

The logo of Galgotias University is a circular emblem with a stylized 'G' shape. It features three curved, overlapping bands in shades of yellow, blue, and red, set against a light brown background.

Biotechnology, Cloning and Genetic Engineering

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Disclaimer

All the content material provided here is only for teaching purpose.

The logo of Galgotias University is a stylized circular emblem. It features three overlapping, curved bands that spiral inward. The outermost band is a light pinkish-red, the middle band is a pale yellow, and the innermost band is a light blue. The bands are separated by thin white gaps, creating a sense of depth and movement.

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Selective Breeding

- Humans use selective breeding to pass desired traits on to the next generation.
- Selective breeding is AKA artificial selection
(humans decide who will breed instead of nature)
- Hybrids (heterozygous for a trait) can be used to increase hardiness of plants.
- Inbreeding keeps desired traits within a line of organisms by breeding related organisms.

Increasing Variation

- To increase variation, breeders often introduce **mutations** (the ultimate source for genetic variation) into the population.
- Breeders discovered a pumpkin **mutation** that produced white Spots.
- With careful inbreeding they eventually able to produce a white pumpkin.



Biotechnology

- The terms "biotechnology" and "genetic modification" commonly are used interchangeably
- **Biotechnology** is a field of applied **Biology**
- Biotechnology involves the use of living organisms and bioprocesses in engineering, technology, medicine and other fields requiring bioproducts.

Biotechnology

- **Biomimicry**- is imitating living organisms to solve human problems.
- My favorite example is velcro that we have all become so dependent on.



Biotechnology-Cloning

- A **clone** is a member of a population of genetically identical cells produced from a single cell.
- Dolly-the famous sheep
- Cows , Cats and more.
- Can we bring back endangered or even extinct species?



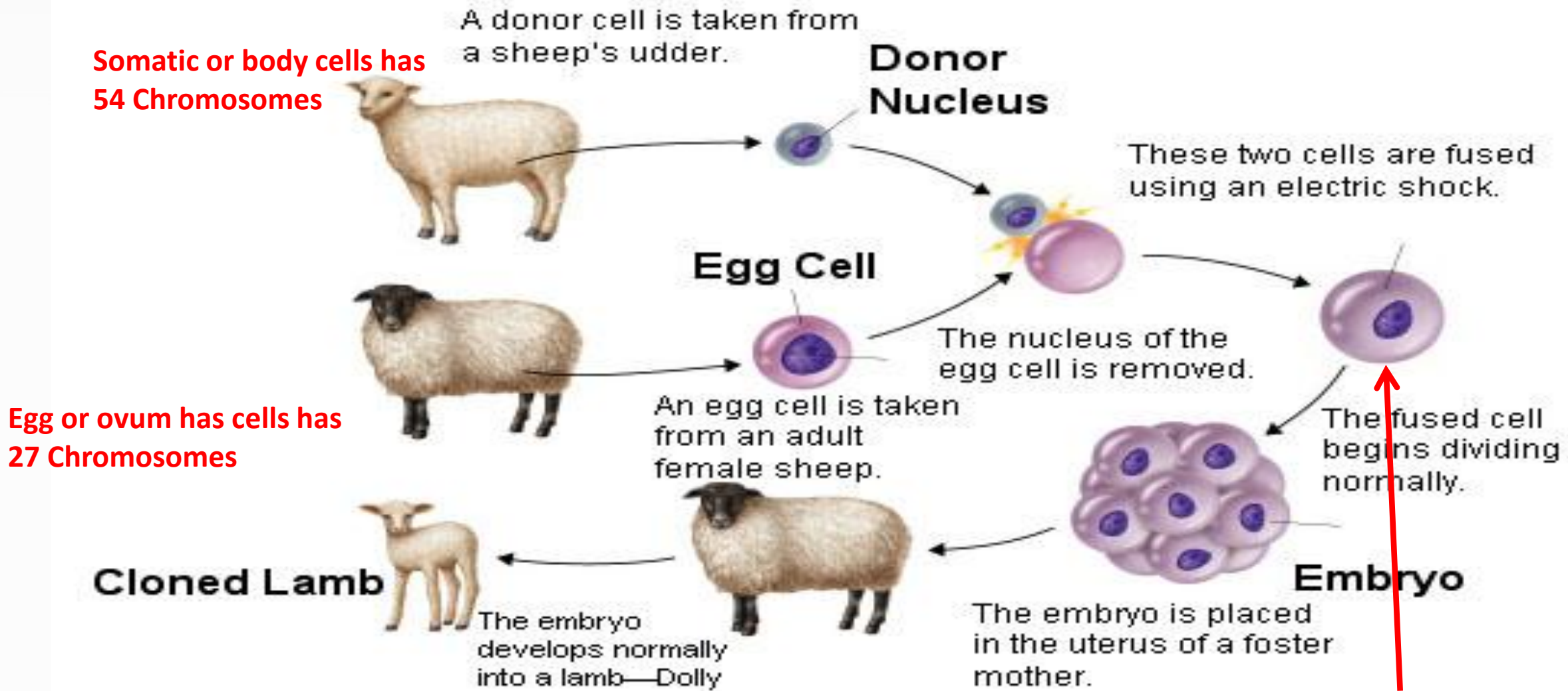
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Reproductive cloning

- Reproductive cloning generally uses "[somatic cell nuclear transfer](#)" (SCNT) to create animals that are genetically identical.
- This process entails the transfer of a nucleus from a donor adult cell (somatic cell) to an egg that has no nucleus.
- If the egg begins to divide normally it is transferred into the uterus of the surrogate mother.

Dolly the sheep

- Dolly, the sheep was the first mammal to have been successfully cloned from an adult cell.
- Dolly was formed by taking a cell from the udder (**54 Chromosomes**) of her biological mother.
- Her embryo was created by taking the nucleus of that cell and inserting it into a sheep ovum.
- The embryo was then placed inside a female sheep that went through a normal pregnancy.†



Somatic or body cells has 54 Chromosomes

Egg or ovum has cells has 27 Chromosomes

Fused cells has 54 tricking the cell into thinking it got fertilized by a sperm

Dolly the sheep

- She was cloned at the [Roslin Institute](#) in [Scotland](#) and lived there from her birth in 1996 until her death in 2003 when she was six.
- This photo is of Dolly and her first lamb called Bonnie

Telomeres get shorter as an organism ages



BioTechnology- Genetic engineering

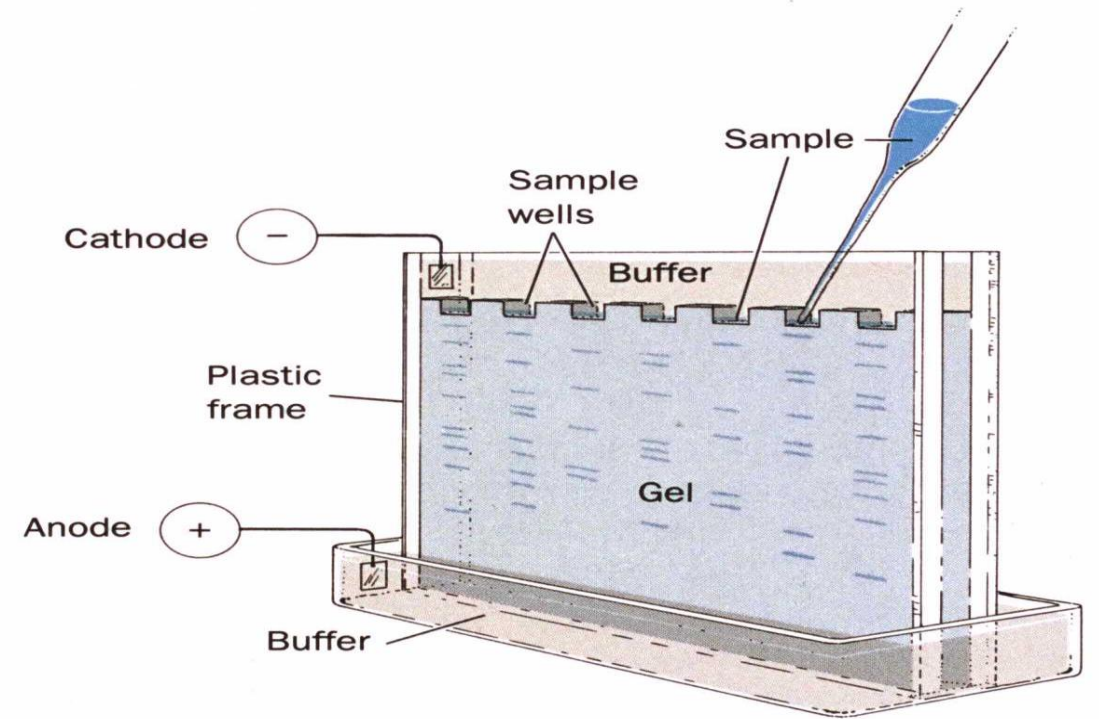
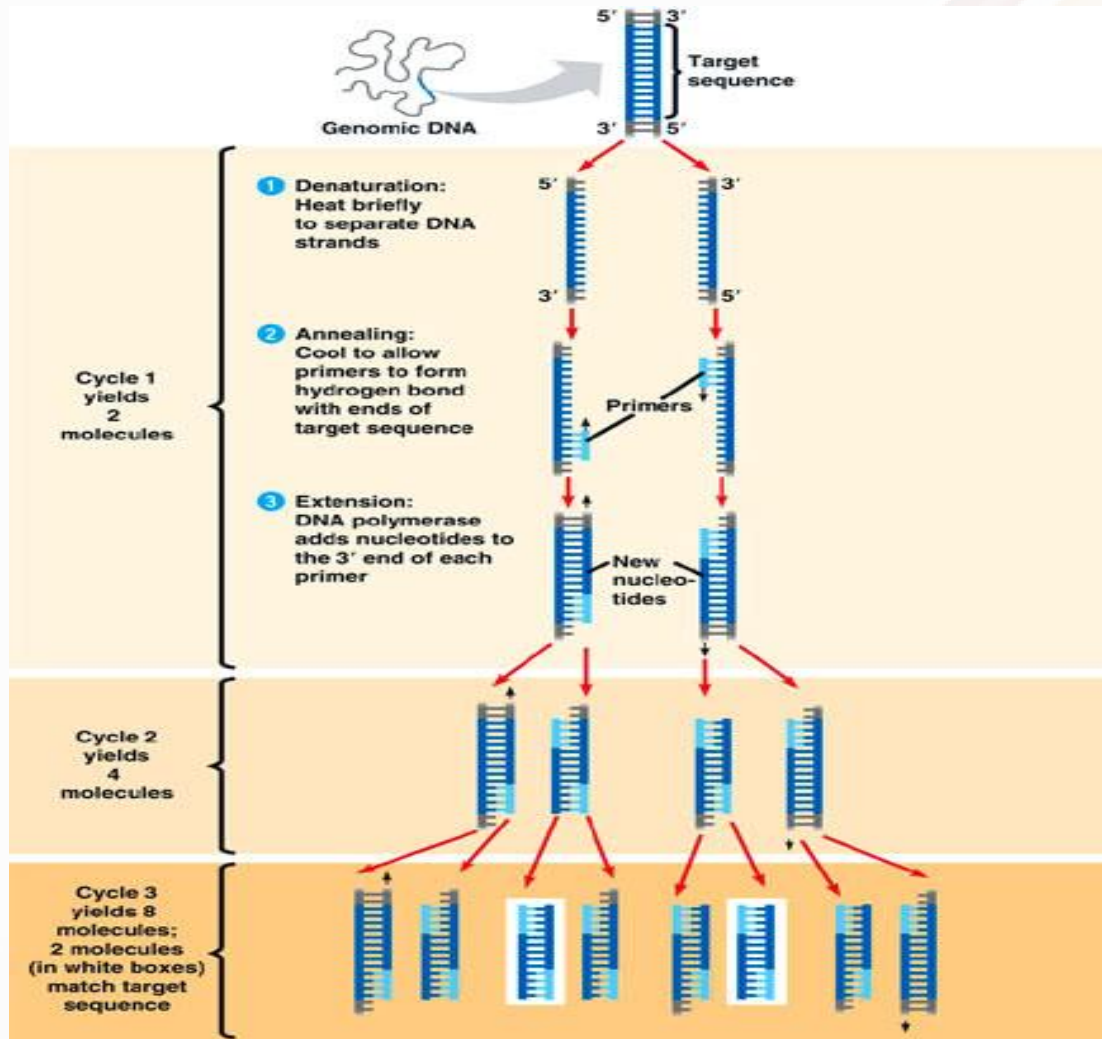
- **Genetic engineering**- the direct human manipulation of an organism's genome using modern DNA technology.
- It involves the introduction of foreign or synthetic genes into the organism of interest.

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Manipulating DNA

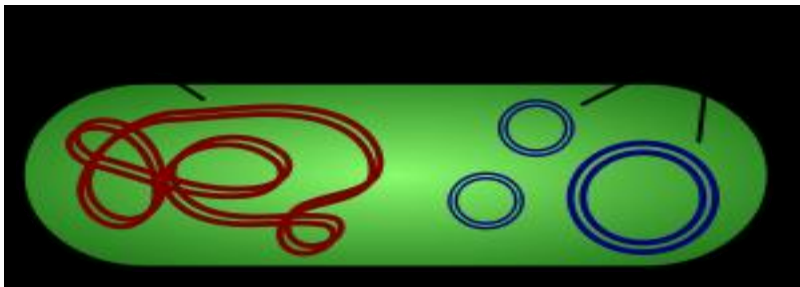
- Using their knowledge of DNA and various techniques, scientists can extract, cut, identify and copy DNA.
- DNA Extraction – simple chemical procedure to separate DNA.
- DNA Cutting – restriction enzymes cut particular DNA sequences.
- Separating DNA – gel electrophoresis.
- Copy – using polymerase chain reaction “PCR”

Gel Electrophoresis and PCR

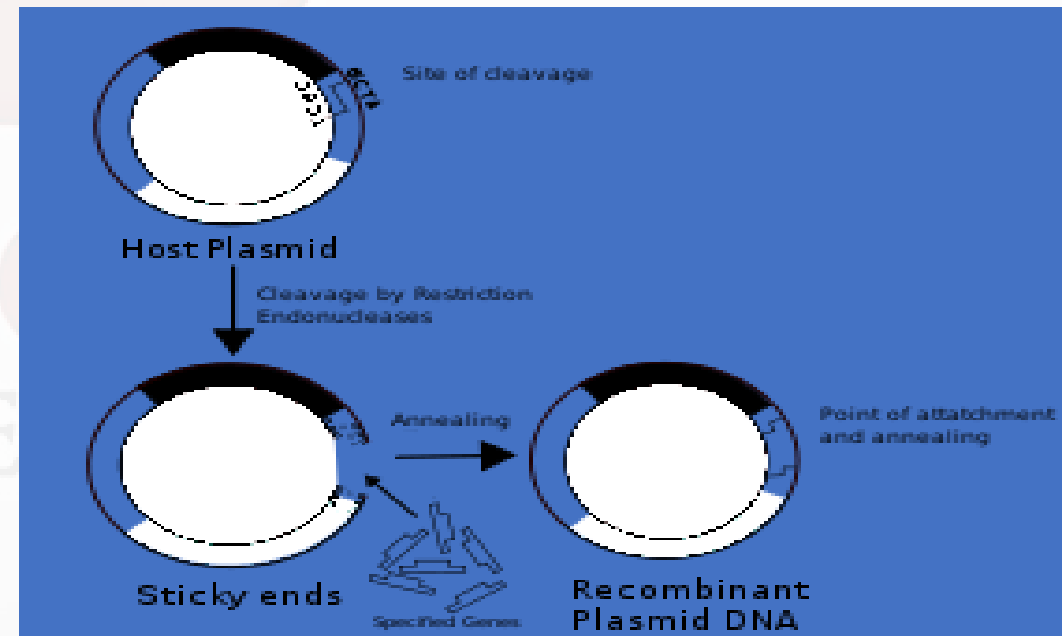


- **Recombinant DNA technology**- Combining genes from different organisms
- The resulting organism is said to be "**genetically modified**," "**genetically engineered**," or "**transgenic**."
- The first organisms genetically engineered were bacteria in 1973 and then mice in 1974.

- **Insulin** -producing bacteria were commercialized in 1982
- Formation of recombinant DNA requires a cloning vector, a DNA molecule that will replicate within a living cell.
- Vectors are generally derived from plasmids or viruses.



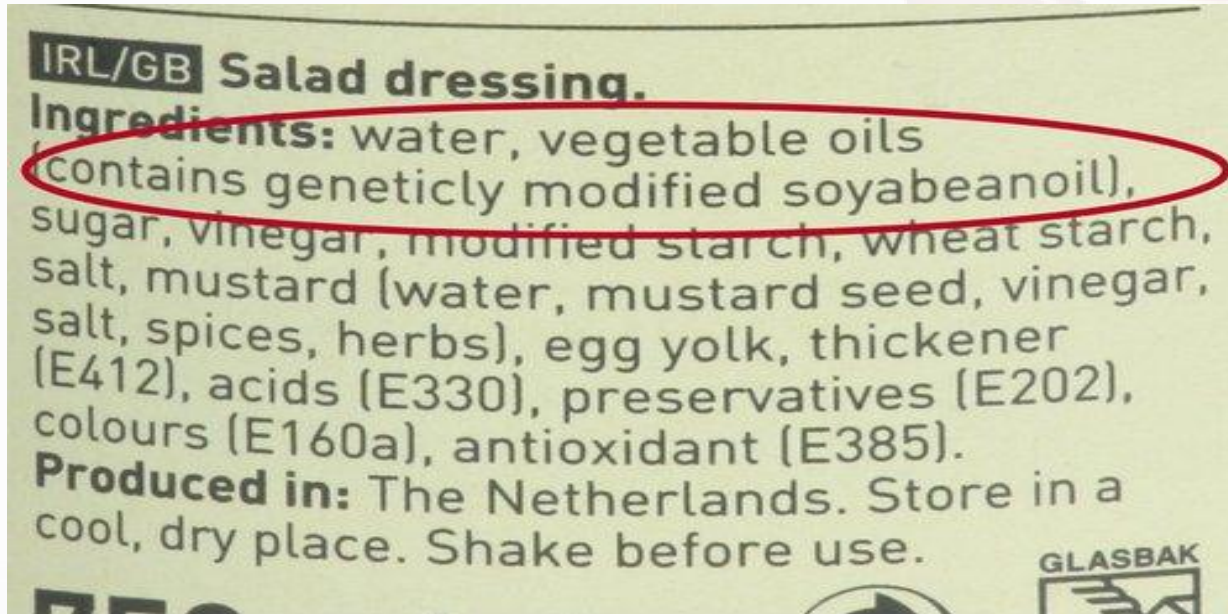
Plasmid- a DNA molecule that is separate from, and can replicate independently of, the chromosomal DNA



Genetic Engineering-Transgenic Organisms

- **Transgenic organisms** contain genes from other organisms.
- Making onions glow using jellyfish DNA.
- Using bacteria to make human insulin.
- Using genetic modification to improve food supply known as GM foods.

- One of the best-known and **controversial** applications of genetic engineering is the creation of **genetically modified foods**.
- Genetically modified food has been sold since 1994.



Currently in the U.S.
labeling of GMF is not
mandatory

Genetically Modified Food

- This is a short list of the genetically modified food crops that are grown in the US today:

Corn

Soy bean

Sugar cane

Tomatoes

Potatoes

Sweet peppers

Bananas

StrawberriesZucchini

Pineapples Cocoa beansYellow squash

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Ethical and safety concerns

- A major safety concern relates to the human health implications of eating genetically modified food, in particular whether toxic or allergic reactions could occur.^[70]
- Ethical concerns involve [religious issues](#), [corporate](#) control of the food supply, [intellectual property](#) rights and the level of labeling needed on genetically modified products.

Gene Therapy

- In gene therapy, an absent or faulty gene is replaced by a normal, working gene.
- During your life time gene therapy has the potential to almost “cure “ some genetic disorders.

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Gene Therapy-One Example

- In May 2008, three groups reported positive results using gene therapy to treat Leber's Congenital Amaurosis (LCA)
- LCA is a rare inherited eye disorder that causes blindness in children.
- The patients had a defect in the RPE65 gene, which was replaced with a functional copy using a virus as a vector.

Gene Therapy-One Example

- Think of the virus as infecting the cell with the good gene.
- That's pretty impressive, restoring vision to a blind person
- In all three clinical trials, patients recovered functional vision without apparent side-effects

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Gene Therapy-One Example

- Also worthy of note. The therapy was repeated in three labs with similar results
- The Scientific Method in Action!

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