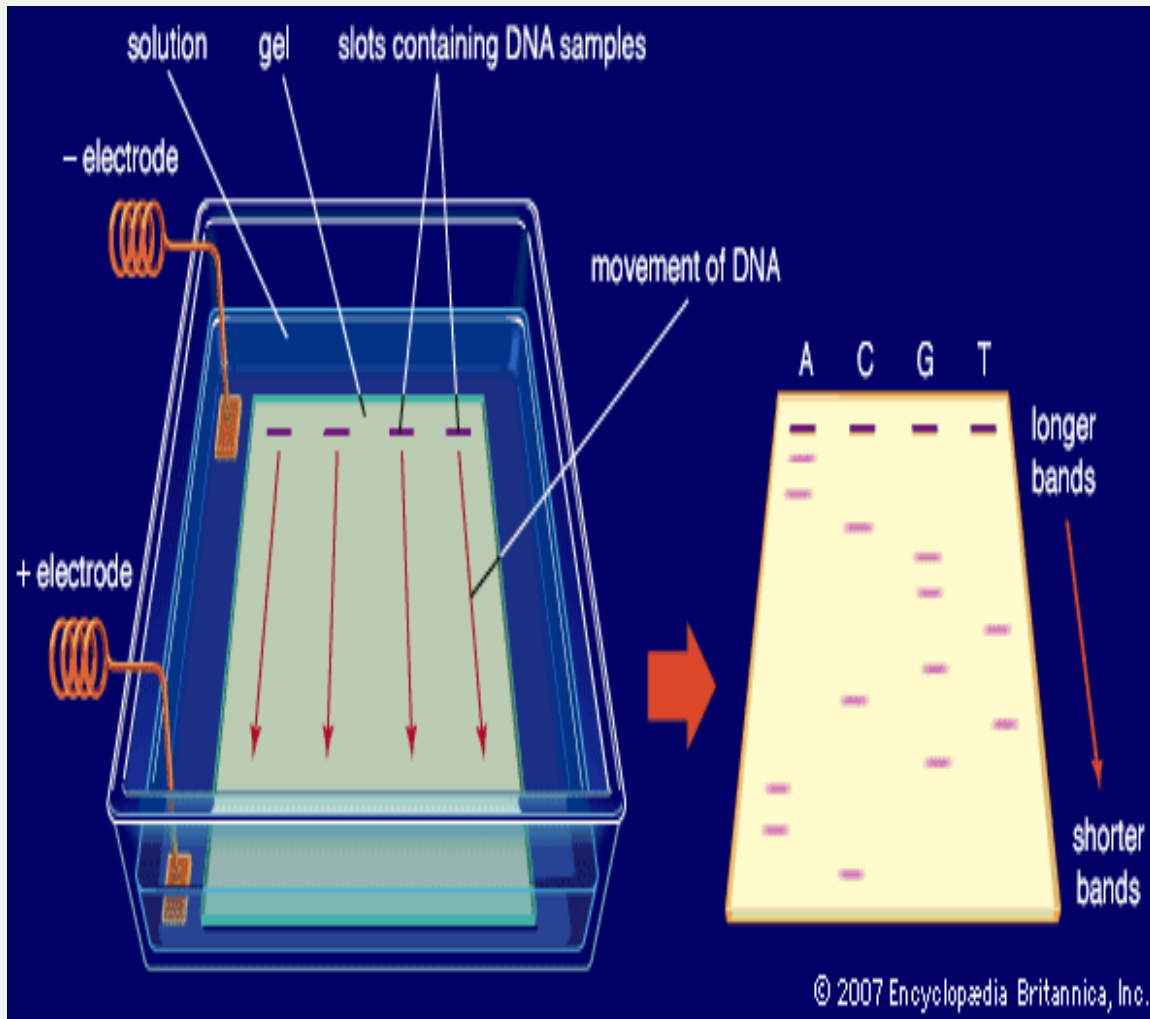


Restriction Fragment Length Polymorphisms

RFLP's are repeats cut out of the DNA double helix by a restriction enzyme that acts like a pair of scissors

Typically, a standard RFLP sequence is 15-25 base pairs long and repeats itself up to a thousand times (1000X)

Electrophoresis



The differences in length between DNA and RFLP's allows Forensic Scientists to distinguish one person from another

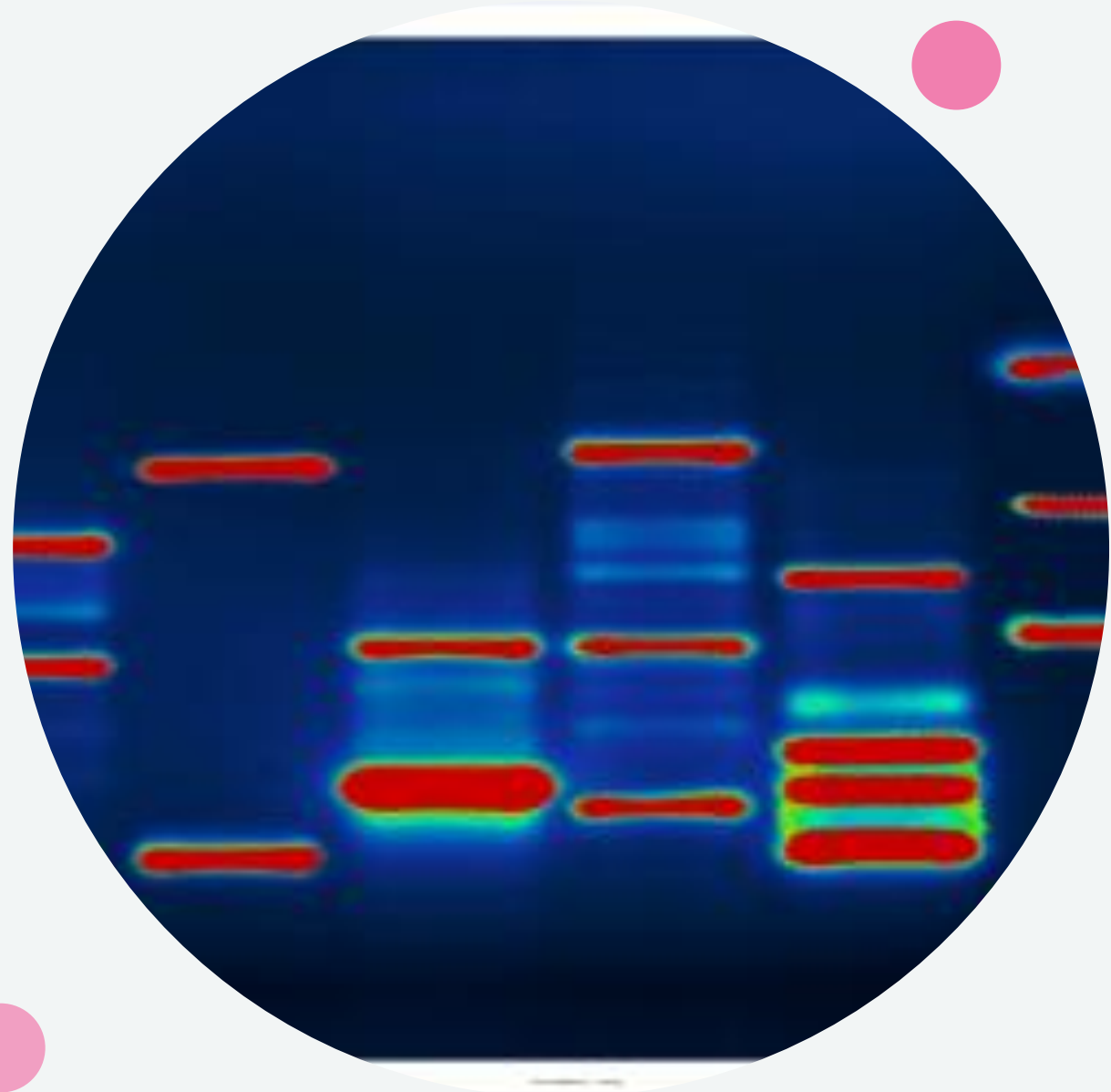
Once the molecules have been cut by the restriction enzyme, the samples must be sorted out using Electrophoresis

During the Electrophoresis Process, DNA samples cut by restriction enzymes are placed in a gel medium

When the gel is subjected to an electrical current, the fragments move across the gel based on relative size (Larger Fragments move SLOWER than smaller Fragments)

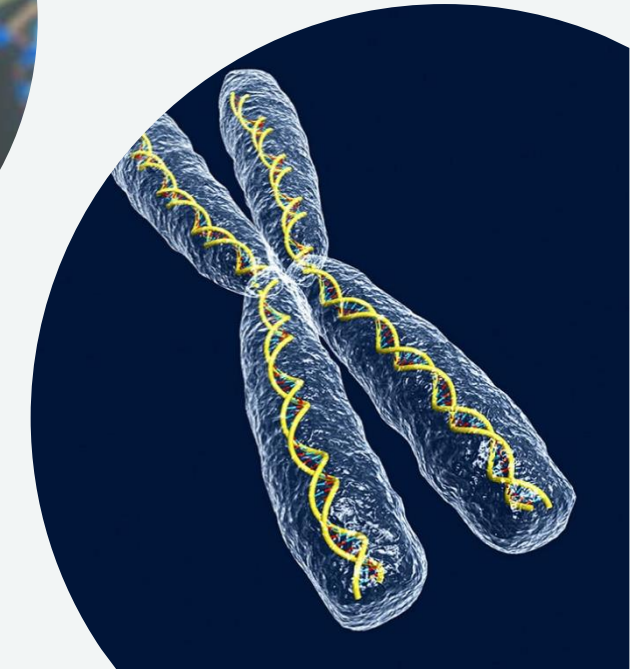
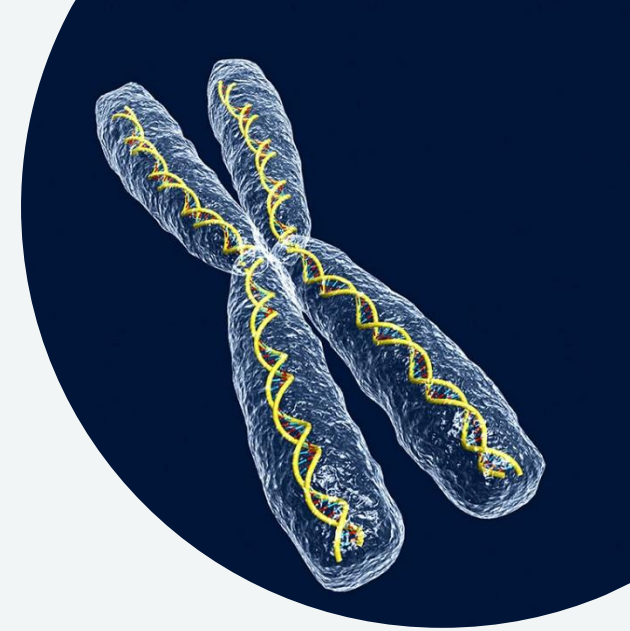
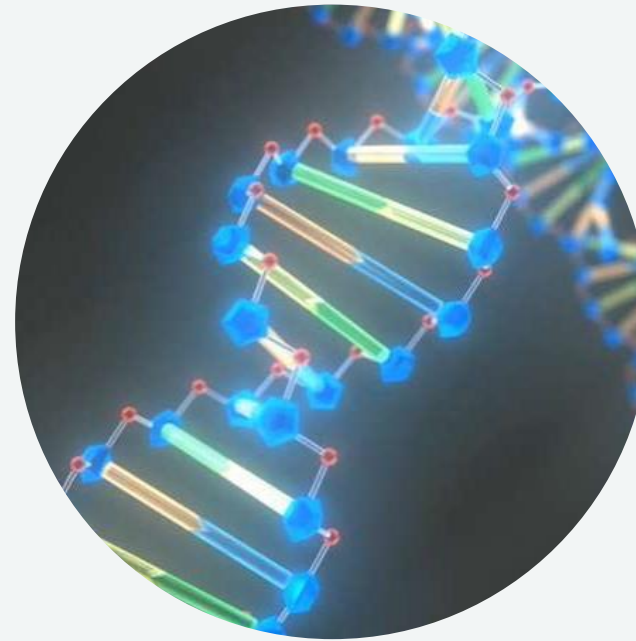
Hybridization

- Once Electrophoresis is completed... the DNA fragments are chemically treated so the strands separate from each other
- Southern Blotting is the movement of the separated strands to a nylon membrane treated with radioactive labeled probes containing base sequences complementary to the RFLP's being identified



DNA Typing with RFLP

- The Nylon sheet is placed against X-ray film and exposed for several days
- The radioactive decay strikes the film
- When the film is processed, bands appear where the radioactive probes struck to the fragments on the Nylon Sheets
- A typical DNA Fragment pattern shows TWO bands (One RFLP from each Chromosome)
- Although only limited number of people in the population would have the same DNA fragment pattern as the suspect in the population would have the same DNA fragment pattern as the suspect, this test itself cannot be used to individualize the strain to the suspect



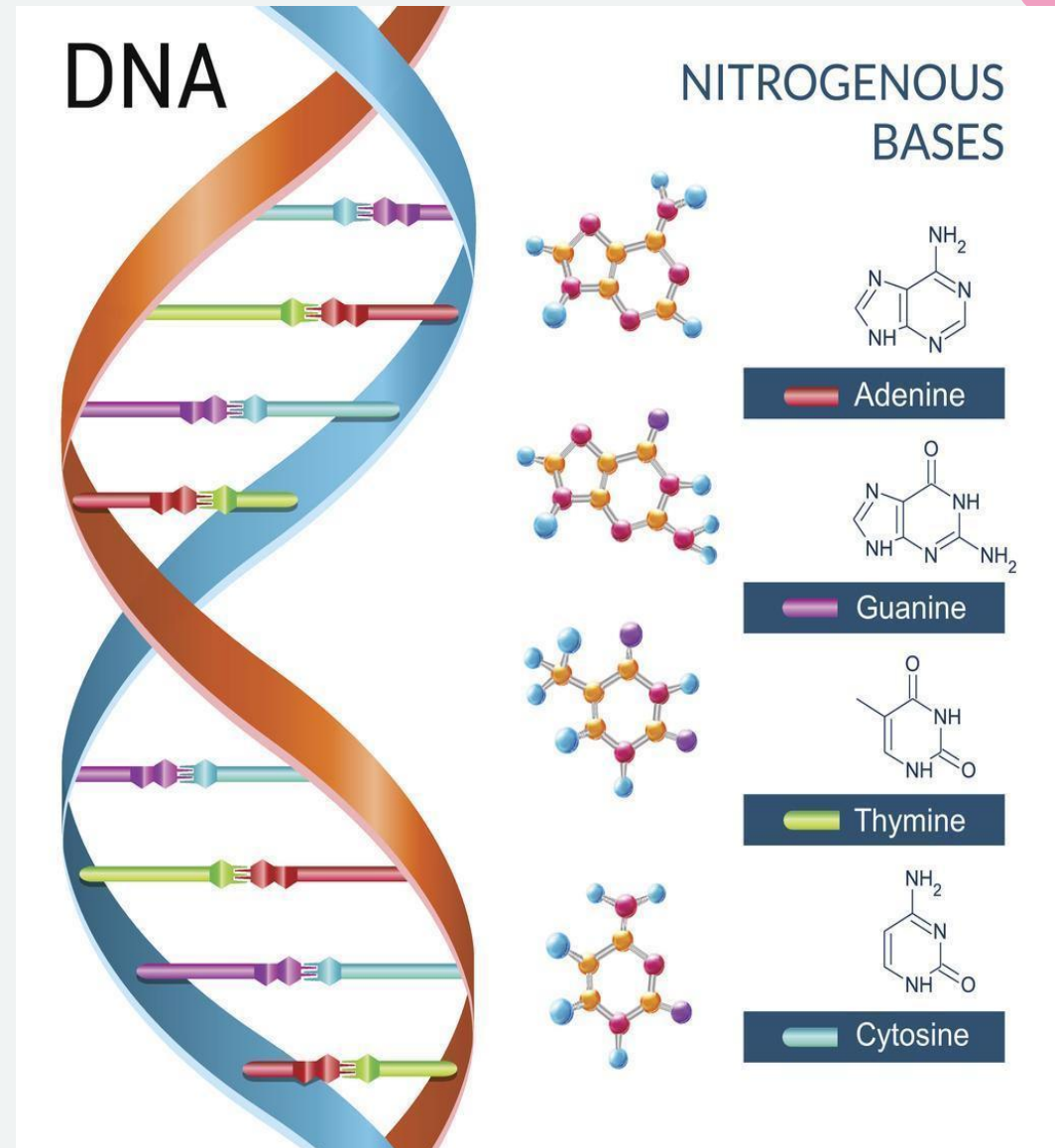
DNA Typing with RFLP CONTINUED

- Using additional DNA probes, each of which recognizes different repeating DNA segments, a high degree of discrimination or even near individualization can be achieved
- RFLP DNA Typing has the first distinction of being the first scientifically accepted protocol in the U.S. for Forensic Characterization of DNA



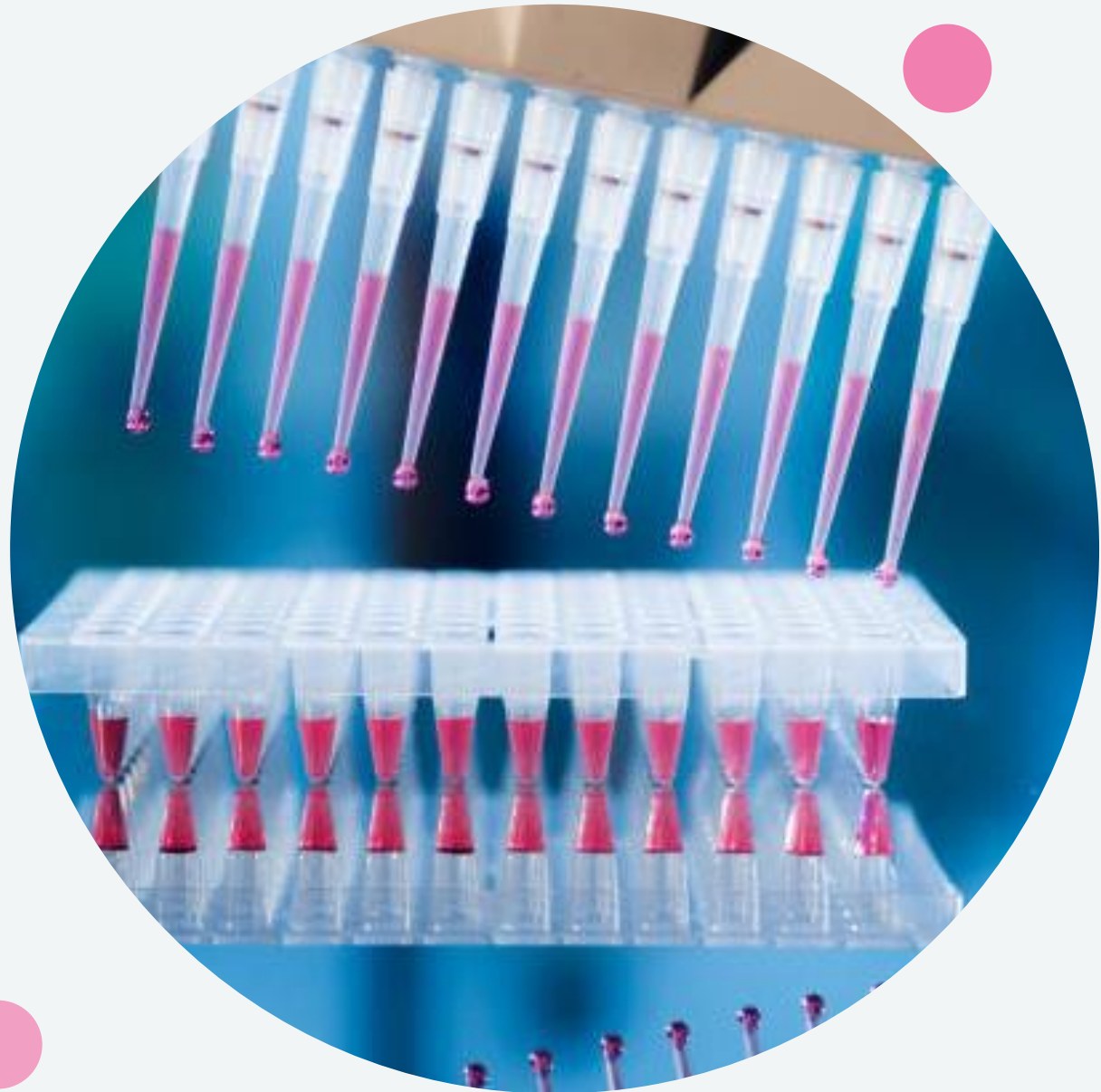
Advantages of PCR

- RFLP strands are typically too long
- PCR is best used with shorter fragments of DNA
- Shorter samples are more stable....less likely to be damaged by environmental factors experienced at crime scenes
- PCR being **MORE SENSITIVE** than RFLP can allow an analyst to characterize the smallest samples of DNA that could **NEVER** be detected by RFLP



Polymerase Chain Reaction

- PCR is the outgrowth of knowledge gained from the understanding of how DNA strands naturally replicate
- During PCR, DNA polymerase can be directed to synthesize a specific region of DNA
- Therefore, PCR can be used to duplicate a strand of DNA under study millions of times



Thank You For Your Attention

Questions and Comments

