



How an Apple Changed the World



In the late 1600s a man was walking with a friend observing the world around him. He noticed an apple on a nearby tree fall to the ground and from this commonplace event he made two key observations that changed science for ever. Firstly, since it sped up before it hit the ground, there must be something constantly pulling on the apple to make it **accelerate** towards the Earth. He also thought that the apples at the very top of the tree must be experiencing the same force acting on them and perhaps even higher objects than that, maybe even as high up as the Moon.

At the time, the man was very interested in studying the planets and stars and had been **postulating** ideas about the subject for many years. He called this force '**gravitas**' which eventually became known as **gravity**. This man was Isaac Newton and he proposed numerous laws that now underpin modern physics. Many people had seen apples and other objects falling, so this definitely wasn't a new sight. However, Newton was the first person to ask *why* and then attempt to explain what was happening.

It isn't clear whether the apple account actually occurred or not. Over time it has become a story about Newton sitting under an apple tree when an apple fell on his head and in a '**eureka**' moment he had the idea of gravity. The version generally accepted is the original one and this is supported by the quotes below taken from the royal society paper written by William Stukeley.

*"Amid other **discourse**, he told me, he was just in the same situation, as when formerly the notion of gravitation came into his mind. Why sh[oul]d that apple always descend **perpendicularly** to the ground, thought he to himself; occasion'd by the fall of an apple, as he sat in **contemplative** mood."*

"Why sh[oul]d it not go sideways, or upwards? But constantly to the Earth's centre? Assuredly the reason is, that the Earth draws it. There must be a drawing power in matter. And the sum of the drawing power in the matter of the Earth must be in the Earth's centre, not in any side of the Earth."



One of Newton's laws is the Law of Universal Gravitation, which states that two objects will attract each other with a force that is relative to their size and their distance apart. This idea wasn't actually tested until over a hundred years later when the gravitational attraction between heavy balls of different size was measured. These measurements gave the force of gravity acting between the balls. There is even a gravitational attraction between you and other everyday objects but it is so small, it is difficult to measure. If at least one of the objects involved is very large then there will be a significant pull. For instance, the massive size of the sun holds several planets, moons and other **astronomical bodies** around it. Similarly, the Earth, because of its size, pulls all near objects towards it which is why things fall to the ground when dropped and not to one side or upwards. If falling objects were to move in other directions that would require additional forces to be applied momentarily or continuously in those directions as well.

Isaac Newton was born on Christmas day 1642 in England. He lived with his grandmother after his widowed mother was remarried to his step-father whom he disliked. He went to Kings School and studied Latin and finished there as one the school's top students. He tried farming when his mother became a widow for the second time. He had no interest in agriculture and did not enjoy this work. He later attended Cambridge University and studied for a Bachelor of Arts degree and while

there developed a mathematics theory that later became **calculus** (a kind of mathematics that deals with the study of change using **infinitesimals**). While at college, he studied religion and philosophy but at home he focussed on mathematics, **optics** and gravitation.

During his studies, he was **prone** to arguments around the **authenticity** of his work and he had disagreements with other scientists such as Leibniz, Duillier and Hooke. Because Newton took the ideas of others and linked them, expanded on them, disproved them and built laws around them, he inevitably upset people and caused a lot of **controversy**.

In 1701 Newton became the Master of the Mint. The Mint was the organisation responsible for producing money and coins. He felt that there were too many fake coins being produced, so took it upon himself to personally find and punish the **counterfeiters** responsible for the fake coins. The punishment of the time for counterfeiting was to be hung, drawn and quartered. He went undercover in the many pubs of London and found evidence to prosecute 28 'coiners' as they were called.

He was also a keen **alchemist** with a passion for studying metals, their properties and even finding ways of turning lead into gold. This is believed to have led to his death. In 1726 he died in his sleep of unknown causes but later tests conducted on his hair showed the presence of the metal mercury. Mercury poisoning damages the lungs, brain and kidneys and can cause a person to act in an odd manner, which is how Newton is believed to have behaved in his later life.

Sir Isaac Newton is one of the best known and most innovative scientists of all time. He is responsible for the advancement of both maths and science and his contribution to many of our modern scientific understandings is **unsurpassed**.