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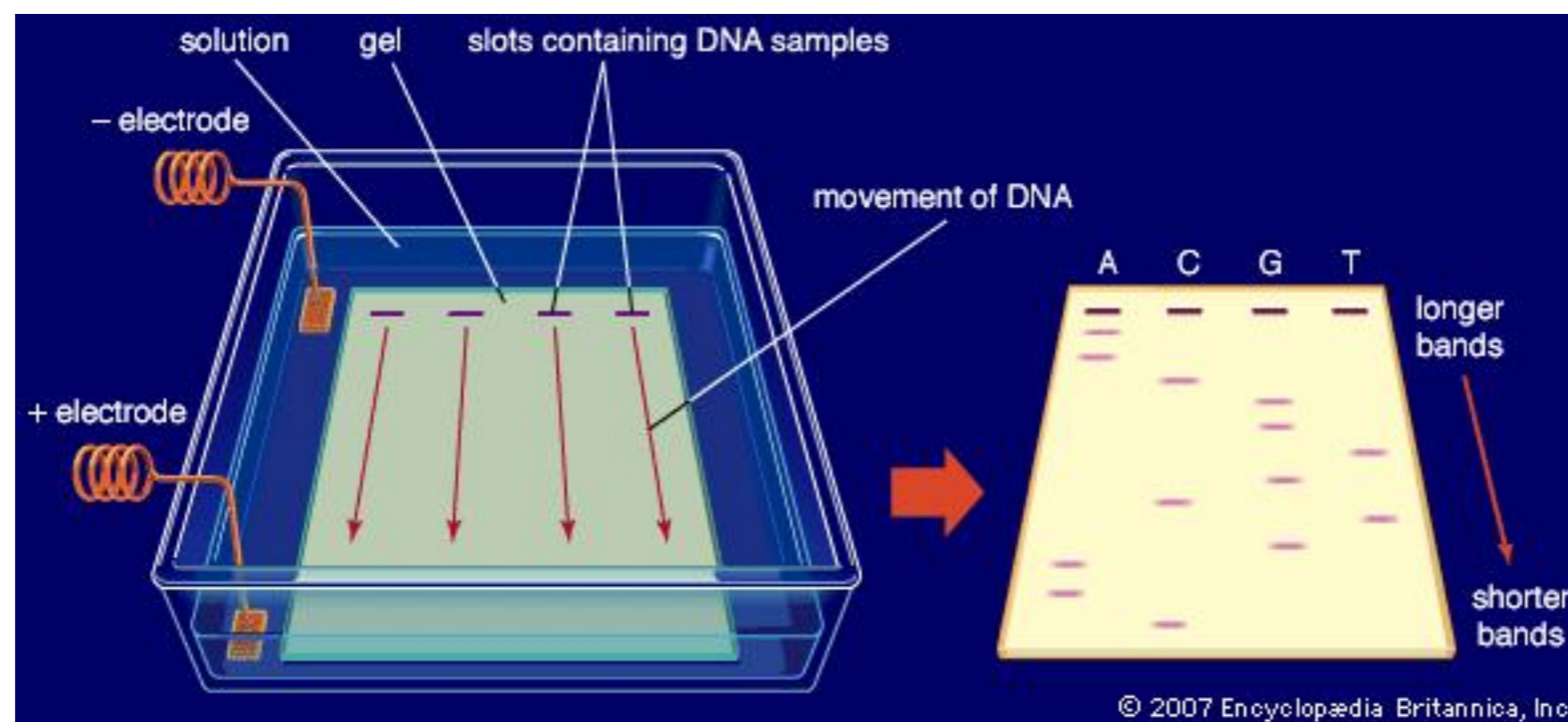
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THE TECHNOLOGY

*Gel Electrophoresis - DNA Fingerprinting,
RFLPs, and STRs*

WHAT IS GEL ELECTROPHORESIS?

- A method used in biology to separate DNA strands to create a DNA fingerprint.
 - Separates DNA by fragment lengths.
 - Uses an electric current to separate DNA.
 - Negative charge of the DNA fragments move toward the positive electrode.



WHAT ARE THE STEPS OF USING THIS TECHNOLOGY?

- First, extract DNA from organism and place in tubes.
- Next, add the liquid bluffer.
- Then, place the restriction enzymes in the DNA.
- Next, dye the DNA and place it into agarose gel.
- Then, run the electrical current through the gel (- to +)
- Now, place in the stain and then under the UV light.

** The smallest DNA fragments will move the fastest and furthest.

HOW IS GEL ELECTROPHORESIS CREATED?

- First, Agarose powder is placed in a flask.
- Next, add some liquid buffer and cover the flask loosely.
- Then, heat the mixture in the microwave until it's one liquid mixture.
- Now, pour the melted mixture into the gel mold and put the plastic comb in the melted mixture.
- Then, allow the gel to solidify for a set amount of time.
- Then, add some loading buffer, using the micropipette, to your DNA sample {This is a dye, so DNA will be visible}.

THE HISTORY

- 1930- first reports of the use of sucrose for gel electrophoresis.
- 1955- introduction of starch gels; mediocre separation.
- 1959- introduction of acrylamide gels; Ornstein and Davis invented disc electrophoresis; accurate control of parameters such as pore size and stability.
- 1969- Weber and Osborn discovered denaturing agents in electrophoresis.
- 1975- 2-dimensional gels by O'Farrell.
- 1977- sequencing gels.
- 1983- pulsed field gel electrophoresis enables separation of large DNA molecules.
- 1983- introduction of capillary electrophoresis.
- 2004- standardized time of polymerization of acrylamide gels enable clean and predictable separation of native proteins.

CURRENT USES

(Applications)

HOW IS IT USED?

- Used in forensics for DNA fingerprinting to find out whether a person was at a crime scene or not.
- To determine paternity.
- To diagnose genetic disease and identify damaged genes.
- Helps determine kinship in organisms.
- Can help to compare genetic similarities and differences between species.
- Separates macromolecules.



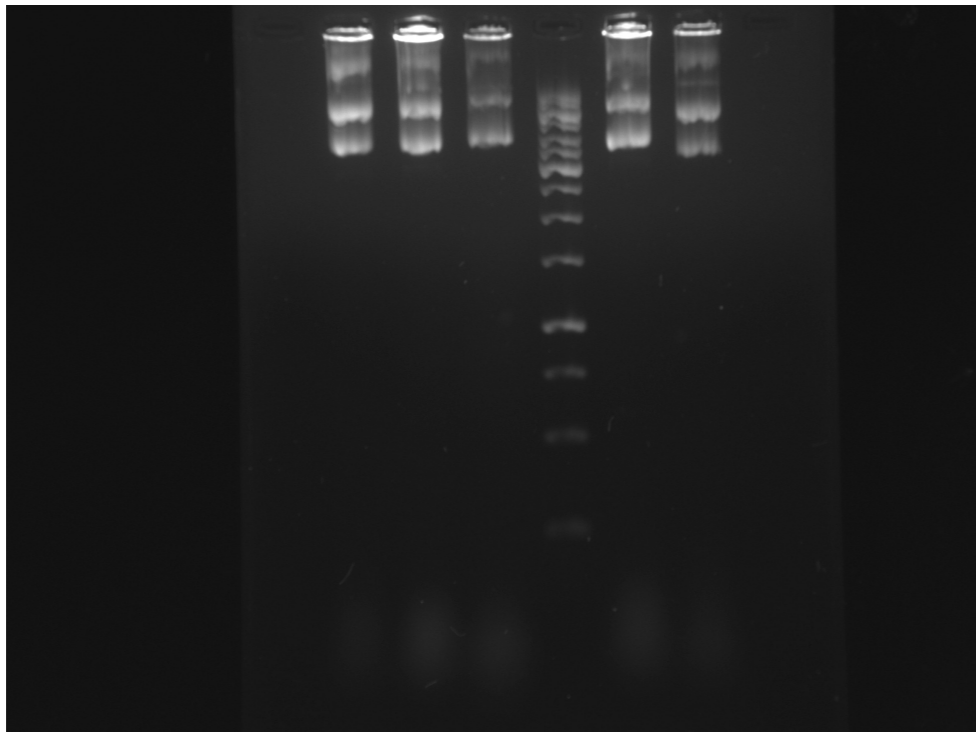
BIOETHICS, LAW, AND SOCIETY

Pros and Cons

WHAT ARE THE PROS AND CONS?

Pros

- Small amount of starting material (DNA) needed
- DNA can be detected regardless of size of DNA



Cons

- Hazardous material
- Expensive
- Time consuming
- Blank gel can occur
- Smear bands can happen
- Abnormal running duration

WHAT ARE THE BIOETHICAL CONSIDERATIONS?

- There are no bioethical concerns in the nonhuman biological environment
- The ethical concerns about this technology and its relationship to people is that it can invade ones privacy, but usually it's used for good of the society like suspect identification



CASE STUDY

The Sad But True Case of Earl Washington

REAL LIFE EXAMPLE...

- Wrongfully-convicted former Virginia death-row inmate, who was falsely imprisoned for rape and murder of Rebecca Lyn Williams.
- Washington, with an IQ estimated at 69, confessed to the crime, but apparently only after being coerced by investigators.
- DNA evidence in 1994 showed that Washington could not have made the seminal stain and raised doubt that he was responsible for the crimes for which he was sentenced.
- Nine days before his scheduled execution, Virginia's Governor Jim Gilmore commuted his sentence to life in prison.
- In 2000, after more accurate DNA testing strengthened the case for his innocence, he received a full pardon from Governor Gilmore.

REAL LIFE EXAMPLE... (CONTINUED)

- In 2006, Washington was awarded \$2.25 million from the estate of Agent Wilmore who had forced the false confession from Washington.
- In 2007, the actual murderer Kenneth Tinsley pled guilty and was sentenced to life in prison.
- Washington's case is frequently cited by opponents of the death penalty as an example of a wrongful death sentence.