

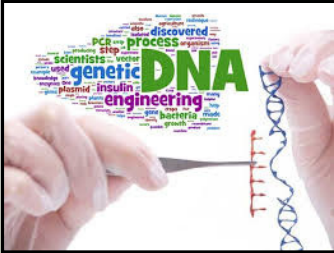
DNA Technology

Genetic Engineering/Biotechnology


Genetic Engineers can alter the DNA code of living organisms.

Examples

- ▶ Selective Breeding
- ▶ Recombinant DNA
- ▶ Gel Electrophoresis
- ▶ Transgenic Organisms (GMOs)






DNA Technology



Using DNA technology:

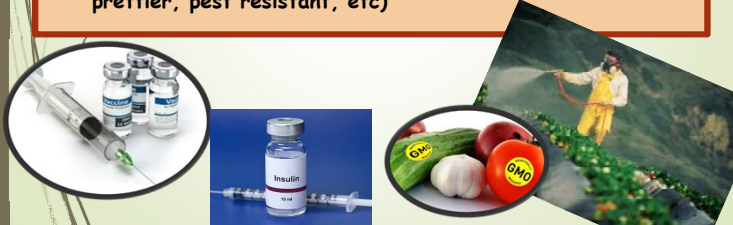
1. Cure diseases
2. Treat genetic disorders
3. Improve food crops
4. Improve the lives of humans.

DNA Technology

Practical Uses of DNA Technology

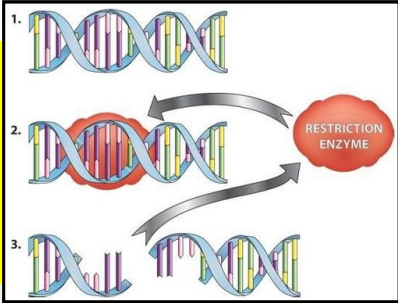
1. Pharmaceutical products (ex. A bacteria is used to produce human insulin)
2. Vaccines - safer and more effective
3. Pest resistance
4. Increase agricultural yields (Crop plants are bigger, prettier, pest resistant, etc)



DNA Technology

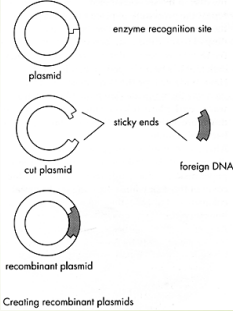
How can genetic engineers manipulate genes?

They can cut segments of DNA using restriction enzymes into smaller, more manageable pieces.



Recombinant DNA Technology

- ▶ The ability to combine the DNA of one organism with the DNA of another organism.
- ▶ Use "restriction enzyme" to cut out a bad gene
- ▶ Use a "cloning vector" to insert (splice) a good gene
- ▶ Recombinant DNA technology was first used in the 1970's with bacteria.



enzyme recognition site

plasmid

sticky ends

cut plasmid

foreign DNA


recombinant plasmid

Creating recombinant plasmids

Recombinant DNA Technology





Benefits of Recombinant Bacteria

1. Bacteria can make human insulin or human growth hormone.
2. Bacteria can be engineered to "eat" oil spills.




Selective Breeding

- ▶ Breed only those plants or animals with desirable traits
- ▶ People have been using selective breeding for 1000's of years with farm crops and domesticated animals.

Genetically Modified Organism (GMOs)











The DNA of plants and animals can also be altered.



PLANTS

1. disease-resistant and insect-resistant crops
2. Hardier fruit
3. 70-75% of food in supermarket is genetically modified.

Top 10 genetically modified foods

 Corn	 Soy	 Cottonseed	 Papaya	 Rice
 Rapeseed (Canola)	 Potatoes	 Tomatoes	 Dairy products	 Peas

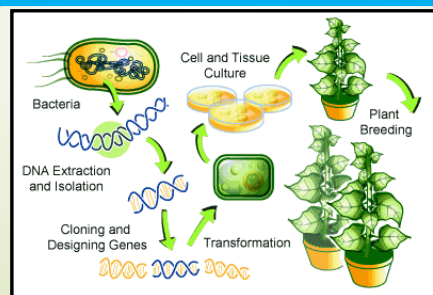
www.HealingPowerHour.com

GMO video

Genetically Modified Organism (GMOs)

How to Create a Genetically Modified Plant

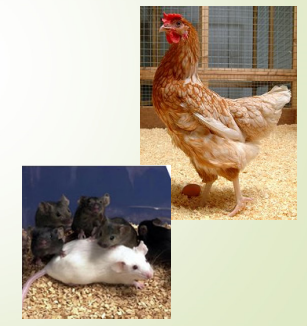
1. Create recombinant bacteria with desired gene.
2. Allow the bacteria to "infect" the plant cells.
3. Desired gene is inserted into plant chromosomes.



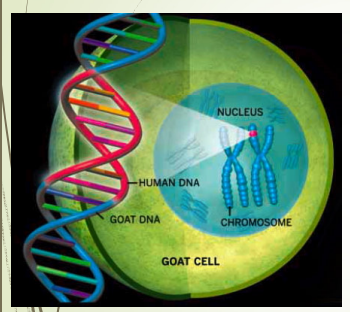
Genetically Modified Organism (GMOs)

Genetically modified organisms are called **transgenic organisms**.

- ### TRANSGENIC ANIMALS
1. Mice - used to study human immune system
 2. Chickens - more resistant to infections
 3. Cows - increase milk supply and leaner meat
 4. Goats, sheep and pigs - produce human proteins in their milk



Transgenic Goat



Human DNA in a Goat Cell

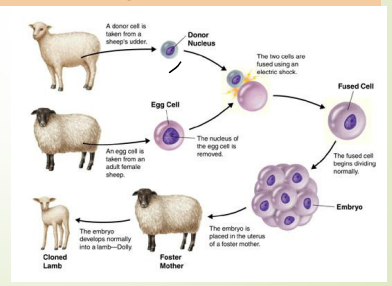
This goat contains a human gene that codes for a blood clotting agent. The blood clotting agent can be harvested in the goat's milk.

Cloning

Cloning describes the processes used to create an exact genetic replica of another cell, tissue or organism.

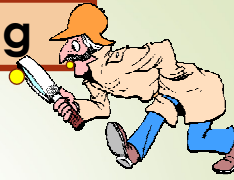


Dolly the sheep



DNA Fingerprinting

This technology allows scientists to identify someone's DNA!

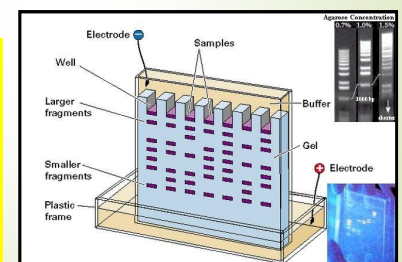
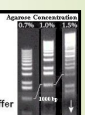



- A pattern of bands made of DNA fragments
- Compare the band pattern to see if 2 samples are related
- Used in forensic science

DNA Fingerprinting

➤ Gel Electrophoresis is a technique used to separate DNA fragments according to their size and charge

1. "Cut" DNA sample with restriction enzymes.
2. Run the DNA fragments through a gel.
3. Bands will form in the gel.
4. Everyone's DNA bands are unique and can be used to identify a person.
5. DNA bands are like "genetic fingerprints".

[Animation](#)

DNA Fingerprinting

Forensic Science

DNA Fingerprints From a Murder Case

Defendant's blood (D)

D

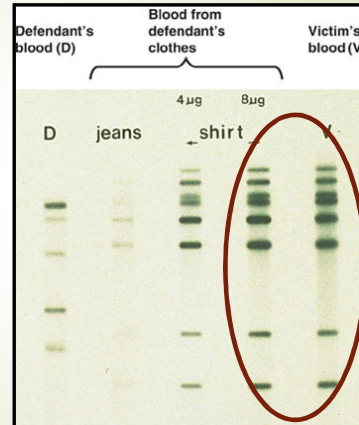
Blood from defendant's clothes

4 µg jeans

8 µg shirt

Victim's blood (V)

V




Was he the killer?


[Video](#) [Video](#)

Which suspect is the criminal?


DNA samples from:


crime scene





suspect #2

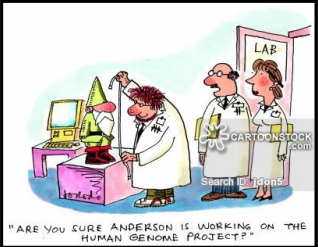
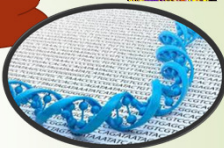




Human Genome Project

Started in 1990-
Finished 2003

- Mapping – find the location of every gene on every chromosome
- Sequencing – find the sequence of the entire human genome has 3 billion nucleotides, about 100,000 genes
- Find out the function of each gene
→ gene therapy – inserting normal genes into human cells to correct genetic disorders



"ARE YOU SURE ANDERSON IS WORKING ON THE HUMAN GENOME PROJECT?"