

Biotechnology and Genetic Engineering

Manipulating or altering DNA to produce a different organism or product.

Benefits:

- Improved food products (Ex: Frost resistance, pest resistance, and herbicide resistance)
- Medical advances (Ex: Insulin)
- Environmental improvements (Ex: Fish to eat alga and bacteria to eat oil)

Selective Breeding

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

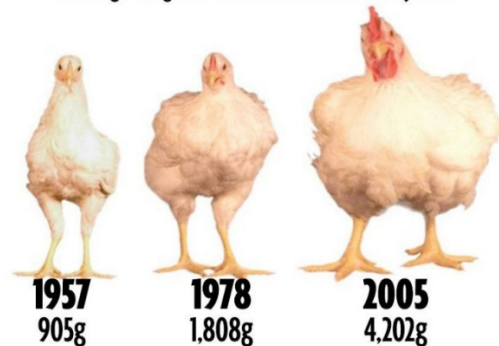
Ex: Dog breeding

Horses

Arranged Marriages

Super cows

JUST HOW BIG ARE TODAY'S CHICKENS?
Average weight of chicken breeds at 56 days old



Genetic engineering is not as easy as it seems:

- First the DNA must be extracted from cells.
- The cells are lysed with an enzymes and the sticky DNA is "spooled".



Restriction Enzymes

- Restriction enzymes are chemical scissors that cut the DNA at a specific sequence.
- They allow for the DNA to be more useable/manageable.

Ex: BamH I

5'... GGATCC ...3'

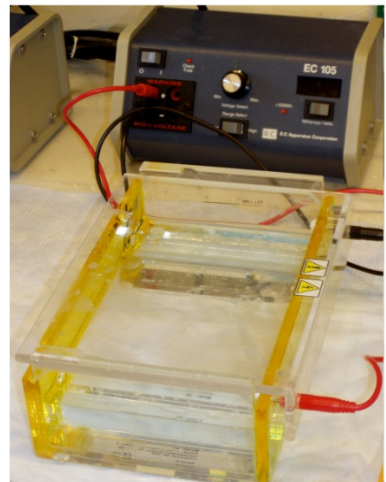
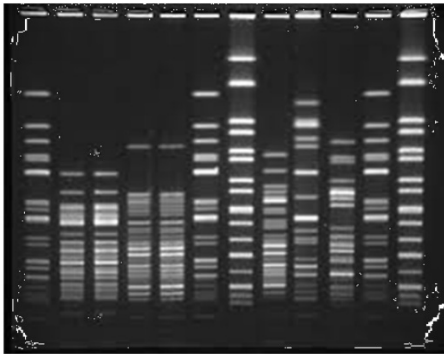
3'... CCTAGG ...5'

ACTGGGATCCTTGATGGATCCAT

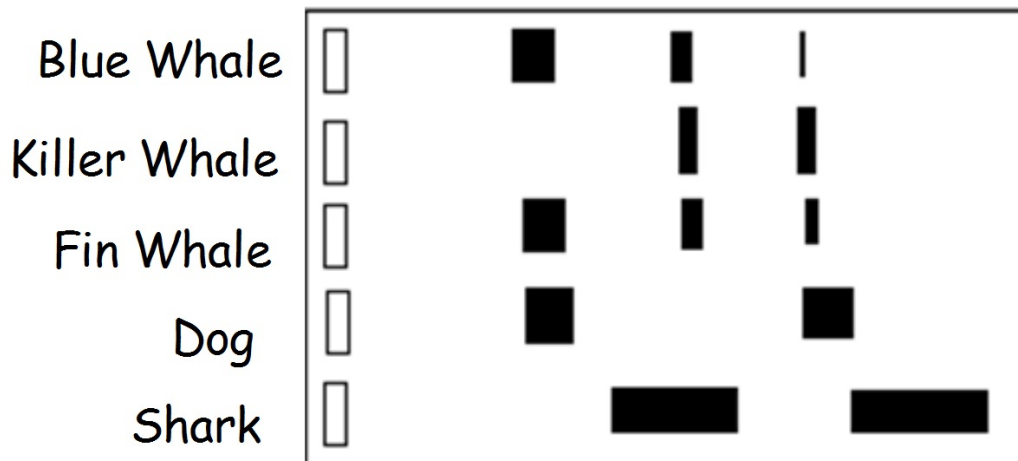
TGACCCTAGGAACTACCTAGGTA

Gel Electrophoresis or DNA Fingerprinting

- Used to separate DNA to isolate a specific gene.
- 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.



Which organism is most closely related to the blue whale?



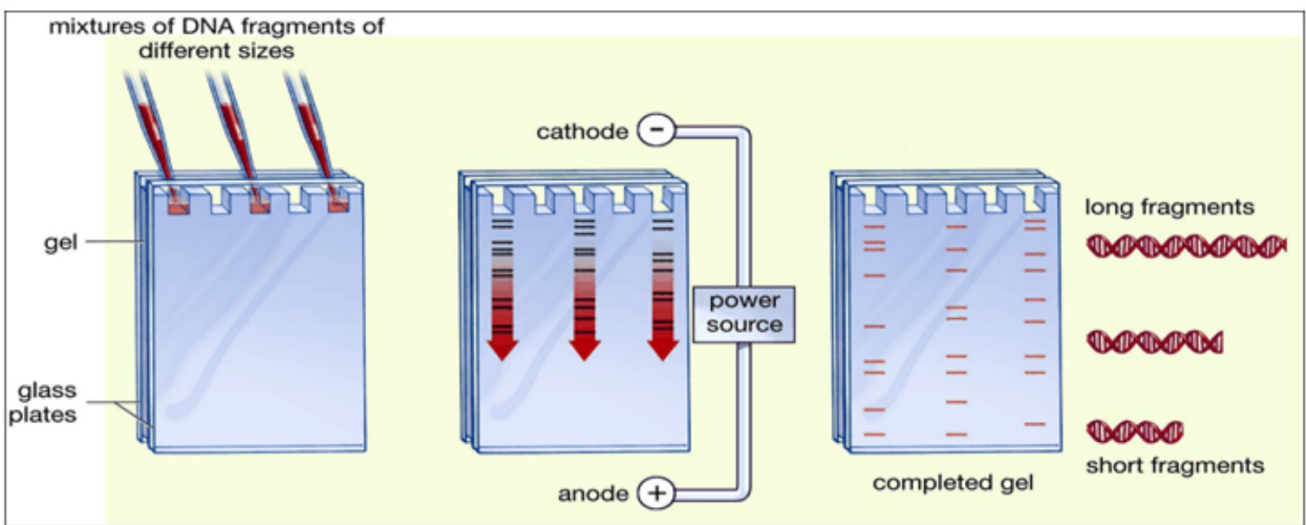
How is the DNA separated?

The DNA is cut with the restriction enzymes.
Then, it is loaded into the gel and hooked up to an electrical source.

The negative electrical source repels the negative DNA.

DNA is separated by size!

-Small fragments move further down the gel.



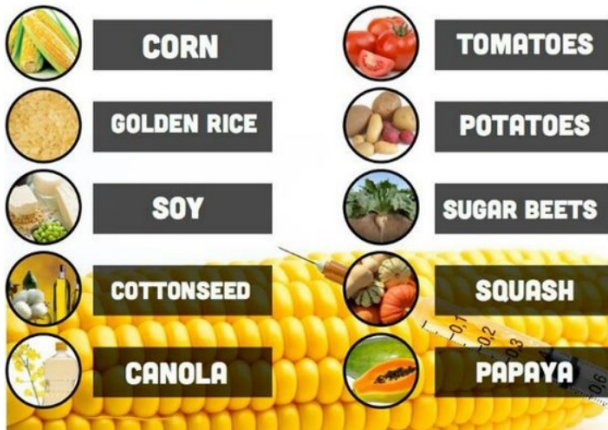
GMO's / GMC's / Transgenic Organisms

The genes from one organism and insert them into the DNA of another organism.

- 92% of U.S. corn is genetically engineered
- 94% of soybeans
- 94% of cotton (cottonseed oil is often used in food products).
- It has been estimated that upwards of 75% of processed foods on supermarket shelves - from soda to soup, crackers to condiments - contain genetically engineered ingredients.

TOP 10 GENETICALLY MODIFIED FOODS

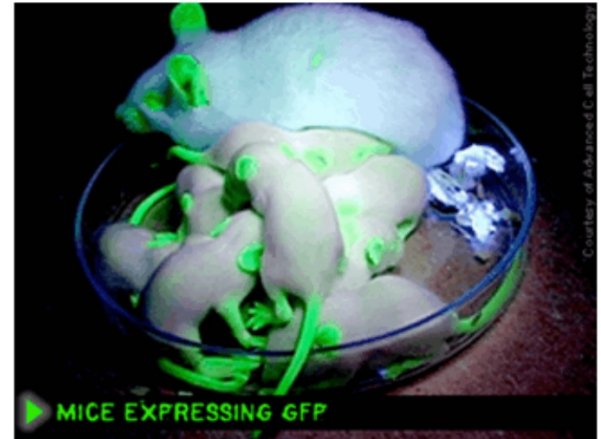
WWW.LIVELOVEFRUIT.COM



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
		

www.Facebook.com/MamasHealthWebsite



Benefits and Concerns:

Benefits:

- Increased profit for farmers.
- Less spoilage
- Vitamin fortified foods (important in poverty stricken countries).
- Medical advancements

Concerns:

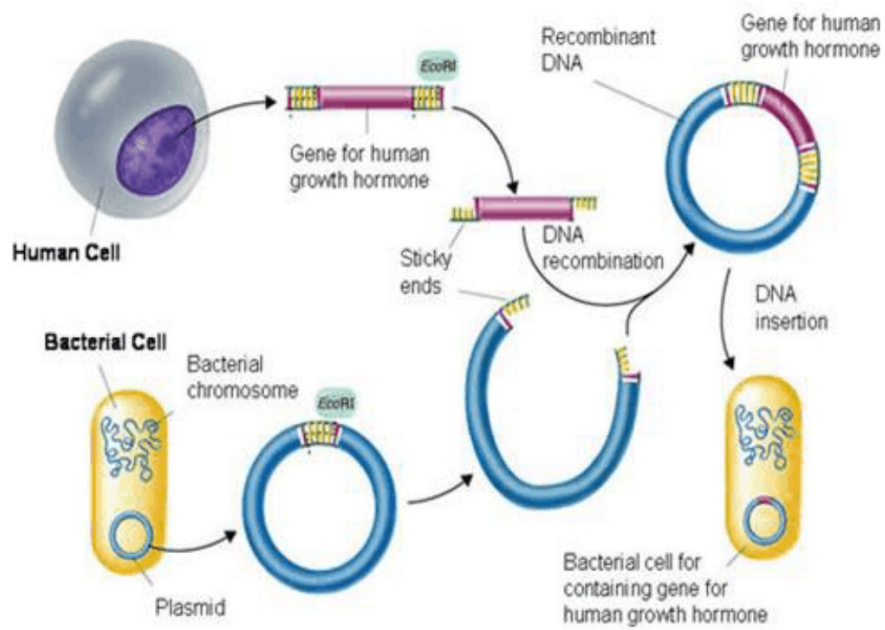
- Nobody know the long term effects
- Cross contamination
- Poor digestion and increase in health issues (gluten intolerance).

Transgenic Bacteria / Bacterial Transformation

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

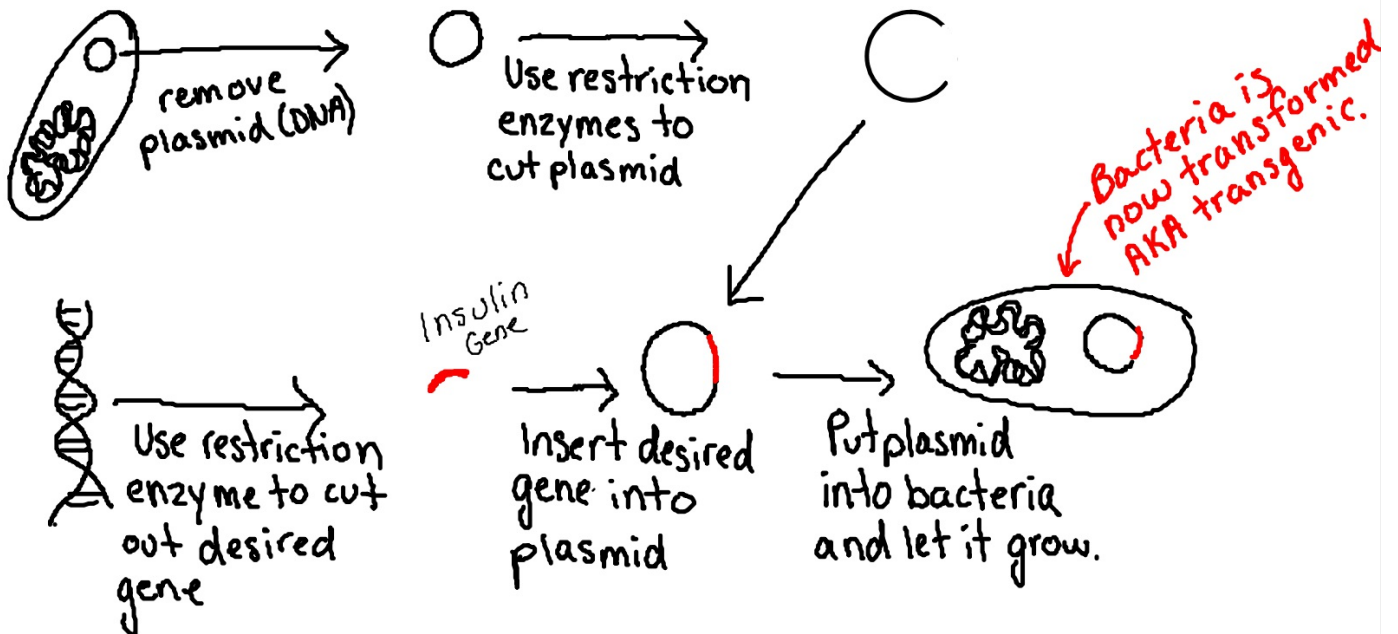
Makes a protein or chemical our body is lacking!

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



Restriction enzymes cut the DNA and the plasmid.

Steps in bacterial transformation (Recombinant DNA)



Cloning

Making exact genetic copies of cells, tissues, or organisms.

Two Type:

1. **Therapeutic**- Cloning your cells so that they can be put back into your body.

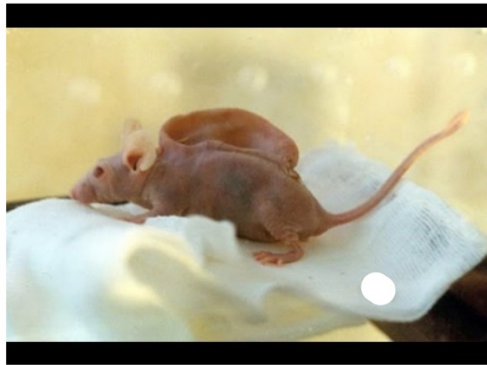
Benefits:

- No chance of rejection of the tissue, since it is the donor's tissue.
- No waiting for a donor.

Concerns:

- Still experimental!

Orange header bar



Cloning Continued

2. **Reproductive**- Making an exact copy of an organism.

Benefits:

- Used for medical and research purposes.
Ex: Test different medicines on the same organism.
- Possibly used for extinct/endangered animals.

Concerns:

- It can not be done reliably accurate.
- What is the limit and who decides?

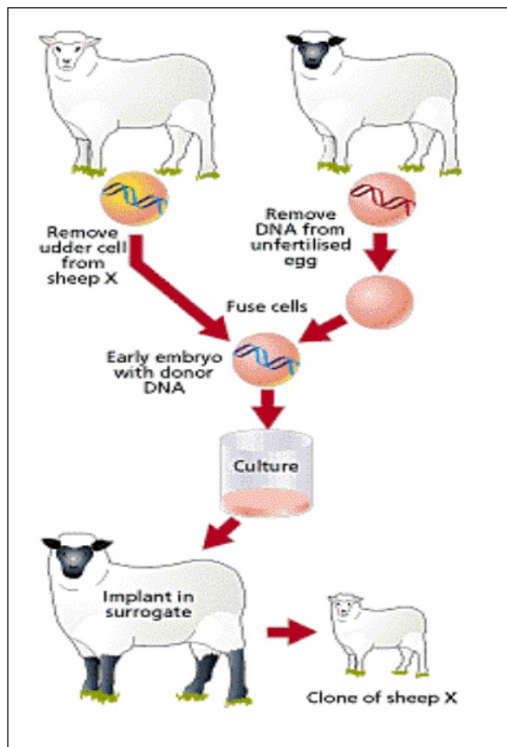
Dolly the Sheep

(July 5, 1996 - February 14, 2003)



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

How is cloning done:



1. Remove a body cell from an organism and remove its nucleus.
2. Remove the nucleus from your desired organism's cell.
3. Implant the desired nucleus into the empty body cell.
4. Implant into a surrogate.

Human Genome Project

A quest to sequence all 3 billion letters, or base pairs, in the human genome(**a complete** set of DNA in the human body).

- Started in 1990 and completed in 2003.

Benefits:

- Helped us understand the genetic factors in human disease,
- Provided new strategies for diagnosis, treatment and prevention of diseases.
- Improvements in technology for sequencing.

Biotechnology and Genetic Engineering

Concerns:

- Who would have access to your medical info?
- Family and insurance disclosure
- Do you really want to know?
- Designer babies





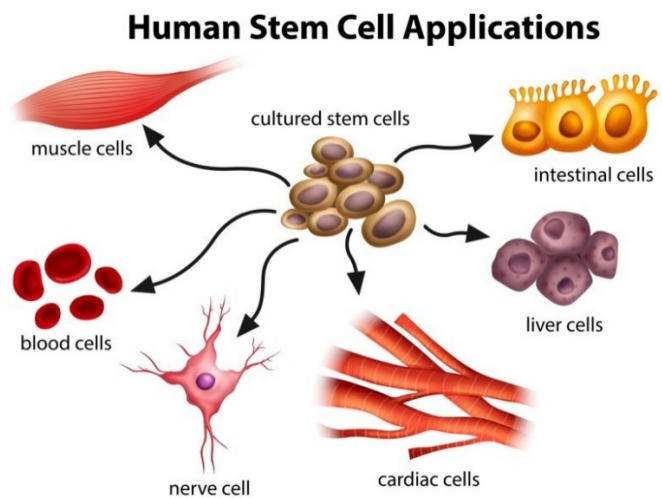
FOX 25 ACTRESS ANGELINA JOLIE
6:13 44' UNDERGOES DOUBLE MASECTOMY
HIGHS AROUND 60 DEGREES. WINDS: N 5-15 MPH, SEA BREEZE ALONG THE COAST FOX 25 A GREAT NIC

Stem Cells

Stem cells are undifferentiated/unspecialized cells that have the ability to become many types of cells.

Two Types:

1. Embryonic Stem Cells
2. Adult Stem Cells



Embryonic Stem Cells

Obtained from the umbilical cord or from a blastocyst (a few divided cells).

Benefits:

- Have the ability to become any cell!
 - Could be used for human organ transplants, curing cancers, diseases, and even spinal cord injuries.

Concerns:

- Highly controversial because they require the destruction of a human embryo in harvesting.
- Unnatural-death and illness or part of life.

Adult Stem Cells

Found in adults in places like bone marrow.
They are less flexible than embryonic stem cells.

Benefits:

- Are used to successfully treat leukemia and other blood/bone marrow diseases
- Much less controversial since they are obtained from a consenting adult.

Concerns:

- Not natural

