

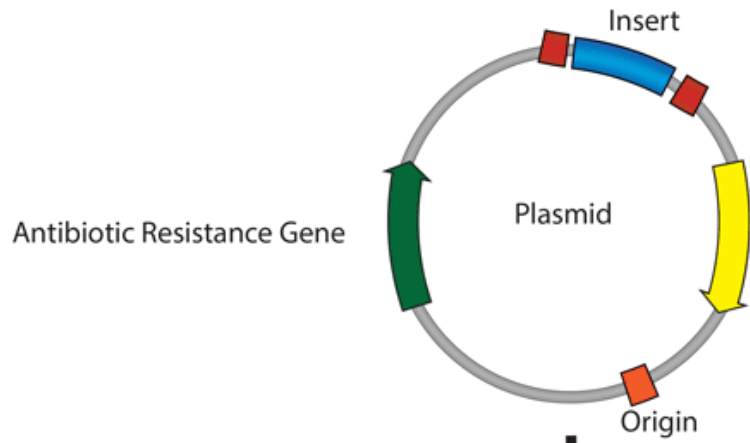
BIOTECHNOLOGY

Cell Transformation

- ⦿ A cell takes in DNA from outside the cell
- ⦿ This external DNA becomes a component of the cell's DNA
= Recombinant DNA

Transformation Steps:

1. Locate desired DNA in donor organism
2. Foreign DNA is inserted into a bacterial plasmid
3. Bacteria takes in plasmid
4. Bacteria then replicates the foreign DNA
5. Produces product



Transformation of Plasmid into Bacterial Cell

Plasmid in cell expresses antibiotic resistance gene

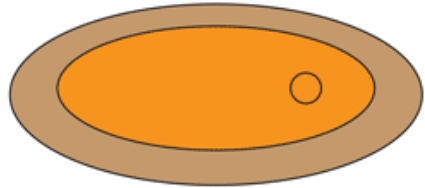
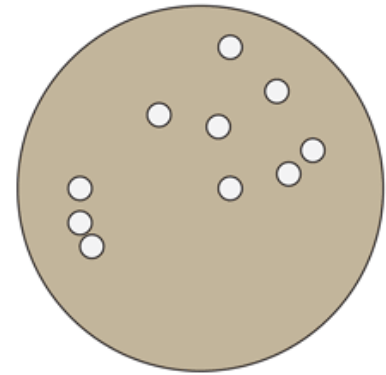


Plate cells on LB Agar Antibiotic

Only cells that contain the plasmid will be able to grow/divide and form colonies.



Transgenic Organism

- Contain genes from other organisms

Importance of Transgenic Organisms

- ① Increase genetic variability
- ① Cheaply produce human proteins for use in medicine
 - Human insulin
- ① Improve food supply
 - Can produce crops that are resistant to weed-killing chemicals

Genetically Modified Organisms (GMO's)

- Organisms' whose genetic material has been artificially manipulated through genetic engineering

Examples of GMO's:

- BT Corn
- Drought Resistant crops
- Medicine

Advantages of GMO's:

⦿ Increase food supply:

- Freeze resistance
- Pest resistance
- Decrease food prices

⦿ Research use:

- Medicine
- Drugs
- Gene Therapy

Gene Therapy

- ① Using genes to treat or prevent diseases
- ① Insert genes into a patient's cell instead of a drug or surgery
 - Replace mutated gene
 - Inactivate a mutated gene

- E.g. Cystic Fibrosis
 - Severe Combined Immunodeficiency

Disadvantages of GMO's:

- ⦿ May interbreed with wild organisms and spread a gene that is not naturally occurring in the population
- ⦿ Environmental impacts
 - Chemical contamination
- ⦿ Chemical traces in food
- ⦿ Human Health
 - No long-term data
- ⦿ In U.S. labels aren't required

A GMO IS:

the direct human manipulation of an organism's DNA in a laboratory environment.

GMO?

Genetically Modified Organism

A GMO IS NOT:

Plants and animals that are traditionally bred to achieve specific characteristics such as breeding dogs or cross-pollination of plants



SCIENCE OF GMOS

Genetic modification may include the **ADDITION OF DNA** from species that would **NOT BREED** in nature.

Genetic modification may also involve **REMOVING SPECIFIC STRANDS OF DNA**.

Cross-species—or transgenic—genetic manipulation has gone so far as to **COMBINE FISH DNA WITH STRAWBERRIES** and tomatoes.



GMO foods have only existed in groceries since the late 1990's.

GMO life can be patented

GMO varieties of corn and potatoes are engineered to **PRODUCE THEIR OWN PESTICIDES**.

STUDIES OF GMOS

NO LONG-TERM TESTING.

It took decades for the dangers of Trans-Fats (another artificial food) to become understood.

Mice fed GM pesticide-producing corn over four generations showed **ABNORMAL** structural and chemical changes to various organs and significantly reduced fertility.



Pesticide-producing GMO crops have led to **RESISTANCE IN INSECTS**.



TRANSGENIC DNA HAS BEEN FOUND IN **80% OF WILD CANOLA** IN NORTH DAKOTA

herbicide-resistant crops can cross-pollinate to create **HERBICIDE-RESISTANT WEEDS**.

PREVALENCE OF GMOS

You probably eat GMOs **EVERY DAY**.



30,000

different GMOs exist on grocery store shelves (largely because of how many processed foods contain soy)

PERCENT OF GMOS IN TOTAL CROP PRODUCTION 2011 (USA)



PUBLIC OPINION OF GMOS

Polls consistently show that a significant majority of North Americans would **LIKE TO BE ABLE TO TELL** if the food they're purchasing contains GMOs.

OUT OF A CBS NEWS POLL:



87% want GMOs labelled



53% would not buy genetically modified food

NATIONAL OPINIONS OF GMOS:

The USA is the **largest** producer of GMO crops and **does not mandate** labels for GMO food.

In 30 other countries there are bans or restrictions on the production of GMOs, because they are **not considered** proven safe.

Cloning

- ⦿ Producing genetically identical individuals
- ⦿ 1997- Cloned a sheep named Dolly
 - Dolly and her DNA donor are genetically identical
- ⦿ Ethical concerns for cloning humans



Stem Cell Research

- Primary Goal: Grow organs for transplant surgery



Human Genome Project:

- 1990- ongoing effort to analyze the human DNA sequence
- 2000- completed copy of human DNA sequence
- Goal: determine genetic make-up of humans (all 3.3 billion basepairs)
- Advantages: helps with gene therapy and treatment of genetic disorders