

# Women Scientists Who Changed The World

The history of women in science is often a tale of unrecognised talent, overwhelming male prejudice and tragic circumstances. In many cases, pioneering work was not taken seriously, or had to be attributed to male partners or colleagues in order to be accepted. In several cases, the recognition they deserved arrived only many years later. Despite this, there are a handful of brilliant women scientists who have changed our lives and the way we see the world.



Take the example of Hypatia (c 370 – 415). At the height of her fame, this talented Greek mathematician, astronomer and philosopher was head of the Neoplatonic school in Alexandria and a highly respected teacher. But this was a time of a religious power struggle between pagans and Christians. Being a pagan, Hypatia was targeted by a mob of angry Christians, dragged through the streets, killed then finally burned. Today, Hypatia's legacy remains as the first

recorded female scientist in history.

**Barbara McClintock (1902 - 1992)** was a genetics researcher decades ahead of her time. Working with maize plants, she proposed the concept of the 'jumping gene'.

Certain sequences of DNA, she said, can move around to different positions within the genome of a single cell, a process known as transposition. The jumping around of genes affects the DNA content of the cell and causes visible mutations such as different leaf colour or plant height. Her ideas were received with intense skepticism by her peers. Only through tireless and dedicated research was her work finally recog-



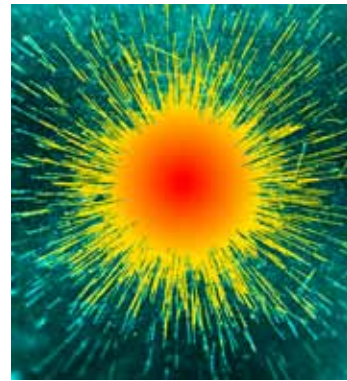
nised with the Nobel Prize in 1983, an astonishing 30 years after her initial discovery. Thanks to McClintock's work, the concept of genetic transposition, found not only in maize but also in nature everywhere from bacteria to humans, is now recognised as a major breakthrough in genetics. Researchers today utilise transposition to create and study novel mutants such as antibiotic resistant bacteria.

### Marie Curie (1867 – 1934)



Born Maria Sklodowska, Marie Curie's achievements make her one of the great scientists of all time. Winner of two Nobel Prizes (the first person to do

so), she was the first woman to teach at the Sorbonne in Paris. Together, with her husband Pierre Curie, they discovered two new chemical elements: polonium and radium. She was also a model scientist, preferring not to patent her radium isolation process so that other scientists could research unhindered. Sadly, her lifetime of dedicated research in radioactivity almost certainly contributed to her death from leukaemia in 1934. The Curies opened the door to modern



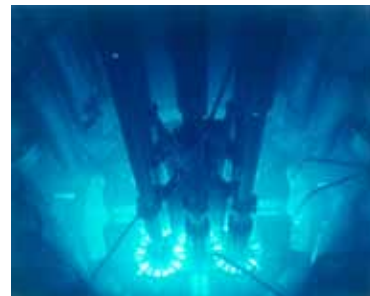
Pierre and Marie's honour.

### Irene Joliot-Curie (1897-1956)



In many ways, Irene Joliot-Curie's life echoed that of her famous mother, Marie Curie. Along with her husband Frederic, they studied radio-

activity, and were the first to create an artificially radioactive element, winning them the Nobel Prize in Chemistry in 1935. Irene's work on heavy elements was a major contributor to



uses of radiation, including medical treatments for cancer. Element 96, Curium, was named in

the discovery of nuclear fission – the fundamental proc-

ess behind nuclear energy and atomic weapons. She also taught at the Sorbonne and received many honours, just like her mother, but tragically, also like her mother, she contracted leukaemia through her work and died in 1956.

### Dorothy Crowfoot Hodgkin (1910 - 1994)



British scientist Dorothy Crowfoot used the new technique of x-ray crystallography and the first powerful computers to discover the molecular structures of penicillin, vitamin B12 and insulin. At the time, even simple structures were very difficult to photograph, and her work on mapping complex proteins is hailed as a great achievement.



With the discovery of the structure of these molecules, scientists were then able to modify and synthesise new varieties of penicillin, insulin and B12 - helping to save countless lives. Despite her talents and tenure at Oxford University, male-dominated traditions meant Crowfoot was barred from faculty club meetings. As well

as being a leading scientist, winning the Nobel Prize in 1964, Dorothy Crowfoot Hodgkin was an active humanitarian who campaigned for world peace and disarmament

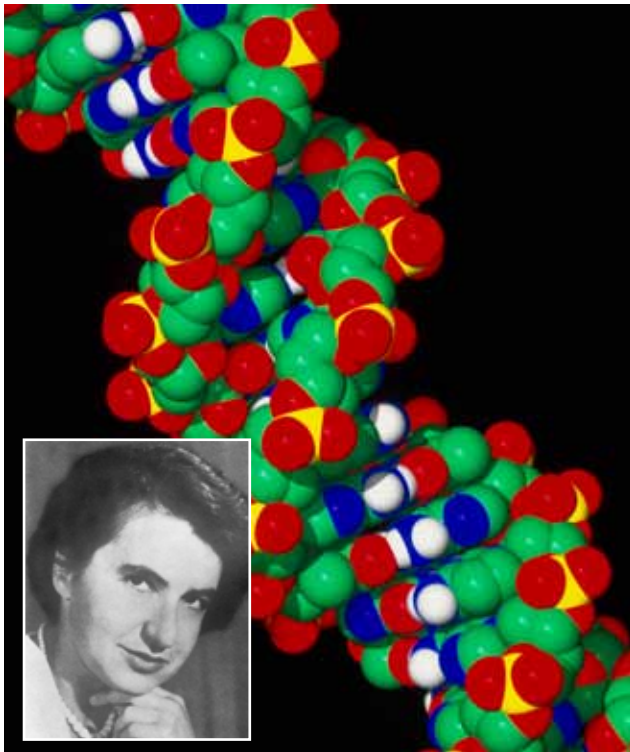
### Caroline Lucretia Herschel (1750-1848)



Herschel was a talented singer, receiving many plaudits for her vocal ability. But she turned down a lucrative career in music for an entirely different discipline –

astronomy. When her famous brother William, discoverer of the planet Uranus, was appointed the Astronomer Royal by King George III, Caroline joined him as his full time assistant, building telescopes, making notes and working lengthy calculations while he scoured the night sky. In her spare time, Caroline also swept the skies for new objects and discovered 3 new nebulae and 8 comets. Her efforts were fully recognised by the King and the





the final piece of the DNA jigsaw with her high quality x-ray crystallographic images. The unpublished data was crucial to Watson and Crick who were finally able to deduce the helical nature of the molecule. Tragically, at the age of 37, Franklin contracted ovarian cancer and died in 1958. Although her supervisor Maurice Wilkins shared the Nobel Prize in 1962 with Watson and Crick, her contribution to the DNA race was left unrecognised for years. Rosalind Franklin is now remembered for her vital contribution to the discovery of the structure of DNA.

Royal Society, as she received many honours for her achievements. Caroline Herschel will be remembered as the first woman officially recognised for a scientific position and the first professional female astronomer. The asteroid Lucretia, was named in her honour.

**Rosalind Franklin (1920 – 1958)**  
The race to map the structure of DNA was won in 1953 when James Watson and Francis Crick published their famous paper in Nature. But it was a British scientist called Rosalind Franklin who arguably contributed

**Lise Meitner (1878 – 1968)**



The early 20th Century physics community was a male-dominated profession. Female scientists were considered at best

curiosities, at worst, positively discouraged from taking up research. After finishing her PhD, Lise Meitner moved to Berlin to study under Max Planck. There she met chemist Otto Hahn, who was to be her collaborator in the new field of radioactivity. Faculty



gender rules forbade Meitner to work in the laboratories, so they set up their own lab in a carpenter's workshop. Meitner's work was crucial to the discovery that an atom of uranium could be split using neutrons to yield huge amounts of energy. She was first to coin the term 'nuclear fission' - the process behind modern nuclear power stations and atomic weapons. However, it was her collaborator, Otto Hahn, who was awarded the Nobel Prize in 1944, while Meitner was ignored. Because she was of Jewish descent and lived in Nazi Germany, she was forced to flee for Sweden in 1938 after Hitler's annexation of Austria. Although continuing to work on nuclear fission, she refused to collaborate on the Manhattan Project – the secret mission to produce the first atomic bomb. Her legacy today is her reputation as

a pioneer in nuclear physics, a brilliant female scientist who succeeded against the bastion of male prejudice. In honour of her contribution to physics, element 109, Meitnerium was named after her.

**Ada Lovelace (1815-1852)**

Ada, Countess of Lovelace, was the daughter of romantic poet Lord Byron.

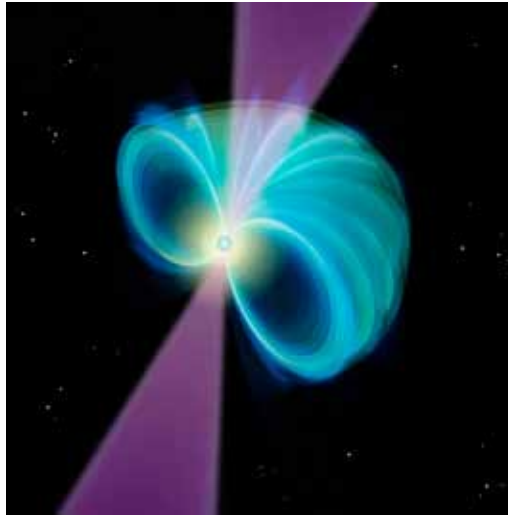


She never met her father and was raised by her domineering mother, who encouraged Ada Lovelace to pursue an interest in mathematics, music and elite social circles. At the age of 17, she

met Charles Babbage, Lucasian Professor of Mathematics at Cambridge University and inventor of the 'difference engine', an early mechanical calculator. Babbage was to become her lifelong friend and Ada was asked



to translate and articulate his ideas for an 'analytical engine' – what we would call today an all-purpose computer. The analytical engine was never constructed, but historians agree that Ada Lovelace's visualization of the machine was a remarkable foresight of things to come almost a century later. Sadly, the final years of her life were consumed with deteriorating health, drink, opium addiction and gambling debts. She died at the age of 36 of cancer but her reputation remains - the US Department of Defense named a computer language, ADA, after her, and her image is on Microsoft's authentication hologram sticker.



### Jocelyn Bell (1943 -)



Bell is widely known as the discoverer of pulsars – rapidly spinning collapsed stars that emit strong radio signals. But she almost missed an education when,

at 11 years old, she failed her school exams – the only route to higher education in 1950's Northern Ireland. Her parents, however, supported her through boarding school in England where her passion for astronomy began. It was whilst working on her PhD at Cambridge University that she noticed unusual data in the kilometres of radio telescope readouts she was

examining. Along with her supervisor, Anthony Hewish, she eliminated the idea that these came from interference or even alien signals, dubbed 'little green men', and deduced they must originate from pulsars. It was a landmark achievement in the astronomical community and she went on to discover many more pulsars. However, there was controversy when the 1974 Nobel Prize for physics went to her supervisors Anthony Hewish and Martin Ryle for the discovery of pulsars. Many argued that she should have received or at least shared the prize, but Jocelyn Bell went on to receive many honours and is now one of the very few female physics professors in the UK.

### Mary Leakey (1913 – 1996)

Mary Leakey's early education was

not promising. She was expelled on a number of occasions from convent school, and it wasn't until she went on a family holiday to the Dordogne and visited the prehistoric caves that Mary resolved to dedicate her life to studying prehistory. In 1933 she met and later married anthropologist Louis Leakey.

Together, they discovered the very first fossil ape skull in 1947.



They continued to unearth important hominid fossils including a 2 million year old



human skull and many older Homo species. After the death of Louis, Mary continued to

work and in 1978 her team made their most impressive discovery - the Laetoli

footprints in Tanzania. These footprints were made in wet volcanic ash some 3.75 million years ago by some of the first upright walking hominids. Together with her husband, Mary Leakey's dedicated search for early man has helped shape our current understanding of human evolution.

### Unrecognised masses

Distinguished women scientists have been few and far between. Yet there are also the legion of wives, sisters and mothers who patiently supported, nurtured and became the backbone to many of the great male scientists in history. The women who did rise to prominence have deepened our understanding of the world despite many obstacles. Today, the gender bias and social barriers from the past are no longer so heavily weighted against women, but the numbers entering science today are still much lower than men. Government and institutions are hoping to change that, and perhaps the remarkable story of these women pioneers will help inspire the next generation to extend the frontiers of science.

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Written by Seymour Yang

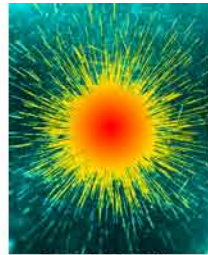
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# FULL PICTURE SET

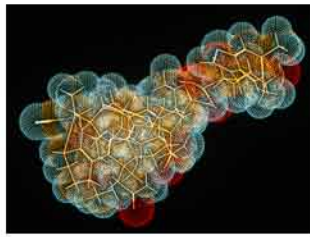
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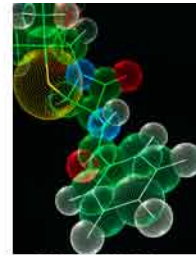
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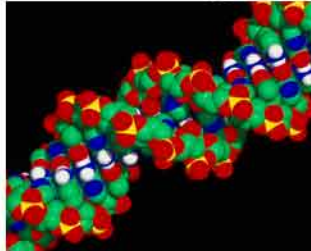
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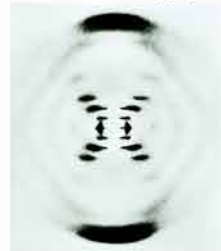
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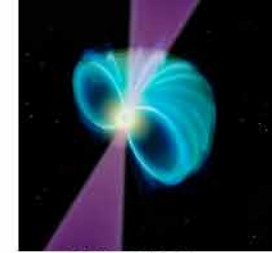
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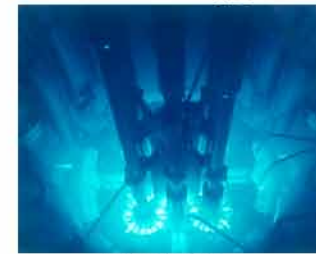
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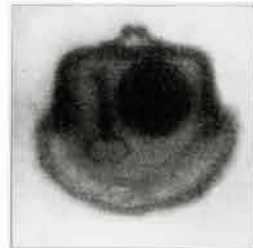
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