

BIOTECHNOLOGY TIMELINE CELEBRATING INNOVATION IN BIOTECHNOLOGY

The Evolution of the Revolution

2,000 BC

Egyptians and Sumerians learn brewing and cheese making



master the art o

winemaking

Dutch spectacle- Dutch student of maker Zacharias Janssen invents the and microscope

In China, moldy soybean curds become the first

microscope.

antibiotic to treat infections and ailments

maker Antonij van

Leeuwenhoek discovers bacteria.

Swedish



The Escherichia coli bacterium is discovered. It later becomes a major research,

development and

production tool

The word biotechnology

liscover insulir

Charles landmark book for biotechnology. The Origin of Species is published.

is used in print for the first time.

Vaccine for Rabi's disease discovered. Pasteur vaccinated a young boy who had been bitten by a rabid

dog. This vaccine was made from the extract of the spinal column of a rabies infected rabbit. A modified version of this vaccination is still used today, and has saved thousands of lives.



By carefully feeding cantaloupe mold in large tanks, American microbiologist Andrew Mover develops a technique of producing penicillin in large quantities,

Toronto, Dr. harles Best

A. Justin coins the n genetic engineering. a technique involving the transfer of a select piece of genetic material from one

organism to anothe



Discovery of messenger RNA 'tape copy'

cell nucleus to the protein-making launching its career as a "wonder drug". machinery in the cell cytoplasm.

the first to describe

For some time after the discovery

deciphering of its double-stranded

structure (by Crick and Watson),

researchers remained perplexed

information was conveyed from the

genes to the cytoplasm to produce

the proteins required for cellular

The French biologists Francois

the Nobel Prize in Physiology

research in 1965.

or Medicine for their part in this

Jacob and Jacques Monod received

about how exactly the genetic

of DNA's genetic role and the

Messenger RNA plays a key role n protein synthesis. Messenger RNA, also known as mRNA, are RNA molecules that carry genetic nformation from the DNA in the



Marshall W. Nirenberg and Har Gobind Khorana win the Nobel Prize for deciphering the genetic codes of the 20 amino acids, leading researchers to later conclude that the genetic code is universal among all living things.

1971

First complete synthesis of a gene. First gene-spliced DNA from different organisms.



against viruses by cutting the birus DNA usina special restriction enzymes. These enzymes are nov widely used in modern DNA

Boyer develop recombinant DNA technology. Considered to be the birth of modern biotechnology, they complete the first successful genetic engineering experiment by inserting a gene from an African clawed toad into bacterial DNA.

Stanley Cohen and Herbert



Genetic fingerprinting is discovered, which is used today to establish family relationships and to identify criminal



recombinant DN/ vaccine for livestoc

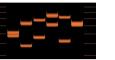


1984

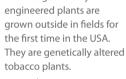




suspects.



The first genetically



The roundworm (elegans becomes the first multi-cellular organism to have i genome complete sequenced.

cheese-making, becomes one of the first food products in Canada to be manufactured with recombinant techniques. Normally extracted from rennet, an enzyme complex found in the lining of a cow stomach, chymosin is now produced directly in agents such as e.coli bacteria.

identifies 20,000-25,000 genes.

German and Swiss The Human Genome Project scientists develop is launched. This international 13-year effort to determine the sequences of the three billion which stimulates chemical base pairs that make up production of the DNA of a person, eventually Vitamin A, thus



completed.

in British Columbia are the first to

sequence the SARS genome.

2005

2007

papillomavirus

The first vaccine against

human papillomavirus- a

cause of cancer- is approved

for use by women and girls

Chymosin, an enzyme used in

The billionth biotech acre is planted by one of 8.5 million farmers in one golden rice, fortifie of 21 countries. with betacarotene,



trials in Canada.

The Human Genome Project is Researchers at Canada's Michael Smith Genome Sciences Centre



Winnipeg's National Microbiology

kind study in the EU. If the Phase I study is successful, larger trials will follow and researchers foresee a new antibody which Ouebecbased firm Medicago will be combined with other medication grows H5N1 (bird flu) vaccine to offer better protection against HIV/ in tobacco leaves. The produc AIDS at a far cheaper price, thus allowing becomes the first plantbased influwider access to treatment in poorer enza vaccine to undergo human

2010

First synthetic cell

has gone toward developing



Human Trials of Malaria Vaccine Draft Genome for Wheat Human trials of a malaria vaccine are An international team derway and showing positive results

grasses, bread wheat 96 000 genes within one plant, making it expanding access to treatment for AIDS particularly complex for 15 million people by 2015. In Europe, measures are already in place to achieve

The first bionic eye has seen the light of day in the United States, giving hope to the blind around the world. Developed by Second Sight Medical Products, the Argus I Retinal Prosthesis System has helped more than 60 people recover partial sight, with some experiencing better

Biotechnology begins, as humans begin choosing o altering plants and livestock so thev can be domesticated. Potatoes become the first cultivated

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Greeks develop

grafting techniques



Robert Hooke discovers the existence of the



by inoculating a small boy with cowpox and then trying to re-infect him with smallpox. The boy recovered from the weaker cowpox infection

'Vaccine' came into use.

and thus became immune

First small pox vaccine is Edward Jenner discovered the process of vaccination

Prussian physician Rudolf

/irchow declares: "Every to smallpox. The cowpox virus was called 'Vaccinia', originates from from the Latin word for cow another 'Vacca'. This is how the word

1839-1855

organisms are

by heating it to kill dangerous

microbes.

German scientists Matthias Schleiden and Theodor Schwann propose that all composed of cells.



Louis Pasteur develops pasteurization a process that protects food

cultivating and testing thousands of pea plant Gregor Mendel publishe a description of rules governing how hereditary traits pass between generations, the foundation Ireland, ending the potato



French chemist

After seven years of





Father of modern plant

breeding Luther Burbank develops over 800 new strains of fruits, vegetables and flowers. His blight-resistant Burbank potato is heavily planted across

Botanist William James Beal

produces the first experimental

corn hybrid in the laboratory.



bacteriologist

1958

DNA is

produced in

a test tube

for the first

Nobel Prize for the discovery of the

transfer in living material".

1962



Canadian scientist

Oswald Theodore

DNA.

Avery isolates pure

'Double Helix' structure of DNA The Nobel Prize in Physiology or Medicine 1962 was awarded jointly to Francis Harry Compton Crick, James Dewey Watson and Maurice Hugh Frederick Wilkins "for their discoveries concerning the molecular structure of nucleic acids and its significance for information



orman Borlaug becomes the first plant breeder to win a Nobel Prize, for his work on new wheat varieties that increase yields by 70 per cent. This marks the beginning of the Green Revolution in world agriculture.

bacterica defent

themselves



1976

The sequence of Herbert Bover, founder of nucleic acid base pairs that combine to make DNA is determined for t first time for a

insulin. The technique represents a significant improvement in the efficiency and long term viability of producing this vital medical therapy, formerly extracted from limited supplies of animal tissues that could lead to allergic reactions. The vast majority of insulin used in the today is now produced through this recombinant

1977

method.

the pioneer biotechnology firm Genentech, uses E. coli bacteria to produce human

Discovery of defective gene for cystic fibrosis by Dr. Lap-Chee Tsui at Toronto's Hospital for Sick Children, Similar discoveries later link specific genes to other disorders, such as autism, Huntington's Disease, and a rare heart problem known as Right Ventricular Cardiomyopathy. Each has added to a growing knowledge of the complex relationship between gene function and disease.



The world meets Dolly the sheep, the first cloned mammal. UNESCO adopts the Universal Declaration on the Human Genome and Human Rights, recognizing the human genome as a common heritage that must be safeguarded



preventing form

of blindness.

in more than 80 countries. from inappropriate manipulation

First Vaccine against human

A Canadian team of scientists and engineers from the University of Toronto develop a microchip with nanoscale components to detect chemical markers for can cer, a technique that could make



This cold be the first vaccine against a parasitic infection.

Access to treatment for HIV/ AIDS

The United Nations adopts a political

declaration adopted committed to

this goal. European biotechnology

scientists launched a clinical trial of an

anti-HIV biotech medicine produced using

genetically modified tobacco- a first of its

announces a draft of the wheat genome. A hybrid of three

has 3 genomes and ove

results than others.

2013

The world celebrates the In May 2010, J. Craig Venter Institute created the first fully synthetic, self-replicating bacterial cell, which was named Synthia. While the U.S. government has plugged \$430 million into synthetic biology since 2005, most of it

60th anniversary of Watson and Crick's discovery of the double helix





