GREAT SCIENTISTS FROM

A LITTLE HISTORY *of* SCIENCE

Isaac Newton 1642–1727

No scientist except Einstein has ever done so much in so short a space of time. Newton saw ripe apples falling off trees in his mother's garden. It probably wasn't as dramatic as stories have it, but it did remind him of a problem that still needed explaining: **why things fall down to the ground.**

Many aspects of Newton's view of the world and the heavens were contained in his **three famous laws of motion**.

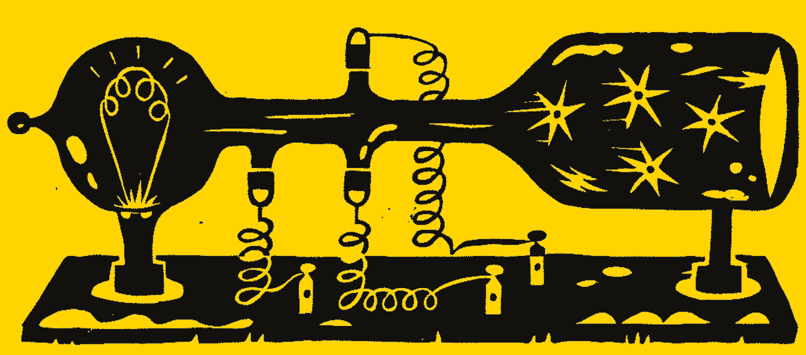
His **first law** stated that every body either stays at rest or moves in a straight line unless something else – some force – acts upon it. A rock on a mountainside will stay there forever unless something – wind, rain, a human being – causes it to move; and, without any disturbance ('friction'), it would move in a straight line forever.

His **second law** stated that if something is already moving, a force can change its direction. How great the change depends on the strength of the force, and the change of direction occurs along a straight line, in the direction of the new force. So, if you swat a falling balloon from the side, it will move sideways; if you swat it from above, it will go down more quickly.

His **third law** of motion concluded that for any action, there is always an equal and opposite reaction. This means that two bodies always act upon each other equally but in opposite directions. You can swat a balloon, and it will move away from your hand, but it will also deliver an action on your hand (you will feel it). If you swat a large boulder, the boulder won't move, but your hand may bounce back, and it will be sore. This is because it is harder for lightweight objects to influence heavy ones than vice versa.

Marie Curie 1867–1934

In 1898 Marie Curie and her husband Pierre obtained a tonne of pitchblende, crude tar-like stuff that contains an **element called uranium**. As they were extracting their relatively pure uranium, radioactivity burned their hands. They also discovered **two new radioactive elements**, which they named **thorium** and **polonium**.



Scientists around the world pressed to find out more about the **powerful rays** that these new elements emitted. These were the **beta rays**; the **alpha rays**; and **gamma rays**. The ancient promise of alchemy, to see one element change into another, was almost fulfilled by the discovery of radioactivity. Almost, because the alchemists' dream had been to change lead or some other base metal into gold; what radioactivity did was **transmute uranium into lead**, a valuable metal into a base one! Still. Nature could do what the alchemists had merely dreamed of.

Radioactivity had important medical uses. Radium, another radioactive element discovered by Marie Curie, was especially valued. Its rays could kill cancer cells. But radioactivity also causes cancer if the dose is too high. Many early workers, including Marie Curie, died from the effects of radiation, before proper safety guidelines were worked out. **Her daughter, Irène, won her own Nobel Prize for work in the same field**, and died early of the blood cancer that had killed her mother.

Albert Einstein 1879–1955

Einstein is famous for his **shock of white hair** and his theories about matter, energy, space and time. In 1905 he introduced his **Special Theory of Relativity**, which showed that all movement is relative, that is, it can only be measured in relation to something else. It is a very complicated theory but can be explained quite simply if you use your imagination.

Imagine a train is moving out of a station. In the middle of one of the carriages there is a light bulb flashing **on** and **off**, sending out a flash at exactly the same time forwards and backwards, which is reflected in a mirror at each end of the carriage. If you were standing exactly in the middle of the carriage you would see the light bounce back from both mirrors at exactly the same time. But someone standing on the platform as the train went past would see the flashes one after the other. Although both flashes are still hitting the mirrors simultaneously, the train is moving forwards, so on the platform you would see the flash from the furthest-away mirror (at the front of the carriage) before you saw the flash from the closer mirror (at the back).

So, although the **speed of light** remains **the same**, **when it is seen is different** depending on – or rather, relative to – **whether the observer is moving or still**. Einstein argued (with the help of some complicated equations, of course) that time is a fundamental dimension of reality. From now on physicists would need to think not simply of the three familiar dimensions of space – length, width and height – but of time, too.

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