



EXPLORE GENOMICS > SCIENCE IN SOCIETY

# Timeline: History of Genomics



**Explore key events in genomics and genetics research alongside those in historical and popular culture.**

## The history of genomics

Genomics is relatively new science. DNA itself was only detected as important for life in the late nineteenth century, and the ability to decode the sequence of DNA bases in a genome

only discovered a century later in the 1970s. Since then genomics has moved quickly, making leaps in technology and understanding.



1871

- Friedrich Miescher identifies the presence of ‘nuclein’ (now known as DNA) and associated proteins in the cell nucleus.
- The first international rugby union match is played between England and Scotland.



1904

- The chromosome theory of heredity: Walter Sutton and Theodor Boveri find that chromosomes exist in matched pairs, with one inherited from each parent.
- Theodore Roosevelt is elected President of the US.



1905

- X and Y sex chromosomes: Nettie Stevens discovers that sperm cells can produce X or Y chromosomes, while egg cells can only produce X chromosomes.
- Einstein puts forward the famous equation ' $E = mc^2$ '.



1910

- Discovery of the five DNA bases – A, T, C, G and U – by Albrecht Kossel, who receives the first Nobel Prize in Physiology or Medicine.
- The first horror movie is shown, a version of Mary Shelley's Frankenstein.



1945

- Varieties of plants: Janaki Ammal and CD Darlington reveal information about the evolution of species and varieties of plants, through a series of chromosome studies.
- World War II comes to an end.



1950

- DNA, rather than protein, is proven to carry our genetic information – in the Hershey-Chase experiments, by Alfred Hershey and Martha Chase.
- Mother Theresa opens a home for the dying and destitute in Kolkata, India.



1953

- The discovery of DNA's double helix structure by James Watson and Francis Crick, with contributions from Rosalind Franklin and Maurice Wilkins.
- The coronation of Queen Elizabeth II takes place at Westminster Abbey in London.



1961

- Cracking the ‘code for life’: Marshall Nirenberg, Har Gobind Khorana and colleagues identify how DNA bases are read in blocks of three called a ‘codon’. Each codon specifies an amino acid which is added to the protein during synthesis. They later jointly win the Nobel Prize for Physiology and Medicine.
- John F Kennedy becomes President of the US.



1968

- Doctors perform the first successful bone marrow transplant to treat severe combined immunotherapy.
- The Apollo 8 becomes the first human-crewed spacecraft to orbit the moon.



1977

- The first DNA sequencing technique: Frederick Sanger and his team develop ‘chain-termination sequencing’ (or ‘Sanger sequencing’) and sequence the first full genome – that of a virus called phiX174. Sanger later wins the Nobel Prize for Chemistry.
- The first home computers, Apple II, go on sale in the US.



1983

- The polymerase chain reaction (PCR) technique is developed – meaning scientists can now amplify DNA.
- Seatbelt use for drivers and front seat passengers becomes compulsory in the UK.



1985

- A new method for DNA profiling: Alec Jeffreys produces a DNA profile by counting the number of short repeating DNA sequences found at 10 specific regions of the genome.
- Age 17, Boris Becker becomes the youngest-ever winner of the men's singles title at Wimbledon.



1990

- Human Genome Project is launched. The project aims to sequence all 3.2 billion letters of a human genome in 15 years.
- Nelson Mandela is released from prison in South Africa.



1992

- American and British teams of scientists reveal technique for testing embryos, while still in the womb, for genetic diseases such as cystic fibrosis and haemophilia.
- ViolaWWW, the first popular web browser, is publicly released.



1993

- The Sanger Centre near Cambridge is opened by Fred Sanger.
- The film Jurassic Park is a box office hit across the world – the first film to integrate computer-generated imagery (CGI) with live action scenes.



1995

- The first bacterium genome sequence is completed (*Haemophilus influenza*).
- Amazon.com sells its first book



1996

- The full genome sequence of the model organism Baker's yeast (*Saccharomyces cerevisiae*) is completed.

- The first cloned animal, Dolly the Sheep, is born at the Roslin Institute, University of Edinburgh, UK.
- The Olympics Games are held in Atlanta, US, marking the 100th anniversary of the modern games.



1998

- The full genome sequence of the model organism the nematode worm (*Caenorhabditis elegans*) is completed.
- Google is founded.



1999

- Chromosome 22 is the first human chromosome to be sequenced as part of the Human Genome Project.
- Ensembl, the first ‘search engine’ for genome sequences, launches.
- David Bowie’s *Hours* becomes the first complete music album available to download over the Internet, ahead of its physical release.



2000

- The full genome sequence of the model organism the fruit fly (*Drosophila melanogaster*) is completed.
- The PlayStation 2 releases and later becomes the best-selling video game console of all time.



2001

- The first draft of the human genome sequence is released.
- Wikipedia is founded.



2002

- The mouse is the first mammal to have its full genome sequence completed, by the International Mouse Genome Sequencing Consortium.

- The genome of the parasite *Plasmodium falciparum*, which causes malaria in humans, is completed.
- The Euro becomes the official currency of the Eurozone in Europe.



2003

- The Human Genome Project is completed, confirming humans have approx. 20,000 to 25,000 genes. It read and recorded more than 92% of the genome – as much as was technologically possible at the time.
- The Concorde jet makes its last flight, bringing an end to the era of civilian supersonic travel – at least for the time being.



2005

- The first report from HapMap (Map of Human Genetic Variation) is published, which aimed to produce a ‘catalogue’ of common human genetic variations and where they are found in the genome.
- The sequence of the chimpanzee (*Pan troglodytes*) genome is completed.
- The first video is uploaded to YouTube.



2007

- A new DNA sequencing technology (microarray hybridisation) is introduced, increasing the output of DNA sequencing by 70-fold.
- Apple introduces the iPhone.



2008

- 1,000 Genomes Project launched – the first project that aims to sequence the whole genomes of a large number of people.
- Barack Obama is elected as the first Black president of the USA.



2009

- The first comprehensive analysis of cancer genomes is published, including lung cancer and malignant melanoma.

- The Bitcoin cryptocurrency network is created.



2010

- Wellcome Trust launches UK10K, aiming to compare the genomes of 4,000 people without a known genetic condition, with those of 6,000 people living with a condition of suspected genetic cause.
- The sequence of the Neanderthal (*Homo neanderthalensis*) genome is completed.
- The tallest man-made structure to date – the Burj Khalifa in Dubai, United Arab Emirates – officially opens.



2012

- The ENCODE study confirms that the human genome contains more than 20,600 protein-coding genes.
- The Olympic Games are held in London, UK.

A circular graphic consisting of a dashed outer ring and a solid inner circle. The year "2013" is centered in the inner circle.

- The gene editing tool CRISPR-Cas9 is discovered. Later, Jennifer Doudna and Emmanuelle Charpentier win the Nobel prize for its discovery – the first time in history the prize is awarded to two women.
- The US Supreme Court rules that naturally occurring DNA cannot be patented.

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- The first gene editing of human embryos takes place, using CRISPR-Cas9, to remove DNA responsible for a hereditary heart condition.
- SpaceX builds and flies the first reusable rocket.

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- The 100K Genomes project is completed, sequencing 100,000 genomes from people affected by a rare genetic disease or cancer.
- NASA launches its first mission to the sun.



- The sequence of the SARS-CoV-2 virus genome is completed.
- The world enters lockdown with the outbreak and eventual pandemic of Covid-19.



- The first CRISPR-edited food goes on sale in Japan: tomatoes modified to produce more GABA – a molecule that some people take as a supplement to reduce stress.
- The James Webb Space Telescope is launched, using high-resolution and high-sensitivity instruments to view galaxies 4.6 billion light years away.



2022

- The entirety of the human genome sequence is completed. Various project have slowly filled the remaining gaps since the first 92% was published in 2003.
- Climate change report: the IPCC reports that greenhouse gas emissions must peak before 2025 to limit global warming to 1.5 °C.



2023

- The UK launches a pilot to test whole-genome sequencing in babies that looks for 200 genetic conditions. Read more in our conversation about **sequencing in newborns**.
- The development of artificial intelligence chatbots, like ChatGPT, can generate human-like text based on context and past conversations.

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