This article is about the scientist. For the agriculturist, see Isaac Newton (agriculturist).

Sir Isaac Newton (25 December 1642 – 20 March 1727) was an English physicist and mathematician (described in his own day as a "natural philosopher") who is widely recognised as one of the most influential scientists of all time and as a key figure in the scientific revolution. His book Philosophiae Naturalis Principia Mathematica ("Mathematical Principles of Natural Philosophy"), first published in 1687, laid the foundations for classical mechanics. Newton made seminal contributions to optics, and he shares credit with Gottfried Leibniz for the development of calculus.

Newton's Principia formulated the laws of motion and universal gravitation, which dominated scientists' view of the physical universe for the next three centuries. By deriving Kepler's laws of planetary motion from his mathematical description of gravity, and then using the same principles to account for the trajectories of comets, the tides, the precession of the equinoxes, and other phenomena, Newton removed the last doubts about the validity of the heliocentric model of the Solar System.

This work also demonstrated that the motion of objects on Earth and of celestial bodies could be described by the same principles. His prediction that Earth should be shaped as an oblate spheroid was later vindicated by the measurements of Maupertius, La Condamine, and others, which helped convince most Continental European scientists of the superiority of Newtonian mechanics over the earlier system of Descartes.

Newton built the first practical reflecting telescope and developed a theory of colour based on the observation that a prism decomposes white light into the many colours of the visible spectrum. He formulated an empirical law of cooling, studied the speed of sound, and introduced the notion of a Newtonian fluid. In addition to his work on calculus, as a mathematician Newton contributed to the study of power series, generalised the binomial theorem to non-integer exponents, developed a method for approximating the roots of a function, and classified most of the cubic plane curves.

Newton was a fellow of Trinity College and the second Lucasian Professor of Mathematics at the University of Cambridge. He was a devout but unorthodox Christian, and, unusually for a member of the Cambridge faculty of the day, he refused to take holy orders in the Church of England, perhaps because he privately rejected the doctrine of the Trinity. Beyond his work on the mathematical sciences, Newton dedicated much of his time to the study of biblical chronology and alchemy, but most of his work in those areas remained unpublished until long after his death. In his later life, Newton became president of the Royal Society. Newton served the British government as Warden and Master of the Royal Mint.

Life

Early life

Main article: Early life of Isaac Newton

Isaac Newton was born according to the Julian calendar (in use in England at the time) on Christmas Day, 25 December 1642 (NS 4 January 1643), at Woolsthorpe Manor in Woolsthorpe-by-Colsterworth, a hamlet in the county of Lincolnshire. He was born three months after the death of his father, a prosperous farmer also named Isaac Newton. Born prematurely, he was a small child; his mother Hannah Ayscough reportedly said that he could have fit inside a crusty tart. When Newton was three, his mother remarried and went to live with her new husband, the Reverend Bamabas Smith, leaving her son in the care of his maternal grandmother, Margery Ayscough. The young Isaac disliked his stepfather and maintained some enmity towards his mother for manning him, as revealed by this entry in a list of sins committed up to the age of 19: "Threatening my father and Smith to burn them and the house over them." Newton's mother had three children from her second marriage. Although it was claimed that he was once engaged, Newton never married.

From the age of about twelve until he was seventeen, Newton was educated at The King's School, Grantham which taught him Latin but no mathematics. He was removed from school, and by October 1659, he was to be found at Woolsthorpe-by-Colsterworth, where his mother, widowed for a second time, attempted to make a farmer of him. Newton hated farming. He was an ardent student of mathematics and was soon becoming one of the best mathematicians in the county. He returned to Cambridge in 1667, was identified by Barrow — paying his way by teaching. He started as a scholar at Trinity College, Cambridge, on the recommendation of his uncle Rev William Ayscough. He started as a scholar at Trinity College, Cambridge, on the recommendation of his uncle Rev William Ayscough. He started as a scholar at Trinity College, Cambridge, on the recommendation of his uncle Rev William Ayscough. He started as a scholar at Trinity College, Cambridge, on the recommendation of his uncle Rev William Ayscough. 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Newton was generally considered with the generalized binomial theorem, valid for any exponent. He discovered Newton's identities, Newton's method, classified cubic plane curves (polynomials of degree three in two variables), made substantial contributions to the theory of finite differences, and was the first to use fractional indices and to employ curvilinear coordinate systems to derive solutions to polynomial equations. He approximated partial sums of the harmonic series by the formula and was the first to use power series with confidence and to apply power series.

Newton's law of universal gravitation – History

Startling in 1686, many other members of the Royal Society (of which Newton was a member) accused Leibniz of plagiarism. The dispute then broke out in full force in 1711 when the Royal Society proclaimed in a study that it was Newton who was the true discoverer and labelled Leibniz a fraud. This was the true discoverer and Newton later found that Newton himself wrote the study's concluding remarks on Leibniz. Thus began the bitter controversy which marred the lives of both Newton and Leibniz until the latter's death in 1716 [26].

In 1666, Newton observed that the colours of a prism in the position of minimum deviation is oblong, even when the light entering the prism is circular, which is to say, the prism reflects different colours by different angles [38]. This led him to conclude that colour is a property inherent to light—a point which had been debated in prior years.

By 1670 to 1672, Newton lectured on optics. During this period he investigated the refraction of light, demonstrating that the multi-colored spectrum produced by a prism could be recombined into white light by a lens and a second prism [40]. Newtonian scholarship has revealed that Newton's analysis and reassembly of white light owes a debt to corpuscular theory.

Newton argued that light is composed of particles or corpuscles, which were reflected by a flat mirror. He demonstrated on a diagram using a prism and found that the multi-colored spectrum produced by a prism could be recombined into white light by a lens and a second prism [40].

For Newton, it was not precisely the centre of the Sun or any other body that could be considered at rest, but rather “the common centre of gravity of the Earth, the Sun and all the Planets is to be esteem'd as the Centre of the World”, and this centre of gravity “either is at rest or moves uniformly forward in a right line” (Newton adopted the “at rest” alternative in view of common consent that the centre, wherever it was, was at rest) [44].

In his papers on motion “during the two decades preceding 1684”, Newton was the first to show a diagram using a prism as a beam expander. In the same book he describes, via diagrams, the use of multiple-prism arrays. Some 278 years after Newton's discussion, Isaac Newton's law of universal gravitation – History

John Maynard Keynes, who authored many of Newton's works in algebra, stated that “Newton was not the first of his age: he was the last of the magicians.” [41] Newton's interest in algebra cannot be isolated from his contributions to science. It was at this time that there was no clear distinction between alchemy and science. He had not yet developed his ideas on the interplay of action at a distance, so he might have developed his theory of gravity. (See also Isaac Newton's occult studies.)

In 1704, Newton published Opticks, in which he expressed his corpuscular theory of light. He considered light to be made up of extremely small corpuscles, that ordinary matter was made of grosser corpuscles and specified that through a kind of alchemic transmutation “Are not gross Bodies and Light convertible into one another, ... and may Bodies receive much of their Activity from the Particles of Light which enter their Composition?” [42] Newton also constructed a primitive form of a frictional electrostatic generator, using a glass globe. [43]

Mechanics and gravitation

Further information: Wringing Principle of Mathema

In an article entitled “Newton, prisms, and the ‘opticks’ of tunable lenses” [44], it is indicated that Newton in his book Opticks was the first to show a diagram using a prism as a beam expander. In the same book he describes, via diagrams, the use of multiple-prism arrays. Some 278 years after Newton's discussion, multiple-prism beam expanders became central to the development of narrow-inwidth tunable laser. Also, the use of these pragmatic beam expanders led to the multiple-prism dispersion theory.

Subsequent to Newton, much has been amended. Young [45] and Fresnel [46] combined Newton's particle theory with Huygens' wave theory to show that colour is the visible manifestation of light's wavelength. Science also slowly came to realize the distinction between perception of colour and materialistic optics. The German poet and scientist, Goethe, could not shake the Newtonian foundation—only one “hole” Goethe did find in Newton’s armour; ... Newton had committed himself to the doctrine that refraction without color was impossible. He therefore thought that the object glasses of telescopés must for ever remain imperfect, achromatism and refraction being incompatible. This inference was proved by Dallol to be wrong. [57]

is the lever. Newtonian mechanics is the branch of classical mechanics that describes the motion of extended objects.

Mechanics and gravitation

Further information: Wringing Principle of Mathema

In 1679, Newton returned to work on (celestial) mechanics by considering gravitation and its effect on the orbits of planets with reference to Kepler's laws of planetary motion. This followed stimulation by a brief exchange of letters in 1679–80 with Hooke, who had been appointed to manage the Royal Society's correspondence, and who opened a correspondence intended to elicit contributions from Newton to Royal Society transactions. [52] Newton's rekindling of interest in astronomical matters received further stimulus by the appearance of a comet in the winter of 1680–1681, on which he corresponded with John Flamsteed [54]. After the exchanges with Hooke, Newton worked out proof that the elliptical form of planetary orbits would result from a centripetal force inversely proportional to the square of the radius vector (see Newton's law of universal gravitation – History and De motu corporum in gyrum: “On the motion of bodies in orbit”), and this centripetal force is what Newton's later definition would be as the “at rest” alternative in view of common consent that the centre, wherever it was, was at rest.

For Newton, it was not precisely the centre of the Sun or any other body that could be considered at rest, but rather “the common centre of gravity of the Earth, the Sun and all the Planets is to be esteem’d as the Centre of the World”, and this centre of gravity “either is at rest or moves uniformly forward in a right line” (Newton adopted the “at rest” alternative in view of common consent that the centre, wherever it was, was at rest) [44].

In 1696, Dürer started to write a new version of Newton's Principia, and corresponded with Leibniz. In 1693, the relationship between Dürer and Newton deteriorated and the book was never completed.

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The Principia was published on 5 July 1687 with encouragement and financial help from Robert Hooke. In this work, Newton stated the three universal laws of motion and explained why he put his expositions in this form, remarking also that “henceby the same thing is performed as by the method of indivisibles.” Because of this, the Principia has been called “a book dense with the theory and application of the infinitesimal calculus” [47] and “equal est pasqua plu de calcu” (nearly all of it is of this calculus) in Newton's time. [52] Use of methods involving “one or more orders of the infinitesimally small” is present in his De motu corporum in gyrum [53] in 1679, and in his paper “De motu” during the two decades preceding 1684.

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The Principia was published on 5 July 1687 with encouragement and financial help from Edmond Halley. In this work, Newton stated the three universal laws of motion. Together, these laws describe the relationship between any object, the force acting upon it and the resulting motion, laying the foundation for classical mechanics. It contributed to many advances during the Industrial Revolution which soon followed and were not improved upon for more than 200 years. Many of these advances continue to be the underpinnings of non-relativistic technologies in the modern world. He used the Latin word gravitas (weight) for the effect that would become known as gravity, and defined the law of universal gravitation.

In the same work, Newton presented a calculus-like method of geometric analysis using “first and last ratios”, gave the first analytical determination (based on Boyle's law) of the speed of sound in air, inferred the oblateness of Earth's spheroidal figure, accounted for the precession of the equinoxes as a result of the Moon's gravitational attraction on the Earth's oblateness, initiated the gravitational study of the irregularities in the motion of planets, defined a theory for the deformations of the orbits of comets, and on much more.

Newton made clear his heliocentric view of the Solar System—developed in a somewhat modern way, because already in the mid-1680s he recognised the “deviation of the Sun” from the centre of gravity of the Solar System. For Newton, it was not precisely the centre of the Sun or any other body that could be considered at rest, but rather “the common centre of gravity of the Earth, the Sun and all the Planets is to be esteem’d as the Centre of the World”, and this centre of gravity “either is at rest or moves uniformly forward in a right line” (Newton adopted the “at rest” alternative in view of common consent that the centre, wherever it was, was at rest) [44].
Newton postulates an invisible force able to act over vast distances led to him being criticised for introducing "occult agencies" into science.[90] Later, in the second edition of the Principia (1713), Newton firmly rejected such criticisms in a concluding General Scholium, writing that it was enough that the phenomena implied a gravitational attraction, as they did: but they did not so far indicate its cause, and it was both unnecessary and improper to frame hypotheses of things that were not implied by the phenomena. (Here Newton used what became his famous expression "hypotheses non-ergo imperat".)

With the Principia, Newton became internationally acclaimed.[91] He acquired a circle of admirers, including the Swiss-born mathematician Nicolaus Fatio de Ducler, with whom he formed an intense relationship. This abruptly ended in 1693, and at the same time Newton suffered a nervous breakdown.[92]

**Classification of cubics and beyond**

Descartes was the most important early influence on Newton's development. Descartes used plane curves from the Greek and Mersenne's extant conic sections, and Newton followed his lead by classifying the cubic curves in the plane. He found 72 of the 78 species of cubics. He also divided them into four types, satisfying different equations, and in 1717 Siris, probably with Newton's help, proved that every cubic was one of these four types. Newton also claimed that the four types could be subject to plane projection from one of them, and this was proved in 1731.[94]

According to Tom Whitehead (1933–2008), who published 8 volumes of Newton's mathematical papers, it is no exaggeration to say that Newton mapped out the development of mathematics for the next 200 years, and that Euler and others largely carried out his plan.[95]

**Later life**

Main article: Later life of Isaac Newton

In the 1690s, Newton wrote a number of religious tracts dealing with the literal and symbolic interpretation of the Bible. A manuscript Newton sent to John Locke in which he discussed the Nicene 1.5 and its fidelity to the original manuscripts of the New Testament, remained unpublished until 1785.[96] Even though a number of authors have claimed that the work might have been an indication that Newton disputed the belief in Trinity, others assure that Newton did question the passage but never denied Trinity as such. His biographer, scientist Sir David Brewster, who compiled his manuscripts for over 20 years, wrote about the controversy in contemporary "known book "Memoirs of the Life, Writings, and Discoveries of Sir Isaac Newton, where he explains that Newton questioned the veracity of those passages, but he never denied the doctrine of Trinity as such. Brewster states that Newton was never known as an Arius during his lifetime, it was not until William Whiston (an Arius) who argued that "Sir Isaac Newton was so nearly for the Baptists, as well as for the Eastumans or Arians, that he sometimes suspected these two were the two witnesses in the Revelations," while other like Hopton Haynes (a mafioso and employee of humanitarians), "mentioned to Richard Barron, that Newton held the same doctrine as himself!"[97]

Later works—The Chronology of Ancient Kingdoms Amended (1728) and Observations Upon the Prophesies of Daniel and the Apocalypse of St. John (1733)—were published after his death. He also devoted a great deal of time to alchemy (see above).

Newton was also a member of the Parliament of England for Cambridge University in 1689–90 and 1701–2, but according to some accounts his only comment were to complain of a cold draught in the chamber and request that the window be closed.[98][99] Newton moved to London to take up the post of warden of the Royal Mint in 1696, a position that he had obtained through the patronage of Charles Montagu, 1st Earl of Halifax, then Chancellor of the Exchequer. He took charge of England's great recoinage, somewhat treading on the toes of Lord Lucas, Governor of the Tower (and securing the job of deputy comptroller of the temporary Chester branch for Edmond Halley). Newton became perhaps the best-known Master of the Mint upon the death of Thomas Neale in 1699, a position Newton held for at least 20 years of his life.[100] These appointments were intended as sinecures, but Newton took them seriously, retiring from his Cambridge duties in 1701, and exercising his power to reform the currency and punish coiners and counterfeiters.

As Warden, and afterwards Master, of the Royal Mint, Newton estimated that 20 percent of the coins taken in during the Great Recoinage of 1696 were counterfeit. Counterfeiting was high treason, punishable by the felon being hanged, drawn and quartered. Despite this, countering even the most flagrant criminals could be extremely difficult. However, Newton proved equal to the task.[101]

Disguised as a habit of bars and taverns, he gathered much of this evidence himself.[102] For all the barriers placed to proselation, and separating the branches of government, English law still had ancient and formulative customs of authority. Newton had himself made a public plea of the peace in all the countries—there is a draft of a letter respecting this matter stuck into Newton's personal first edition of his Philosophiae Naturalis Principia Mathematica which he must have been amending at the time.[103] Then he conducted more than 100 cross-examinations of witnesses, informers, and suspects between June 1699 and Christmas 1699. Newton successfully prosecuted 28 coiners.[104]

As a result of a report written by Newton on 21 September 1717 to the Lords Commissioners of His Majesty's Treasury the bimetallic relationship between gold coins and silver coins was changed by Royal proclamation on 22 December 1717, forbidding the exchange of gold guineas for more than 21 silver shillings.[105] This inadvertently resulted in a silver shortage as silver coins were used to pay for imports, while exports were paid for in gold, effectively moving Britain from the silver standard to its first gold standard. It is a matter of debate as whether he intended to do this or not: it has been argued that Newton conceived of his work at the Mint as a continuation of his alchemic work.[106]

Newton was made President of the Royal Society in 1703 and an associate of the French Académie des Sciences. In his position at the Royal Society, Newton made an enemy of John Flamsteed, the Astronomer Royal, by prematurely publishing Flamsteed's Historia Coelestis Britannica which Newton had used in his studies.[107]

In April 1705, Queen Anne knighted Newton during a royal visit to Trinity College, Cambridge. The knighthood is likely to have been motivated by political considerations connected with the Parliamentary election in May 1705, rather than any recognition of Newton's scientific or service works as Master of the Mint. Newton was the second scientist to be knighted, after Sir Francis Bacon.[108]

Newton was one of many people who lost heavily when the South Sea Company collapsed. Their most significant trade was slaves, and according to his niece, he lost around £20,000.[109]

Towards the end of his life, Newton took up residence at Cranbury Park, near Winchester with his niece and her husband, until his death in 1727.[110] His half-niece, Catherine Barton Conduct, served as his hostess in social affairs at his house on Jermyn Street in London; he was her "very loving Uncle," according to his letter to her when she was recovering from smallpox.

Newton died in his sleep on 20 March 1727 (OS 31 March 1726; NS 20 March 1726; NS 31 March 1727)[111] and was buried in Westminster Abbey, Voltaire may have been present at his funeral.[112] A bachelor, he had devested much of his estate to relatives during his last years, and died intestate. After his death, Newton's hair was examined and found to contain mercury, probably resulting from his alchemical pursuits. Mercury poisoning could explain Newton's eccentricity in late life.[113]

**Personal relations**

Newton never married. The French writer and philosopher Voltaire, who was in London at the time of Newton's funeral, said that "he was never sensible to any passion, was not subject to the common fancies of mankind, nor had any commerce with women—a circumstance which was assured me by the physician and surgeon who attended him in his last moments."[114] The widespread belief that he died a virgin has been confirmed by historians such as mathematician Charles Hutton,[115] economist John Maynard Keynes,[116] and physicist Carl Sagan.[117]

Newton did find a close friendship with the Swiss mathematician Nicolaus Fatio de Ducler, with whom he met in London around 1720.[118] Their friendship came to an unexpected end in 1699. Some of their correspondence has survived.[119][120]

In September of that year, Newton had a breakdown which included sending wild accusatory letters to his friends Samuel Pepys and John Locke. His note to the latter included the charge that Locke "endeavoured to embroil me with women'."[121]

**After death**

**Fame**

The mathematician Joseph-Louis Lagrange often said that Newton was the greatest genius who ever lived, and once observed that Newton was also "the most wonderful, for we cannot find more than once a system of the world to establish."[122] English poet Alexander Pope was moved by Newton's achievements to write the famous epigraph:

Nature and nature's laws lie hid in night;
God said "Let Newton be" and all was light.

Newton himself had been rather more modest of his own achievements, famously writing in a letter to Robert Hooke in February 1676:

If I have seen further it is by standing on the shoulders of giants."[123]

Two critics write that the above quotation, written at a time when Newton and Hooke were in dispute over optical discoveries, was an oblique attack on Hooke (said to have been short and hunchbacked), rather than—or in addition to—a statement of modesty.[124][125] On the other hand, the widely known saying about standing on the shoulders of giants, published among others by seventeenth-century poet George Herbert (a former master of the University of Cambridge and fellow of Trinity College) in his Jacula Prudentum (1611), has as its main point that "a dwarf on a giant's shoulders sees farther of the two", and so its effect as an analogy would place Newton himself rather than Hooke as the "founder."[126]

In a later memoir, Newton wrote:

I do not know what I may appear to the world, but to my self I seem to have been only like a boy playing on the sea-shore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me."[127]

In 1816, a sooth said to have belonged to Newton was sold for £730[128] (£13,563) in London to an aristocrat who had it cut in a ring.[129] The Guinness World Records 2002 classified it as the most valuable tooth, which would have sold for approximately £25,000 (£55,700) in late 2001.[130] Who bought it and who currently has it has not been disclosed.

Albert Einstein kept a picture of Newton on his study wall alongside ones of Michael Faraday and James Clerk Maxwell.[131] Newton remains influential to today's scientists, as demonstrated by a 2005 survey of members of Britain's Royal Society (formerly headed by Newton) asking who had had the greater effect on the history of science, Newton or Einstein. Royal Society scientists deemed Newton to have made the greater overall contribution.[132] In 1999, an opinion poll of 100 of today's leading physicists voted Einstein the "greatest physicist ever," with Newton the runner-up, while a parallel survey of rank-and-file physicists by the site PhysicsWeb gave the top spot to Newton.[133]
Commendations

Newton's monument (1731) can be seen in Westminster Abbey, at the north of the entrance to the choir against the choir screen, near his tomb. It was executed by the sculptor Michael Rysbrack (1694–1770) in white and grey marble with design by the architect William Kent. The monument features a figure of Newton recumbent on top of a sarcophagus, his right elbow resting on several of his great books and his left hand pointing to a scroll with a mathematical design. Above him is a pyramid and a celestial globe showing the signs of the Zodiac and the path of the comet of 1680. A relief panel depicts putti using instruments such as a telescope and prism.[11] The Latin inscription on the base translates as:

Here is buried Isaac Newton, Knight, who by a strength of mind almost divine, and mathematical principles peculiarly his own, explored the course and figures of the planets, the path of comets, the tides of the sea, the dissimilarities in rays of light, and, what no other scholar has previously imagined, the properties of the colours thus produced. Diligent, sagacious and faithful, in his expositions of nature, antiquity and the holy Scriptures, he vindicated by his philosophy the majesty of God mighty and good, and expressed the simplicity of the Gospel in his manners. Mortal rejoice that it has existed such and so great an ornament of the human race! He was born on 25 December 1642, and died on 20 March 1727[7]—Translation from G.L. Smyth, The Monuments and Genesis of St. Paul's Cathedral, and of Westminster Abbey[12], I, 703.[11]

From 1979 until 1988, an image of Newton designed by Harry Ecclestone appeared on Series D £1 banknotes issued by the Bank of England (the last £1 notes to be issued by the Bank of England). Newton was shown on the obverse of the banknote. In popular culture

Religious views

Main article: Religious views of Isaac Newton

Although born into an Anglican family, by his thirties Newton held a Christian faith that, had it been made public, would not have been considered orthodox by mainstream Christianity.[12] In recent times he has been described as a heretic.[15] By 1672 he had started to record his theological researches in notebooks which he allowed to no one and which have only recently been examined. They demonstrate an extensive knowledge of early church writings and show that in the conflict between Athanasius and Arius which defined the Great Council, he took the side of Arius, the loser, who rejected the conventional view of the Trinity. Newton “recognized Christ as a divinely mediating Being between God and man, who was subordinate to the Father who created him.”[16] He was especially interested in prophecy, but for him, “the great savior was trinitarian.”[17]

In a minority view, T.C. Pfizenmaier argues that Newton held the Arian position was vigorously defended by his follower Samuel Clarke, in his Memorials of Sir Isaac Newton’s Life[13] in a conversation with Newton in Kensington on 15 April 1726: “I have been driven by the necessity of using what is called ‘gravitation’ to explain the motions of the planets.”[12] Clarke wrote in his Principles that “the conclusion of such principles must have work with considering men for the belief of a Deity.”[13] He saw evidence of design in the system of the world. Such a wonderful uniformity in the planetary system must be allowed the effect of choice”. But Newton insisted that divine intervention would eventually be required to reform the system, due to the slow growth of instabilities.[14] For this, Leibniz sympathised: “God Almighty may wish to use his watch from time to time: otherwise it would cease to move. He had not, it seems, sufficient foresight to make it a perpetual motion.”[12] Newton’s position was vigorously defended by his fellow Samuel Clarke in a famous correspondence. A later century, Pierre-Simon Laplace’s work “Celestial Mechanics” had a natural explanation for why the planet orbits do not require periodic divine intervention.[15]

Effect on religious thought

Newton and Robert Boyle’s approach to the mechanical philosophy was promoted by rationalist pamphleators as a viable alternative to the pantheists and enthusiasts, and was accepted hesitantly by orthodox preachers as well as dissenting像like the less radical deists[12]. The clarity and simplicity of science was seen as a way to combat the emotional and metaphysical superstitions of both superstitionists and enthusiasts and the threat of atheism[12] and at the same time, the second wave of English deists used Newton’s discoveries to demonstrate the possibility of a “Natural Religion”.[12]

In a manuscript he wrote in 1704 in which he describes his attempts to extract scientific information from the Bible, he estimated that the world would end no earlier than 3280. In predicting this he said: “This I mention not as a time of the end shall be, but to put a stop to the rash conjectures of fanciful man which are frequently predicting the time of the end, and by doing so bring the sacred prophecies into discredit as often as their predictions fail.”[15]

Alchemy

Newton wrote about alchemy. All of Newton’s known writings on alchemy are currently being put online in a project undertaken by Indiana University: “The Chemistry of Isaac Newton”. Here is a quote from the project web site.

Newton’s fundamental contributions to science include the quantification of gravitational attraction, the discovery that white light is actually a mixture of immutably spectral colors, and the formulation of the calculus. Yet another, more mysterious sides to Newton that is imperfectly known, a realm of activity that spanned some thirty years of his life, although he kept it largely hidden from his contemporaries and colleagues. We refer to Newton’s involvement in the discipline of alchemy, or as it was often called in seventeenth-century England, “alchemy.”"Newton wrote and transcribed about a million words on the subject of alchemy. The project is headed by William R. Newman. Newman presented a lecture entitled “Why did Isaac Newton Believe in Alchemy?” at the Perimeter Institute, in 2010. Speculative fiction author Fritz Leiber said of Newton, “Everyone knows Newton as the great scientist. Few remember that he spent half his life meddling with alchemy, looking for the philosopher’s stone. That was the pebble by the seashore he really wanted to find.”[12]

Enlightenment philosophers

Enlightenment philosophers chose a short history of scientific predecessors – Galileo, Boyle, and Newton principally – as the guides and guardians of their applications of the singular corollaries of Nature and Natural law to every physical and social field of the day. In this respect, the lessons of history and the social structures built upon it could be discarded.[13]

It was Newton’s conception of the Universe based upon Natural and rationally understandable laws that became one of the seeds for Enlightenment ideology.[12] Locke and Voltaire applied concepts of Natural law to political systems advocating in-creasing rights; the physicists and Adam Smith applied Natural concepts of psychology and self-interest to economic systems; and sociologists critiqued the current social order for trying to fit history into Natural models of progress, Montesquieu and Samuel Clarke related elements of Newton’s work, but eventually rationalised it to conform with their strong religious views of nature.

Apple incident

Newton himself often told the story that he was inspired to formulate his theory of gravitation by watching the fall of an apple from a tree.[14] Although it has been said that the apple story is a myth and that he did not arrive at his theory of gravity in any single moment,[15] acquaintances of Newton (such as William Stukeley, whose manuscript account of 1752 has been made available by the Royal Society) do in fact confirm the incident, though not the cartoon version that the apple actually hit Newton’s head. Stukeley recorded in his Memoirs of Sir Isaac Newton’s Life a conversation with Newton in Kensington on 15 April 1726:[12][14]

we went into the garden, & drank tea under the shade of some apple trees; only he, & myself. amidst other discourse, he told me, he was just in the same situation, as when formerly, the notion of gravity came into his mind. “why should that apple always descend perpendicularly to the ground,” thought he to himself, occasioned by the fall of an apple, as he sat in a contemplative mood. “why...
In similar terms, Voltaire wrote in his Essay on Epic Poetry (1727), "Sir Isaac Newton walking in his gardens, had the first thought of his system of gravitation, upon seeing an apple falling from a tree."

It is known from his notebooks that Newton was grappling in the late 1660s with the idea that terrestrial gravity extends, in an inverse-square proportion, to the Moon; however it took him two decades to develop the full-fledged theory.\[145\] The question was not whether gravity existed, but whether it could extend from Earth that it could also be the force holding the Moon to its orbit. Newton showed that if the force decreased as the inverse square of the distance, one could indeed calculate the Moon's orbital period, and get good agreement. He guessed the same force was responsible for other orbital motions, and hence named it "universal gravitation".Various trees are claimed to be "the" apple tree which Newton describes. The King's School, Grantham, claims that the tree was purchased by the school, uprooted and transported to the headmaster's garden some years later. The staff of the [now National Trust-owned] Woolsthorpe Manor dispute this claim, and claim that a tree present in their gardens is the one described by Newton. A descendant of the original tree can be seen growing outside the main gate of Trinity College, Cambridge, beside the room Newton lived in when he studied there. The National Fruit Collection at Brogdale can supply grafts from their tree, which appears identical to Flower of Kent, a coarser-flavored variety.\[146\]

Works

See also: Writing of Principia Mathematica

Published in his lifetime

- De analysi per aequationes numero terminorum infinitas (1669, published 1711)
- Method of Fluxions (1671)
- Of Natures Obscure Laws & Processes in Vegetation (unpublished, c. 1671–75)\[146\]
- De motu corporum in gyrum (1684)
- Philosophiae Naturalia Principia Mathematica (1687)
- Opticks (1704)
- Reports as Master of the Mint (1701–25)
- Arithmetica Universalis (1707)

Published posthumously

- The System of the World (1728)
- Optical Lectures (1728)
- The Chronology of Ancient Kingdoms Amended (1728)
- De mundi systemate (1728)
- Observations on Daniel and The Apocalypse of St. John (1733)

An Historical Account of Two Notable Conformities of Scripture (1754)

Primary sources

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- Newton’s Philosophy of Nature: Selections from his Writings edited by H.S. Trager (1953; online edition)
- Isaac Newton, Sir; J. Edleston. Roger Cotes, Correspondence of Sir Isaac Newton and Professor Cotes, including letters of other eminent men , London, John W. Parker, West Strand; Cambridge, John Deighton (1850, Google Books).

See also

- Book: Isaac Newton
- Israel, Bullard
- De Motu (Berkeley's essay)
- Elements of the Philosophy of Newton
- Finite difference: Newton series
- Gauss–Newton algorithm
- History of calculus
- History of the telescope
- Latin–Newton calculus controversy
- List of multiple discoveries: seventeenth century
- List of things named after Isaac Newton

References

1. During Newton's lifetime, two calendars were in use in Europe: the Julian ("Old Style") calendar in protestant and Orthodox regions, including Britain; and the Gregorian ("New Style") calendar in Roman Catholic Europe. At Newton's birth, Gregorian dates were ten days ahead of Julian dates; thus his birth is recorded as taking place on 25 December 1642 Old Style, but can be converted to a New Style (modern) date of 4 January 1643. By the time of his death, the difference between the calendars had increased to eleven days: moreover, he died in the period after the start of the New Style year on 1 January, but before that of the Old Style new year on 25 March. His death occurred on 20 March 1727 according to the Old Style calendar, but the year is usually adjusted to 1727. A full conversion to New Style gives the date 31 March 1727. See Thony, Christlein (2011) [Caledrical confusion or just when did Newton die?]: 1. Fellows of the Royal Society, London: Royal Society. Archived from the original on 16 March 2015.\[148\]
4. cite error: Invalid -ref tag: no text was provided for refs named The_Newton_Handbook
5. Isaac Newton's Religious Salesgiving USA Today News
6. God is known for his work\[147\] in Isaac Newton's Principles of Philosophy (1738), p. 293. doi: 10.1136/bmj.291.6511.1779
9. Retrieved 6 July 2014.<templatestyles src="Module:Citation/CS1/styles.css" title="Use the CS1 template (styles.css)">\[148\]
10. Retrieved 6 July 2014.<templatestyles src="Module:Citation/CS1/styles.css" title="Use the CS1 template (styles.css)">\[148\]
11. Retrieved 6 July 2014.<templatestyles src="Module:Citation/CS1/styles.css" title="Use the CS1 template (styles.css)">\[148\]
12. This claim was made by William Stukeley in 1727, in a letter about Newton written to Richard Mead. Charles Hutton, who in the late eighteenth century collected oral traditions about earlier scientists, declared that there "do not appear to be any sure sufficient reason for his never marrying, if he had an inclination so to do. It is much more likely that he had a constitutional indifference to the state, and even to the sex in general." Charles Hutton, A Mathematical and Philosophical Dictionary (1795–6), vol. 2, p. 100.
13. Retrieved 6 July 2014.<templatestyles src="Module:Citation/CS1/styles.css" title="Use the CS1 template (styles.css)">\[148\]
14. Retrieved 6 July 2014.<templatestyles src="Module:Citation/CS1/styles.css" title="Use the CS1 template (styles.css)">\[148\]
15. Retrieved 6 July 2014.<templatestyles src="Module:Citation/CS1/styles.css" title="Use the CS1 template (styles.css)">\[148\]
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NEWTON, ISAAC (b. Woolsthorpe, England, 25 December 1642; d. London, England, 20 March 1727) mathematics, dynamics, celestial mechanics [1], astronomy, optics, natural philosophy. Isaac Newton was born a posthumous child, his father having been buried the preceding 6 October. Isaac Newton was born a posthumous child, his father having been buried the preceding 6 October. Newton was descended from yeomen on both sides: there is no record of any notable ancestor. Sir Isaac Newton, has been referred to as one of the greatest geniuses of history. His mathematical and scientific achievements give credence to such a view. His many accomplishments in the field of science include: Developing a theory of calculus. Unfortunately, at the same time as Newton, calculus was being developed by Leibniz. When Leibniz published his results, there was a bitter feud between the two men, with Newton claiming plagiarism. Sir Isaac Newton contributed to many branches of human thought, among which physics and mathematics were the fields in which he contributed substantially. In 1687, the sum total of his discoveries in mechanics were published in the legendary book Philosophiæ Naturalis Principia Mathematica. Newton enunciated his law of universal gravitation and three laws of motion. He thus laid the groundwork for classical mechanics, also known as