

DNA Technology



DNA Extraction

- **Chemical treatments** cause cells and nuclei to burst
- The DNA is inherently **sticky**, and can be pulled out of the mixture
- This is called **“spooling”** DNA



"Spooled" DNA

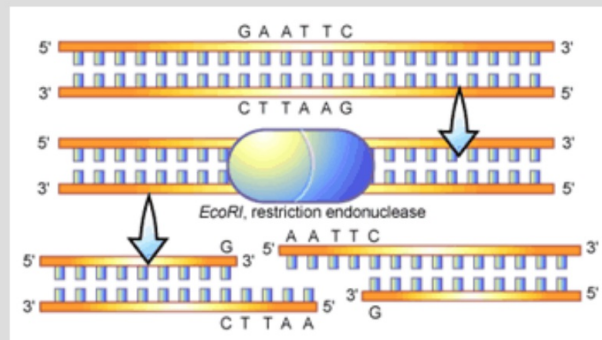


9



Cutting DNA

- *Restriction enzymes* cut DNA at specific sequences.
- Useful to divide DNA into *manageable fragments*, act as chemical scissors.



Electrophoresis or DNA Fingerprinting

- Used to separate DNA.
- Every individual has unique DNA (except identical twins or clones.)
- This unique DNA makes a different DNA fingerprint. This can be used in **criminal cases, paternity cases, or to show common ancestors.**

Electrophoresis

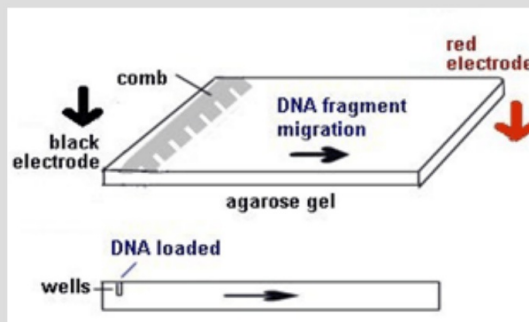
- DNA can be separated based on **size and charge**
- DNA is placed in a gel and **electricity** is run through it.

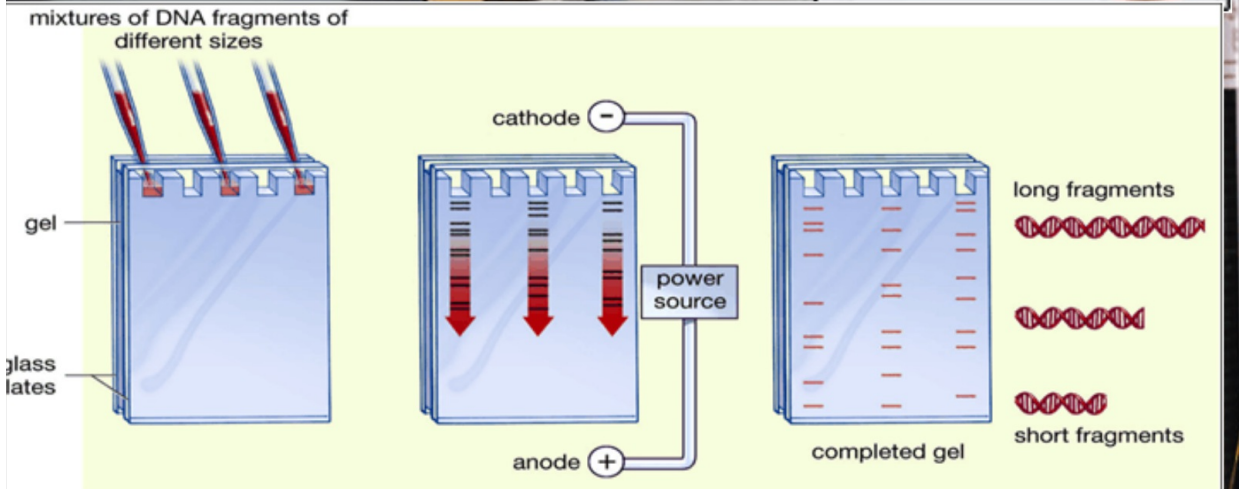
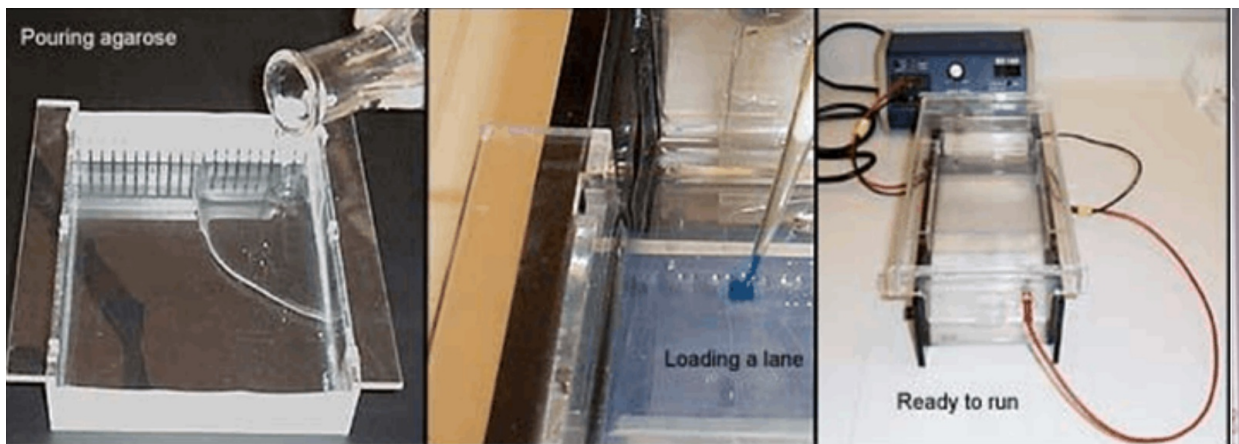
How it separates the

DNA:

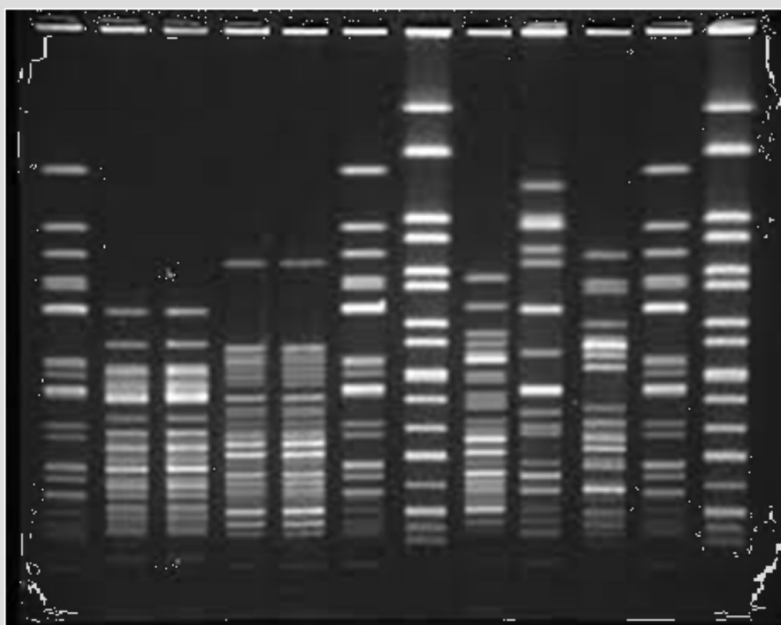
- Negative DNA moves toward the positive end of the electrical charge.

★ Smaller fragments move farther and faster.

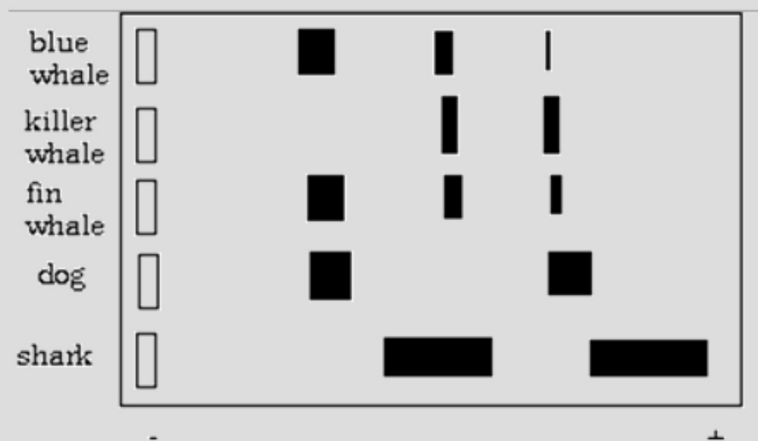




DNA Fingerprinting

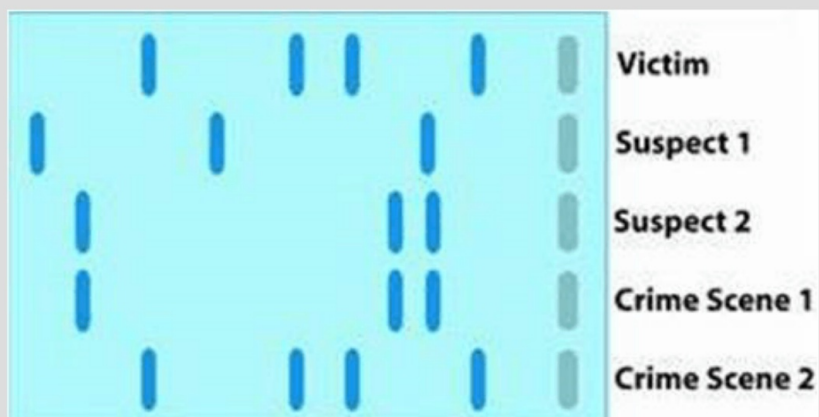


DNA Fingerprinting showing common ancestors.



Which organism is most closely related to the blue whale?

DNA Fingerprinting used in a crime scene.



DNA Fingerprinting used in a paternity case.



Biotechnology -

- **The use of gene science to create new products from plants and animals**



Selective Breeding

- Choosing two organisms with a desirable trait reproduce.
- Oldest form of biological engineering.

Ex: Dog breeding

Horses

Arranged Marriages

Super cows



Genetically Engineering

GMO's

GMC's

Transgenic Organisms

- All these terms refer to the same thing. We take the genes from one organism and insert them into the DNA of another organism.

Benefits of Genetic Engineering

Improved food products

Ex: Frost resistance, pest resistance, herbicide resistance

Medical advances

Ex: Insulin

Environmental improvements

Ex: Fish to eat algae
Bacteria to eat oil.

know your labels

Genetically Modified



5 digit code starting with 8



Organic



5 digit code starting with 9



conventionally Grown



4 digit code starting with 3 or 4



TOP 10 GENETICALLY MODIFIED FOODS

cifically,

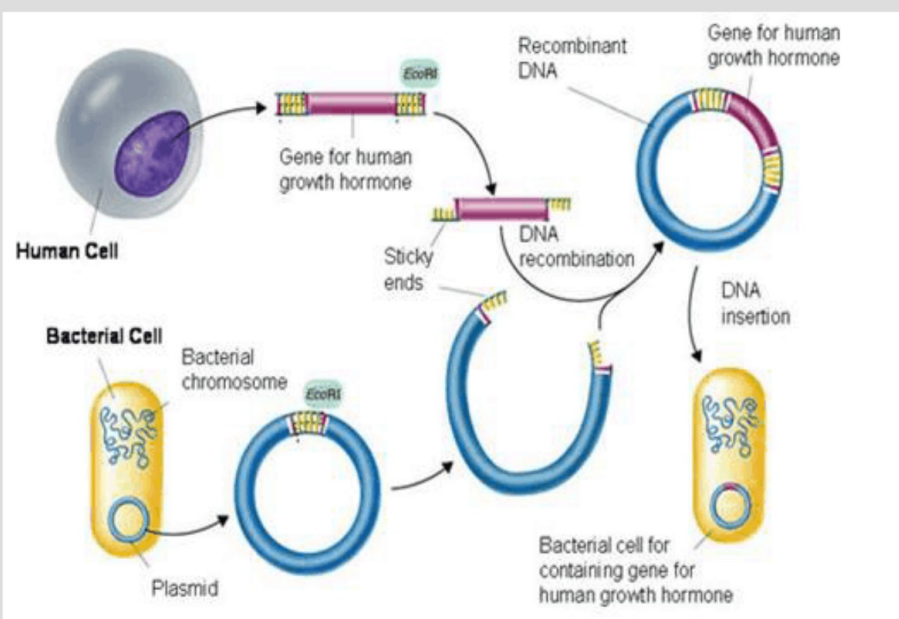


Example: We take human genes that make insulin (hormone that regulates your blood sugar) and put them into a bacterial plasmid (extra bacterial DNA). Then the bacteria will make human insulin and we can extract it for medical purposes!

Makes a protein or chemical our body is lacking!

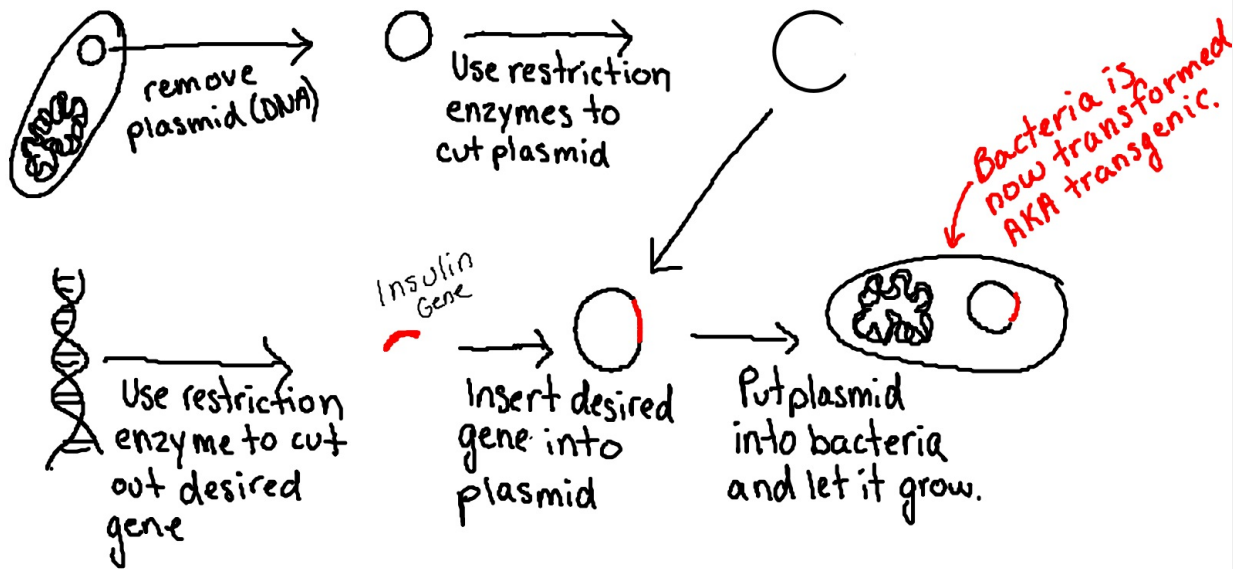
*Insulin is the first commercially made/sold transgenic product!





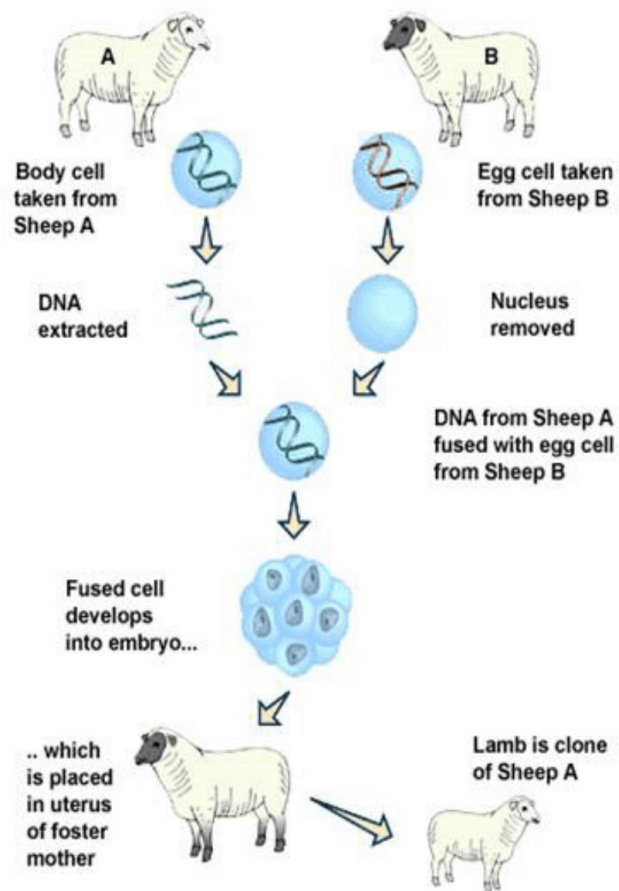
Both the plasmid and the DNA are cut using **restriction enzymes**.

Steps in bacterial transformation (Recombinant DNA)



Cloning

- **Clone**- a member of a group of genetically identical cells
- May be produced by **asexual reproduction** (mitosis)



Cloning "Dolly"



From 277 cell fusions, 29 early embryos developed and were implanted into 13 surrogate mothers. But only one pregnancy went to full term.



Cloning organisms

- A **body cell** from one organism and an **egg cell** from another are fused
- The resulting cell **divides like a normal embryo**

15





There are two main types:



1. Reproductive cloning: used to make a new organism. Has been done in a variety of large and small animals including sheep, cows, goats, rats, mice.

2. Therapeutic cloning: cloning your cells so that they can be put back into your body.

Human Genome Project (HGP)

17



Human Genome Project

- Started in **1990**
- Research effort to **sequence all of our DNA** (46 chromosomes)
- Over 3.3 billion nucleotides
- **Mapping every gene** location (loci)
- Conducted by **scientists around the world**



Benefits of Human Genome Project

- Improvements in **medical prevention** of disease, gene therapies, diagnosis techniques ...
- **Production of useful protein products** for use in medicine, agriculture, bioremediation and pharmaceutical industries.
- Improved **bioinformatics** - using computers to help in DNA sequencing ...

20



PROS

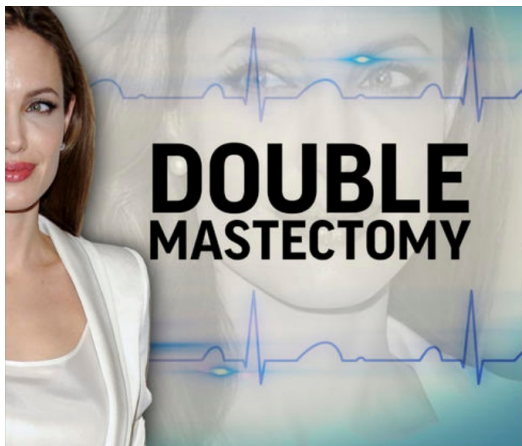
We can determine which genes cause cancers and various diseases

We can look at someone's DNA and see if they are likely to get a disease/disorder

CONS

People might have access to this information that you don't want to

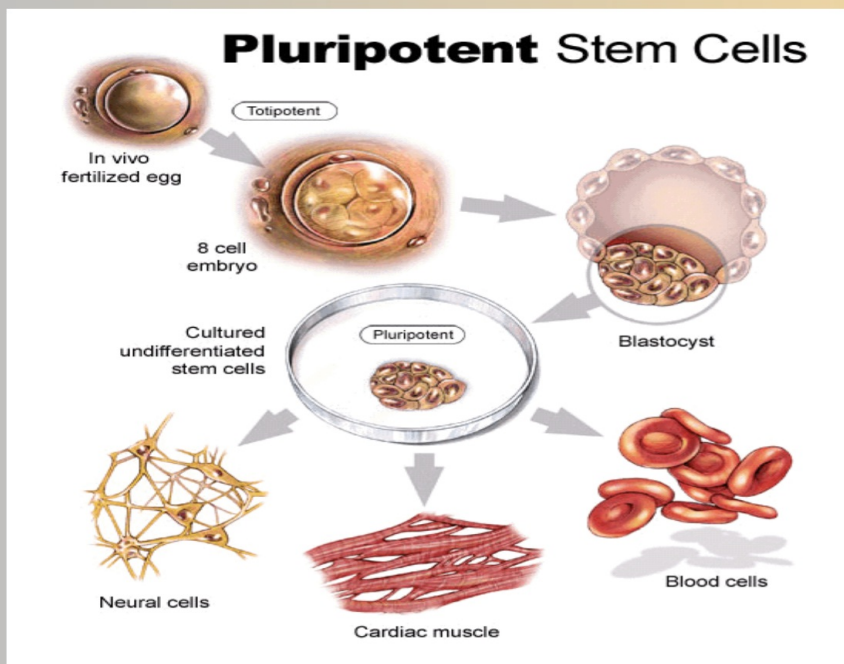
Parents might genetically "select" their children to have certain traits



FOX 25 ACTRESS ANGELINA JOLIE
6:13 44° UNDERGOES DOUBLE MASECTOMY
HIGHS AROUND 60 DEGREES. WINDS: N 5-15 MPH, SEA BREEZE ALONG THE COAST **FOX 25** A G

Stem Cell Research

Stem cells have the ability to become any cell in the body if they receive the right signals!



🌐 stem cell potential

🌐 stem cell interactive

🌐 early stem cell research

embryonic stem cells- have the ability to become any cell!

- could be used for human organ transplants, curing cancers, diseases, and even spinal cord injuries

- controversial because they require the destruction of a human embryo

Adult stem cells- found in adults in places like bone marrow. Less flexible than embryonic stem cells.

- are used to successfully treat leukemia and other blood/bone marrow diseases

- less controversial