MICROSCOPE BEGINNINGS

1590	*Hans and Zacharias Jansen* made the first **compound microscope** by placing two convex **lenses** in a tube.
1663	*Robert Hooke* introduced the term '**cell**' while observing cork under a light microscope. He also worked at improving a number of scientific devices, including the microscope, telescope and barometer.
1668	*Francesco Redi* conducted an experiment to challenge the theory of '**spontaneous generation**'.
1674–1683	*Anton Van Leeuwenhoek*, a Dutch lens maker: ■ produced *lenses* of higher quality, which allowed for greater magnification (up to 200 times). ■ described 'animacules' (unicells) ■ discovered bacteria.
1758	*John and Peter Dollard* (father and son), spectacle makers, produced the first achromatic (colour-free) *lenses*, making microscopes superior to hand lenses.

THE SCIENTIFIC REVOLUTION

the cell theory

1796	*Edward Jenner* used cowpox in the first successful **vaccine** against the disease **smallpox**.
1801	*Robert Brown* a botanist and naturalist, first described the cell **nucleus** while observing plant cells in an orchid. He also noticed the random movement of pollen grains (Brownian motion).
1836	*Charles Darwin* arrived in Sydney Harbour aboard HMS *Beagle*.
1838	*Matthias Schleiden*, a **botanist**, stated that parts of plants are made of *cells* (not visible to the unaided eye).
1839	*Theodor Schwann*, a **zoologist**, stated that parts of animals are made of *cells*; agreed with Schleiden and they published **the cell theory** in a book, stating that the cell is the basis of the structure of all living things.
1843	*Robert Koch* studied the cause of the disease **anthrax**.
1855	*Rudolph Virchow* introduced the idea that cells reproduce by dividing, stating that all living cells can only arise from other living cells, further challenging the theory of 'spontaneous generation'.

evolution

1856–1858	*Gregor Mendel* began a series of controlled experiments with garden peas, to carry out a statistical study of **heredity**.
1858	*Charles Darwin* and *Alfred Wallace* presented a paper 'A Theory of **Evolution** by **Natural Selection**'.
1859	*Charles Darwin*'s book, *On the Origin of Species*, is published.
1860	The *Huxley–Wilberforce* debate takes place.

germ theory of disease

1861	*Louis Pasteur* published his experiments showing that **fermentation** was caused by something in the air, finally disproving 'spontaneous generation'.
1862	*Louis Pasteur*'s experiments with bacteria showed that infectious diseases are caused by micro-organisms, leading to the *germ theory of disease*.
1863	*Louis Pasteur* introduced **pasteurisation**, a practical application of what he had learnt through his fermentation experiments.
1866	*Gregor Mendel* published his work on *studying plant hybrids*.
1867	*Joseph Lister* made the connection between Pasteur's work on infection and introduced *antiseptic surgery* (published paper).
1880	*Charles Louis Alphonse Laveran* first identified cause of **malaria**: a microscopic organism.
1881	*Pasteur* developed a vaccine against anthrax.

CLASSICAL SCIENCE	disease	1882	*Walther Flemming* discovered nuclear material—termed '**chromatin material**'.
		1882–1893	*Koch* proposed *postulates*: 'rules of engagement' for bacteriologists.
		1885	*Pasteur* used a vaccine against **rabies** on humans for the first time, saving the life of a young boy who had been bitten by a dog.
		1891	*Robert Koch* concluded that malaria was transmitted by mosquitoes.
		1897	*Ronald Ross* demonstrated that female *Anopheles* mosquitoes were the **vectors** *(carriers) of malaria*, by showing that these mosquitoes carried malarial oocysts in their gut tissue.
	genetics	1900	Significance of *Mendel*'s experiments in terms of heredity is noticed after three other scientists get similar results.
		1902	*Walter Sutton* and *Theodore Boveri* independently proposed and demonstrated a connection between **chromosomes** and inheritance. Sutton studied meiosis in grasshoppers. Boveri studied chromosome behaviour and inheritance in sea urchins.
		1911	*Thomas Hunt Morgan* studied *sex-linked inheritance* (Nobel Prize in 1933 for life's work).
		1909	*Wilhelm Johannsen* introduced the term 'gene'.
	microscope advances, microbes and antibiotics	1928	*Alexander Fleming* noticed that the mould *Penicillium* killed bacteria in a petri dish.
		1933	*Ernst Ruska* built the first **electron microscope**.
		1935	*Howard Florey* began to search for a useful medicine to kill germs.
		1938	*Fritz Zernike* invented the **phase contrast microscope** which can be used to observe living, unstained cells.
		1939	*Howard Florey* extracted stable **penicillin** (the first antibiotic).
		1941	*George Beadle* and *Edward Tatum* published the results of their experiments with bread mould, in which they proposed the *one-gene-one-enzyme (protein) hypothesis*.
		1942	Viruses first seen under the electron microscope.
		1945	*Frank McFarlane Burnet* isolated influenza A virus (in Australia) and developed a vaccine.
		1945	*Howard Florey* and *Alexander Fleming* received the Nobel Prize for Physiology and Medicine for their work on penicillin.
CONTEMPORARY SCIENCE	molecular technology, biotechnology and health	1950	*Rosalind Franklin* and *Maurice Wilkins* made a crystal of **DNA** to study its structure.
		1953	*James Watson* and *Francis Crick* put together a model of DNA.
		1955	*Marvin Minsky* invented the *scanning* electron microscope.
		1960	*Frank McFarlane Burnet* and *Peter Medawar* received the Nobel Prize for Physiology and Medicine for their work in *immunology* and *organ transplants*.
		1962	*Vernon Ingram* did further work on genes and proteins leading to the change to the *one-gene-one-polypeptide hypothesis*.
		1962	*Watson, Crick* and *Wilkins* received the Nobel Prize for Chemistry for their discovery of DNA. (Rosalind Franklin died in 1958; her work was acknowledged, but Nobel prize nominations cannot be awarded posthumously.)
		1972	*Niles Eldridge* and *Stephen Jay Gould* put forward the theory of *evolution by punctuated equilibrium*.
		1980	**WHO** declared the disease smallpox eradicated worldwide.
		To present	Genetic and reproductive revolution: in-vitro fertilisation, genetic engineering, cloning and advanced biotechnology.

Note: Dates in many timelines show slight inconsistencies when compared. This is due to inconsistent record-keeping long ago. It is the *sequence of events* that is more important in reflecting the historical developments in science, than the absolute dates.