EUROPEAN BIOTECH WEEK

# BIOTECHNOLOGY TIMELINE CELEBRATING INNOVATION IN BIOTECHNOLOGY

# The Evolution of the Revolution

## 8,000 BC

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

## 4,000 BC

Egyptians master the art of winemaking.

## 2,000 BC

Egyptians and Sumerians learn brewing and cheese making.

## 500 BC

In China, moldy soybean curds become the first antibiotic to treat infections and ailments.

## 300 BC

Greeks develop grafting techniques for plant breeding.

## 1590

Dutch spectacle-maker Zacharias Janssen invents the microscope.

## 1663

English physicist, mathematician and inventor Robert Hooke discovers the existence of the cell.

## 1675

Dutch student of natural history and microscope-maker Antonij van Leeuwenhoek discovers bacteria.

## 1796

First small pox vaccine is discovered. Edward Jenner discovered the process of vaccination by inoculating a small boy with cowpox and then trying to re-infect him with smallpox. The boy recovered from the weaker cowpox infection and thus became immune to smallpox. The cowpox virus was called 'Vaccinia,' from the Latin word for cow, 'Vacca'. This is how the word 'Vaccine' came into use.

## 1833

First enzyme discovered and isolated.

## 1838

Swedish chemist Jöns Jakob Berzelius discovers proteins.

## 1839-1855

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

Prussian physician Rudolf Virchow declares:

**„Every cell originates from another cell."**

## 1855

The Escherichia coli bacterium is discovered. It later becomes a major research, development and production tool for biotechnology.

## 1859

Charles Darwin's landmark book, The Origin of Species is published.

## 1861

French chemist Louis Pasteur develops pasteurization, a process that protects food by heating it to kill dangerous microbes.

## 1865

After seven years of cultivating and testing thousands of pea plants, Gregor Mendel publishes a description of rules governing how hereditary traits pass between generations, the foundation of modern genetics.

## 1870-1910

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 Ireland, ending the potato famine.

Botanist William James Beal produces the first experimental corn hybrid in the laboratory.

## 1885

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.

## 1919

The word **biotechnology** is used in print for the first time.

## 1922

In Toronto, Dr. Frederick Banting and his assistant Charles Best discover insulin as a treatment for diabetes.

## 1928

Scottish bacteriologist Sir Alexander Fleming discovers penicillin as an antibiotic.

## 1941

Danish microbiologist A. Justin coins the term **genetic engineering**, a technique involving the transfer of a select piece of genetic material from one organism to another.

## 1942

By carefully feeding cantaloupe mold in large tanks, American microbiologist Andrew Moyer develops a technique of producing penicillin in large quantities, launching its career as a "wonder drug".

## 1943

Canadian scientist Oswald Theodore Avery isolates pure DNA.

## 1953

James Watson and Francis Crick are the first to describe the double helix structure of DNA.

## 1958

DNA is produced in a test tube for the first time.

## 1961

Discovery of messenger RNA 'tape copy' Messenger RNA plays a key role in protein synthesis. Messenger RNA, also known as mRNA, are RNA molecules that carry genetic information from the DNA in the cell nucleus to the protein-making machinery in the cell cytoplasm. For some time after the discovery of DNA's genetic role and the deciphering of its double-stranded structure (by Crick and Watson), researchers remained perplexed about how exactly the genetic information was conveyed from the genes to the cytoplasm to produce the proteins required for cellular functions.
The French biologists Francois Jacob and Jacques Monod received the Nobel Prize in Physiology or Medicine for their part in this research in 1965.

## 1962

Nobel Prize for the discovery of the '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 transfer in living material".

## 1968

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.

## 1970

Swiss scientist Werner Arber, discover that bacterica defent themselves against viruses by cutting the birus DNA using special restriction enzymes. These enzymes are now widely used in modern DNA technologies.

## 1970

Norman 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.

American microbiologist Daniel Nathans discovers the first restriction enzyme that can cut DNA into pieces for various studies and applications. The restriction enzyme technique becomes a fundamental tool in modern genetic research, helping to create the biotechnology industry and providing the basis for the Human Genome Project.

## 1971

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

## 1973

Stanley Cohen and Herbert 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.

## 1976

The sequence of nucleic acid base pairs that combine to make DNA is determined for the first time for a specific gene.

## 1977

Herbert Boyer, founder of the pioneer biotechnology firm Genentech, uses E. coli bacteria to produce human 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 method.

## 1982

The first recombinant DNA vaccine for livestock is developed.

## 1984

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

## 1986

The first genetically engineered plants are grown outside in fields for the first time in the USA. They are genetically altered tobacco plants.

## 1989

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.

## 1990

Chymosin, an enzyme used in 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.

The Human Genome Project is launched. This international, 13-year effort to determine the sequences of the three billion chemical base pairs that make up the DNA of a person, eventually identifies 20,000–25,000 genes.

## 1997

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 from inappropriate manipulation.

## 1998

The roundworm C. elegans becomes the first multi-cellular organism to have its genome completely sequenced.

## 1999

German and Swiss scientists develop golden rice, fortified with betacarotene, which stimulates production of Vitamin A, thus preventing forms of blindness.

## 2003

The Human Genome Project is completed.
Researchers at Canada's Michael Smith Genome Sciences Centre in British Columbia are the first to sequence the SARS genome.

## 2005

The billionth biotech acre is planted by one of 8.5 million farmers in one of 21 countries.

## 2007

First Vaccine against human papillomavirus
The first vaccine against human papillomavirus- a cause of cancer- is approved for use by women and girls in more than 80 countries.

## 2009

A Canadian team of scientists and engineers from the University of Toronto develop a microchip with nanoscale components to detect chemical markers for cancer, a technique that could make diagnosis much faster.

The international Potato Genome Sequencing Consortium, releases a draft of the full sequence of genome of the potato, the world's third most important crop.

## 2009

Winnipeg's National Microbiology Laboratory completes the first genetic sequencing of the H1N1 flu virus, just as the disease is reaching international pandemic proportions.

Quebecbased firm Medicago grows H5N1 (bird flu) vaccine in tobacco leaves. The product becomes the first plantbased influenza vaccine to undergo human trials in Canada.

## 2010

First synthetic cell
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 has gone toward developing alternative fuels. Some firms are now starting to leverage the technology for medical purposes.

## 2011

Human Trials of Malaria Vaccine
Human trials of a malaria vaccine are underway and showing positive results. 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 expanding access to treatment for AIDS for 15 million people by 2015. In Europe, measures are already in place to achieve this goal. European biotechnology scientists launched a clinical trial of an anti-HIV biotech medicine produced using genetically modified tobacco- a first of its kind study in the EU. If the Phase I study is successful, larger trials will follow and researchers foresee a new antibody which will be combined with other medication to offer better protection against HIV/ AIDS at a far cheaper price, thus allowing wider access to treatment in poorer countries.

## 2012

Draft Genome for Wheat
An international team announces a draft of the wheat genome. A hybrid of three grasses, bread wheat has 3 genomes and over 96 000 genes within one plant, making it particularly complex to decipher.

## 2013

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 II Retinal Prosthesis System has helped more than 60 people recover partial sight, with some experiencing better results than others.

## 2013

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

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