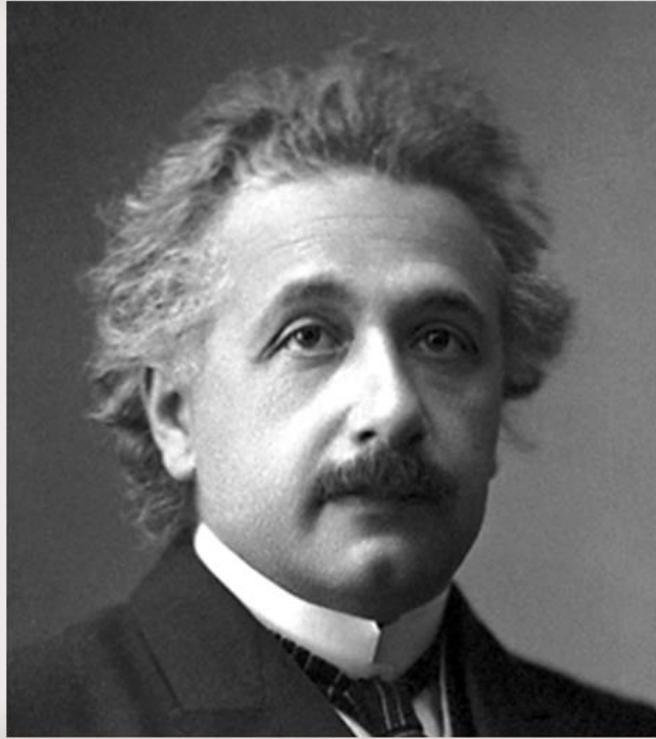
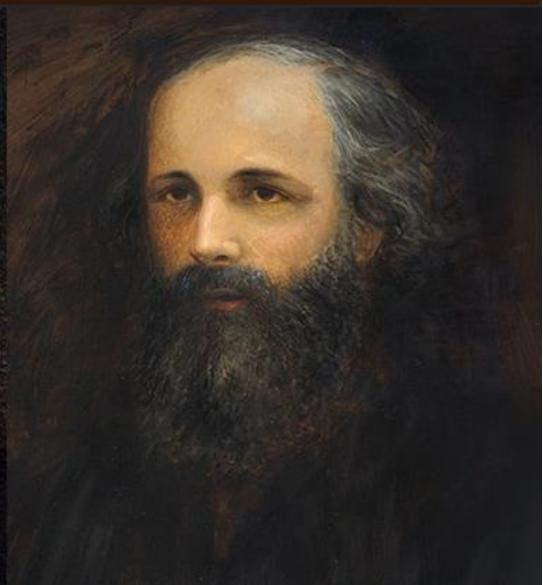
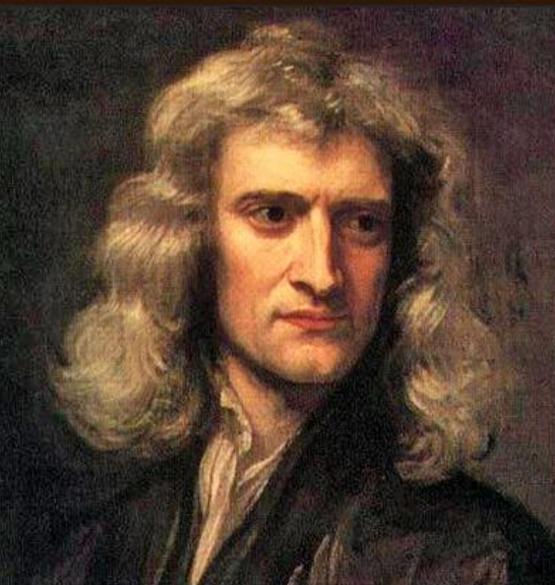


# Einstein's Heroes



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# EINSTEIN'S HEROES

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*First Web Edition*

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Cover illustration: Images of Albert Einstein, Isaac Newton, Michael Faraday and James Clerk Maxwell from Wikipedia. See Image credits at the end.

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## **Endorsement**

“An excellent, well referenced and informative summary of the scientific achievements of three of the world’s greatest scientists: Newton, Faraday and Maxwell. These men were all highly esteemed by Albert Einstein and were his in fact, his ‘heroes’. What this booklet highlights is the extent to which these three great scientists were all devout believers in the God of the Bible and how their understanding of Creation of the Universe described in the book of Genesis both motivated and informed their scientific discoveries.”

Professor Stephen Taylor,  
Department of Electrical Engineering and Electronics, University of Liverpool, United Kingdom

Albert Einstein (1879–1955) is thought by many to have been the greatest scientist of the twentieth century. He is known particularly for his theory of relativity and his formula,  $E = mc^2$ , which led to development of nuclear power. In 1921 he was awarded a Nobel Prize for his explanation of the photoelectric effect. In his house he hung portraits of his greatest scientific heroes. They were Isaac Newton, Michael Faraday and James Clerk Maxwell.<sup>1</sup> All three built their thinking about the world on the Bible.

### Isaac Newton (1643–1727)

*“Isaac Newton ... was the culminating figure of the scientific revolution of the seventeenth century.”*<sup>2</sup>

Richard S. Westfall  
Professor of History of Science, Indiana University

*“Newton most explicitly endorsed the notion of a Creation once and for all as the only sound framework of natural philosophy [i.e. science].”*<sup>3</sup>

Stanley L. Jaki  
Distinguished University Professor, Seton Hall University

Although best known for his three laws of motion, Newton also laid the foundation for the science of optics (the study of light) and, along with Gottfried Leibniz, pioneered the mathematical technique known as calculus. According to Professor Noel Swerdlow, Newton’s *Mathematical Principles of Natural Philosophy* (the *Principia*) is “the single most important book in the history of science.”<sup>4</sup> Along with René Descartes and Robert Boyle, he is one of the three scientists credited with establishing the concept of ‘laws of nature’.<sup>5</sup> *New Scientist* magazine described him as “the supreme genius ... in the history of science.”<sup>6</sup> The SI unit of force (the Newton) is named in his honour.

As noted by Professor Richard Westfall, “Newton came to the investigation of nature with presuppositions drawn from Christianity.”<sup>7</sup> He rejected the teaching of the ancient Greek philosophers like Plato and Aristotle who held that objects have souls and move due to powers within them. According to Genesis, only animals and people are ‘living creatures’ (Genesis 1:20, 24). Hence, and contrary to Aristotle, stones do not fall to the ground because they have a desire to move towards the centre of the earth. Nor do they move due to powers within them, but due to laws external to them and imposed on them by God. Representing Newton in a debate with Gottfried Leibniz, Samuel Clark argued that God “not only composes or puts Things together, but is himself the Author and continual Preserver of their Original Forces or moving Powers ... nothing is done without his continual Government and Inspection.”<sup>8,9</sup> Newton himself wrote that because God “is everywhere present ... [i]n him are all things contained and moved.”<sup>10</sup> Rejecting the teaching of Plato that the world had a divine soul, he wrote that God “governs all things, not as the soul of the world, but as Lord over all: And on account of his dominion he is wont to be called Lord God Παντοκράτωρ, or Universal Ruler.”<sup>11</sup> For Newton, there was only one God and He acted sovereignly throughout the world. All things would obey His laws and the task of the scientist was to discover and describe these laws.<sup>12</sup>

According to ancient Greek philosophers, the creator was not free to create as he wished, but was constrained to follow certain ‘necessary’ principles. These, they believed, could be deduced by processes of reason. For example, believing the planets to be divine, they concluded that they must move in circular orbits because circles are ‘ideal’, perfect forms. Newton, however, embracing the biblical doctrine of God’s omnipotence, held that God could create as he willed. Consequently, he maintained, the only way to discover laws of nature was to make observations. These, of course, led to the conclusion that the planets move in elliptical not circular orbits, and around the sun not the earth. In the preface to the second edition of Newton’s *Principia*, Roger Cotes wrote:

“Without doubt this world ... could arise from nothing but the perfectly free will of God. ... From this fountain it is that those laws, which we call the laws of Nature, have flowed, in which there appear many traces indeed of the most wise contrivance, but not the least shadow of necessity. These therefore we must not seek from uncertain conjectures, but learn them from observations and experiments.”

Much of the motivation for Newton’s scientific writing arose from his desire to promote belief in God, the Christian faith, and associated service to God and society.<sup>13</sup> In his preface to the *Principia*, Cotes emphasised its primary purpose, arguing that it

“will be the safest protection against the attacks of atheists, and nowhere more surely than from this quiver can one draw forth missiles against the band of godless men.”

For Newton, astronomy provided undeniable evidence of God and creation, and particularly the orderliness and harmony seen in the solar system. He declared: “This most beautiful system of the sun, planets, and comets, could only proceed from the counsel and dominion of an intelligent and powerful Being.”<sup>14</sup> In a letter to Richard Bentley he wrote:

“When I wrote my treatise about our system I had an eye upon such principles as might work with considering men for the belief of a Deity and nothing can rejoice me more than to find it useful for that purpose.”<sup>15</sup>

The animal kingdom, too, he argued clearly manifested design. He asked, “Was the eye contrived without skill in optics, and the ear without knowledge of sounds? ... eyes, ears, brains, muscles, heart, lungs ... can be the effects of nothing else than the wisdom and skill of a powerful ever-living Agent”.<sup>16</sup>

Newton penned over a million words on theology and the Bible<sup>17</sup> and testified, “I find more sure marks of authenticity in the Bible than in any profane [i.e. secular] history whatsoever.”<sup>18</sup> According to Professor Robert Iliffe, “Newton was clearly concerned that his reputation and legacy should make clear that he was a deeply devout Christian whose life had been devoted to the study of the Bible.”<sup>19</sup>

### **Michael Faraday (1791–1867)**

*“... the speculations and imaginings which led Faraday to the experiments and the courage which permitted him to publish physical heresies owe something to his unquestioning belief in the unity and interconnections of all phenomena. This belief, in turn, derived from his faith in God as both creator and sustainer of the universe.”*<sup>20</sup>

L. Pearce Williams  
Professor of the History of Science, Cornell University

*“... a greater philosopher than Michael Faraday has rarely been known among us ... but I am bold to add that never have we known a man who more perfectly exhibited the meekness, the peaceableness, the humility, the blamelessness, of the true child of God. I am not consciously exaggerating when I say that there went forth a virtue from that Christian man, which made those who had come from his presence feel happier, and, I may venture to say, even better men.”*<sup>21</sup>

Rev. Charles Pritchard  
Professor of Astronomy, University of Oxford

Michael Faraday has been described as the greatest experimenter in the history of science. He is known principally for his work in electromagnetism and his inventing the first electric motor. He was also the first to generate electricity from a magnetic field. His discovery that light is influenced by magnetism

led to the electromagnetic theory of light. Alongside his pioneering work as physicist, he was a distinguished chemist, making significant contributions to electrochemistry, and identified a number of compounds. The SI unit of capacitance (the Farad) is named in his honour.

#### *An outstanding Christian life*

Faraday was a faithful member of the Sandemanian church, a Christian denomination which upheld the truth and authority of the Bible. He served as an elder at his local chapel, preaching and leading worship.<sup>22</sup> His devout Christian life was recorded by his biographer, Professor L. Pearce Williams (an atheist) who wrote of him that “he never stooped to petty quarrels or sought revenge for any real or imagined slight.” Faraday, he said had a great love of truth—both that revealed in Scripture and that discovered through his scientific work. “Secure in his faith and beloved by his wife and relatives he was able to devote his entire energy for forty years to the task of uncovering one corner of it.”<sup>23</sup>

Faraday was greatly respected by the members of his chapel who testified as to how “he was most assiduous in visiting the poorer brethren and sisters at their own homes, comforting them in their sorrows and afflictions and assisting them from his own purse. ... he was continually pressed to be the guest of the high and noble ... but he would, if possible, decline preferring to visit some poor sister in trouble, assist her, take a cup of tea with her, read the Bible and pray.”<sup>24</sup> Fellow scientist Professor John Tyndall (an agnostic) gave an account of a meal he once shared with Faraday:

“He [Faraday] said grace. I am almost ashamed to call his prayer a ‘saying of grace’. In the language of Scripture, it might be described as the petition of a son, into whose heart God had sent the Spirit of His Son, and who with absolute trust asked a blessing from his father. ... He was bright and joyful—boy-like, in fact, though he is now sixty-two. His work excites admiration, but contact with him warms and elevates the heart. Here, surely, is a strong man. I love strength; but let me not forget the example of its union with modesty, tenderness, and sweetness, in the character of Faraday.”<sup>25</sup>

Professor Williams wrote of him that “his true humility lay in a profound consciousness of his debt to his Creator. That Michael Faraday, poor, uneducated son of a journeyman blacksmith and a country maid was permitted to glimpse the beauty of the eternal laws of nature was a never-ending source of wonder to him.” To him “the world was intelligible, beautiful and adapted to the needs of mankind because God was rational and good. ... Faraday’s science was firmly rooted in his faith. ... What higher goal could a man seek than the knowledge of God’s creation? In this way, he could participate, however infinitesimally, in the Divinity.”<sup>26</sup>

#### *A Scriptural physicist*

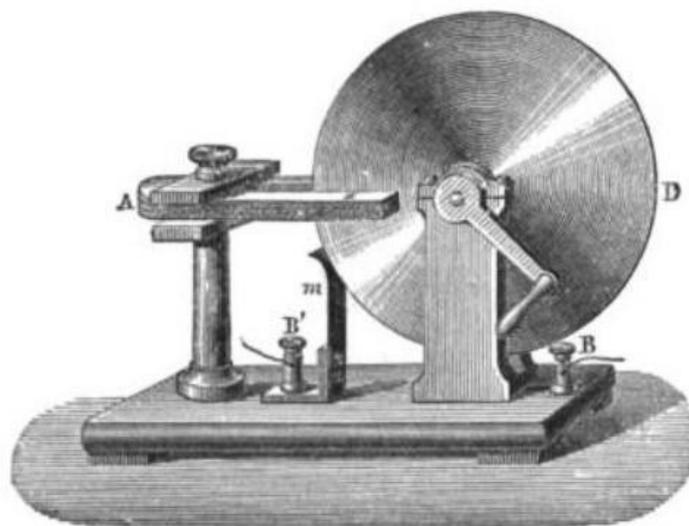
In a memorandum on *Matter*, penned in 1844, Faraday argued that “God has been pleased to work in his material creation by laws, and these laws are made evident to us by the constancy of the characters of matter and the constancy of the effects which it produces.”<sup>27,28</sup> According to Professor Geoffrey Cantor, “Both through the Bible and in nature Faraday’s highest aim was to search for God’s laws” and the scientist’s sacred task, he believed, was to reveal the Divine handiwork to His glory.<sup>29</sup> The practice of science, he believed, “inculcated the correct moral and spiritual values”<sup>30</sup> and his conviction that God had made the workings of His creation intelligible provided him with the motivation to study it.<sup>31</sup>

In a lecture on education, Faraday declared that “the book of nature ... is written by the finger of God”.<sup>32</sup> He believed that, just as we can read God’s book of Scripture (the Bible) so we can read God’s book of nature (the physical world); and just as God had written the Bible in a plain style making it comprehensible to those who seek spiritual truths, so He had constructed the natural world on simple principles making these comprehensible to those who search for them.<sup>33</sup> Hence, scientific enquiry was likely to be fruitful because God had made it possible.

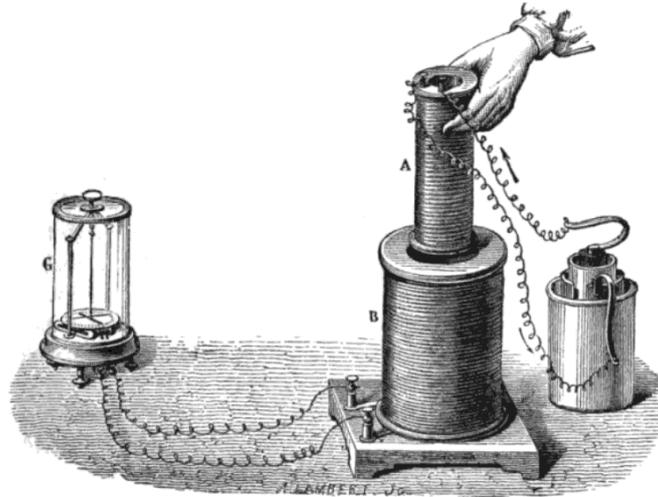
According to Professor Williams, Faraday's "deepest intuitions about the physical world sprang from this religious faith in the Divine origin of nature."<sup>34</sup> He believed that God had made a world in which everything is tightly ordered according to a definite plan, and this belief underpinned and guided much of his scientific research. To him, the nature of God as revealed in the Bible necessitated that natural processes would be simple, beautiful, harmonious and law-like, with observable principles of 'cause and effect'.<sup>35</sup>

"A strong sense of the unity of God and nature pervaded Faraday's life and work"<sup>36</sup> and he therefore expected to find unifying scientific principles, such as what he referred to as "the unity of force" (see *The Christian Doctrine of The Unity of God* below). While today the terms 'force' and 'power' have very specific well-defined meanings, early scientists would use them loosely to refer to various phenomena including heat, light, electricity, magnetism and gravity. All these 'forces' and 'powers', Faraday believed, were simply different manifestations of a single universal 'force'. Faraday's theologically derived sense of "the unity of force" led him to surmise that there was only one kind of electricity, whether produced by an electrostatic generator, magnetic field, electrochemical cell, thermocouple or electric fish. This he then established through a number of experiments.<sup>37</sup>

According to the Bible, only God can create *ex nihilo* (out of nothing) and Faraday concluded from this that it is impossible for us either to create or annihilate 'force'.<sup>38</sup> Hence, he expected to find a principle of "conservation (or convertibility) of force"—something which would also be seen if there were a 'unity of forces'. This he demonstrated in a number of ways, notably in respect of magnetism and electricity. For example, in 1821 he showed that a current-carrying wire would rotate around a magnet and, conversely, a magnet would rotate around a current-carrying wire. He thereby demonstrated that electricity could be converted into mechanical work and, in so doing, produced the first electric motor.<sup>39</sup> In 1831 he showed that, just as electricity could be used to produce magnetism, magnetism could be used to produce electricity. Moreover, the required magnetism could be generated by either a permanent magnet (fig. 1) or an electromagnet (fig. 2). Here again Faraday's belief in the unity of nature was vindicated as, in both cases, the magnetic field was later found to be produced by the motions of electric charges (electrons). Electricity and magnetism, he had shown, are two sides of the same coin.



**Fig. 1.** Faraday's generator using a permanent magnet. The 'horseshoe magnet' A provides a magnetic field between its two legs which passes through the disk D. When the disk is rotated, a current is induced in it which flows to the terminal B' via the sliding spring contact m. Terminal B enables the circuit to be completed.



**Fig. 2.** Faraday's experiment where he demonstrated that electromagnetism could be used to generate electricity. The battery (far right) causes a current to flow through coil A, producing a magnetic field around it. When moved in and out of coil B, this induces a voltage in coil B which is detected by the galvanometer G.

In 1845, Faraday showed that the plane of polarization of light could be rotated by a magnetic field, thus demonstrating the unity of nature in interconnectedness of electricity, magnetism and light. This laid the foundation for the electromagnetic theory of light, an embryonic form of which he discussed in his *Thoughts on Ray Vibrations*, published in 1846. Subsequently he attempted to demonstrate that gravity and electricity are related, anticipating today's search for a 'theory of everything', a description of how the all fundamental forces in nature are linked together.<sup>40</sup> He wrote, "I have long held an opinion, almost amounting to conviction ... that the various forms under which the forces of matter are made manifest have one common origin; or, in other words, are so directly related and mutually dependent, that they are convertible".<sup>41</sup>

The principle of 'conservation of force' was held by a number of prominent nineteenth century scientists. In 1845 James Joule, for example, wrote:

"Believing that the power to destroy belongs to the Creator alone I entirely coincide with Roget and Faraday in the opinion that any theory which, when carried out, demands the annihilation of force, is necessarily erroneous."<sup>42</sup>

Today, this principle is known as the 'conservation of energy'. Surprisingly, despite his uncompromising commitment to 'force conservation'—that 'force' can neither be created nor destroyed—Faraday failed to recognise its proper formulation as 'energy conservation'.<sup>43</sup> Joule, however, did and is credited with playing a major role in establishing what is now known as the 'first law of thermodynamics'.

#### *Public lectures*

Faraday was keen to encourage the general public to engage with science and gave presentations on his work, including a series of 'Christmas lectures' for young people.<sup>44</sup> These took place at the Royal Institution in London. Despite his faith being central to his science, he only occasionally referred to it in public, maintaining that true knowledge of God (and the Gospel) "is received through simple belief of the testimony given", i.e. Scripture. He was critical of the 'natural theology' of deists which placed man's reason above God's revelation (the Bible) and, in this sense, argued that there is "an absolute distinction between religious and ordinary belief."<sup>45,46</sup>

Referring to Faraday and his lectures Rev. Professor Charles Pritchard commented:

“... this great and good man never obtruded the strength of his faith upon those whom he publicly addressed; upon principle he was habitually reticent on such topics, because he believed they were ill suited for the ordinary assemblages of men. Yet on more than one occasion when he had been discoursing on some of the magnificent prearrangements of Divine Providence, so lavishly scattered in nature, I have seen him struggle to repress the emotion which was visibly striving for utterance; and then at the last, with one single far-reaching word, he would just hint at his meaning rather than express it.”<sup>47</sup>

According to Professor J.H. Gladstone, “In his more familiar lectures to the cadets at Woolwich, however, he more than hinted at such elevated thoughts. In conversation, too, Faraday has been known to express his wonder that anyone should fail to recognise the constant traces of design [in nature]”.<sup>48</sup> Moreover, having declared before a Royal Institution audience that there is “an absolute distinction between religious and ordinary belief”, he went on to quote Romans 1:20, declaring:

“... even in earthly matters, I believe that the invisible things of HIM from the creation of the world are clearly seen, being understood by the things that are made, even His eternal power and Godhead; and I have never seen anything incompatible between those things of man which can be known by the spirit of man which is within him, and those higher things concerning his future, which he cannot know by that spirit.”<sup>49</sup>

### *Conclusion*

Faraday is thought by many to have been one of the greatest scientists of the nineteenth century. There can be little doubt, too, that much of his inspiration and energies derived from his Christian faith. Professor Williams observed, “It was the conviction that forces were inherently identical and convertible that inspired Michael Faraday during the major portion of his scientific career”<sup>50</sup> and this conviction “derived essentially from the nature of God and of God’s world.”<sup>51</sup> Tyndall noted, “I think that a good deal of Faraday’s week-day strength and persistency might be referred to his Sunday Exercises. He drinks from a fount on Sunday which refreshes his soul for a week.”<sup>52</sup>

### **James Clerk Maxwell (1831–1879)**

*From a long view of the history of mankind—seen from, say, ten thousand years from now—there can be little doubt that the most significant event of the 19th century will be judged as Maxwell’s discovery of the laws of electrodynamics.*<sup>53</sup>

Richard Feynman  
Professor of Theoretical Physics, California Institute of Technology

*Maxwell’s and Faraday’s persistent sense of the createdness of nature, their theistic worldview, ... undergirded their belief in the coherent unity of nature ... and it encouraged the idea of conservation as a fundamental unifying principle.*<sup>54</sup>

Ian H. Hutchinson  
Professor of Nuclear Science and Engineering, Massachusetts Institute of Technology

Maxwell is best-known for his four equations describing the interrelation of electric and magnetic fields. He thus confirmed mathematically what Faraday’s had demonstrated experimentally, i.e. that electricity, magnetism and light are manifestations of one ‘force’. These equations provide the basis for much of modern physics and have enabled technologies such as TV, radio, mobile phones and wifi.

Maxwell contributed much to our understanding of optics, the behaviour gasses, colour vision, elasticity and dynamics, and is credited with producing the first durable colour photograph. He also showed that the rings of Saturn were made up of unconnected particles. His work was described by Einstein as “the most profound and the most fruitful that physics has experienced since the time of Newton.”<sup>55</sup>

### *Maxwell the Christian*

As a child Maxwell was thoroughly schooled in the Bible. He had an excellent memory and, from an early age, could give chapter and verse for almost any quotation from the Psalms. He could also recite all 176 verses of Psalm 119 by heart. Aged eight, his mother died and, despite this great loss, he responded to the news that “she was now in heaven” by saying, “Oh, I’m so glad! Now she’ll have no more pain.”<sup>56</sup> As a young man his Christian character was noted by Rev. G.W.H. Taylor who wrote:

“Maxwell has indeed left a very bright memory and example. We, his contemporaries at college, have seen in him high powers of mind and great capacity and original views, conjoined with deep humility before his God, reverent submission to His will, and hearty belief in the love and the atonement of that Divine Saviour who was his Portion and Comforter in trouble and sickness, and his exceeding great reward.”<sup>57</sup>

To the end of his life he remained a committed Christian. He would read the Bible each evening with his wife, served as an elder in his local church and gave generously to charitable institutions. He was a keen supporter of education, contributing financially to the local school and, as a younger man, giving classes for ‘working men’. He would also visit the sick and read and pray with them.<sup>58</sup>

In his late forties, Maxwell contracted abdominal cancer and, in the final stages of his illness, was visited regularly by his parish priest who wrote of him:

“He understood his position from the first; knew what it all meant, and calmly girded himself for the awful struggle. He welcomed me at once ... and spoke of our relations with a grave, simple cheerfulness. ... he was never downcast or overburdened, and yet he was the humblest and most diffident of men, with the deepest sense of his own unworthiness ... . But he loved much, and love had cast out fear. ... His knowledge of the Bible was remarkable, and he constantly asked for his most deeply-prized passages. Four days before he was removed from us he received the Holy Communion at my hands, with holy, reverent, fervid devotion, and said what strength it gave him.

... his illness drew out the whole heart and soul and spirit of the man: his firm and undoubting faith in the Incarnation and all its results; in the full sufficing of the Atonement; in the work of the Holy Spirit. He had gauged and fathomed all the schemes and systems of philosophy, and had found them utterly empty ... and he turned with simple faith to the Gospel of the Saviour.”<sup>59</sup>

### *Faith and science*

In creation Maxwell saw the hallmarks of wisdom and power, particularly in what he referred to as its “uniformity, accuracy symmetry, consistency, and continuity of plan”.<sup>60</sup> Like Faraday, he believed in the ‘one true God’ of the Bible who had created a world governed by natural laws which were logical, consistent and unified. Professor Ian Hutchinson comments:

“Lawfulness ... was an expectation they [Faraday and Maxwell] attributed to the existence of a divine lawgiver. These men’s insights into physics were made possible by their religious commitments. For them, the coherence of nature resulted from its origin in the mind of its Creator.”<sup>61</sup>

As a Bible-believing Christian, Maxwell held firmly to the Genesis account of creation, as made clear by a discussion with a colleague who wrote:

“The conversation turned on Darwinian evolution ... [and] I spoke disrespectfully of Noah’s flood. Clerk Maxwell was instantly aroused ... reproving me for want of faith in the Bible! I had no idea at the time that he had retained the rigid faith of his childhood, and was, if possible, a firmer believer than Gladstone in the accuracy of Genesis.”<sup>62</sup>

Gladstone had been the Prime Minister of Great Britain and had an unshakable faith in the truth of the Bible. He wrote of the Genesis account of creation that it is a “detailed exposition of physical facts ... The method here pursued is that of historical recital. The person, who composes or transmits it, seems to believe, and to intend others to believe, that he is dealing with matters of fact.”<sup>63,64</sup>

For Maxwell, the doctrines of God and Creation were central to his practice of science, as was the ‘dominion mandate’ given to Adam and Eve in Genesis 1:28. In a lecture, he stated:

“When we have once made our minds familiar with the one or two great physical laws we begin to look upon the Universe as a realization of the highest principles of Order & Beauty and we are prepared to see in Nature not a mere assemblage of wonders to excite our curiosity but a systematic museum designed to introduce us step by step into the fundamental principles which are displayed in the works of Creation. ... the study of the world in which we live is our obvious duty as a condition of our fulfilling the original command ‘to subdue the earth and have dominion over the creatures’. ... we see more and more that the laws of nature are not mere arbitrary and unconnected decisions of Omnipotence, but that they are essential parts of one universal system in which infinite Power services only to reveal unsearchable Wisdom and eternal Truth.”<sup>65</sup>

As observed by Professor Matthew Stanley, for Maxwell, “The unity of nature was therefore guaranteed by theology”<sup>66</sup> and this theology “gave him a powerful set of tools for understanding the natural world”.<sup>67</sup> Moreover, Maxwell’s conviction that God had intended us to discover these laws provided him with the motivation to persist in his work until he found them.<sup>68</sup>

Maxwell, however, argued against using the latest scientific ideas to interpret Genesis. He wrote:

“But I should be very sorry if an interpretation founded on a most conjectural scientific hypothesis were to get fastened to the text in Genesis ... . The rate of change of scientific hypothesis is naturally much more rapid than that of Biblical interpretations, so that if an interpretation is founded on such an hypothesis, it may help to keep the hypothesis above ground long after it ought to be buried and forgotten.”<sup>69</sup>

However, while cautioning against making science the *interpreter* of Scripture, he believed that it could help us see the *truth* of Scripture. He continued:

“At the same time I think that each individual man should do all he can to impress his own mind with the extent, the order, and the unity of the universe, and should carry these ideas with him as he reads such passages as the 1st chapter of the Epistle to the Colossians ... just as enlarged conceptions of the extent and unity of the world of life may be of service to us in reading Psalm 8, Hebrews 2:6, etc.”<sup>70</sup>

In arguing in this way, Maxwell advocated the *ministerial* rather than *magisterial* use of science (see *Ministerial and magisterial use of science* below).

Among his papers was found the following prayer:

“Almighty God, who hast created man in Thine own image, and made him a living soul that he might seek after Thee and have dominion over Thy creatures, teach us to study the works of Thy hands that we may subdue the earth to our use, and strengthen our reason for Thy service; and so to receive Thy blessed Word, that we may believe on Him whom Thou hast sent to give us the knowledge of salvation and the remission of our sins. All which we ask in the name of the same Jesus Christ our Lord.”<sup>71</sup>

### *Conclusion*

While a student at Cambridge Maxwell wrote, “I believe, with the Westminster Divines and their predecessors ... that ‘Man's chief end is to glorify God and to enjoy him forever’”<sup>72</sup> and there can be little doubt that, throughout his life, he strove to do just that, in both his science and his service to the church.

Conscious of his own sin and his need of God, he once wrote, “I have the capacity of being more wicked than any example that man could set me”.<sup>73</sup> Yet in his final weeks Rev. Professor Hort noted that “every interest of life seemed to be hallowed and brightened by the probable nearness of the Divine summons to a new form of existence.”<sup>74</sup> Maxwell himself testified, “The only desire which I can have is like David to serve my own generation by the will of God, and then fall asleep.”<sup>75</sup>

Shortly after his death, Professor B.F. Westcott wrote of Maxwell’s friends and colleagues:

“It was impossible to think of him whom they had so lately lost ... and to recollect his genius and spirit, his subtle and profound thought, his tender and humble reverence, without being sure that that close connection between Physics and Theology which was consecrated by the past was still a living reality among them.”<sup>76</sup>



## **The Christian Doctrine of the Unity of God**

The Christian religion is monotheistic—from Greek, *monos* (single) and *theos* (God)—holding that there is only one God (Isaiah 45:5–6; 1 Timothy 2:5). When asked which is the greatest commandment, Jesus replied by first quoting from the book of Deuteronomy:

“Hear, O Israel: The LORD our God, the LORD is one” (Deuteronomy 6:4).

The Hebrew word here translated “one” is *echad* which is sometimes used to denote a unified oneness (a plurality within a unity), for example, as in marriage: “For this reason a man will leave his father and mother and be united to his wife, and they will become one [*echad*] flesh” (Genesis 2:24). This is in contrast to the Hebrew word, *yachid*, which denotes solitary oneness.

The Bible teaches that God exists and may be known in three persons: the Father, the Son and the Holy Spirit. Within the unity of God there are Three. Hence, God is said to be a ‘tri-unity’ or ‘trinity’. These three always act together, in perfect harmony and perfect oneness of purpose. This can be seen in

creation (Genesis 1:1–3; John 1:1–3) and salvation (Hebrews 9:14). Jesus said, “whatever the Father does the Son also does” (John 5:19), and the Spirit is the Spirit of the Father and of the Son (John 14:16–18; 26). Christians are baptized in the name (not names) of the Father and of the Son and of the Holy Spirit (Matthew 28:19). Referring to the church, the apostle Paul wrote:

“There are different kinds of gifts, but the same Spirit distributes them. There are different kinds of service, but the same Lord. There are different kinds of working, but in all of them and in everyone it is the same God at work” (1 Corinthians 12:4–6).

The unity of God is also seen in His attributes—his wisdom, love, justice, holiness, wrath etc.—as He always acts in a way that is consistent with all His attributes, all the time. In creation we see his wisdom, power and beauty. In salvation, what His justice demanded, His love provided. His justice demanded a sacrifice for sin and His love provided it (John 3:16). In this way He could be “just and the one who justifies those who have faith in Jesus” (Romans 3:26).

There being only one God would suggest that there is only one set of natural laws, and these would be expected to act together harmoniously, reflecting the unity of their creator and the unity of His purposes. The immutability of God (e.g. Malachi 3:6) would suggest that these laws act consistently at all times. Believing these things provides a basis for doing science.

### Ministerial and magisterial use of science

Advocates of the ministerial use of science—from Latin, *minister* (servant)—hold that science should be placed *under* Scripture, serving the text so as to illuminate the truths revealed in it. Advocates of the magisterial use of science—from Latin, *magister* (master or teacher)—hold that science should be placed *over* Scripture, informing us how we should interpret the Bible.

An example of the magisterial use of science is seen in the King James Bible’s choice of the word ‘firmament’ to translate the Hebrew word *raqia* in Genesis 1 verses 6, 7, 8, 14, 15, 17 and 20. ‘Firmament’ is derived from the Latin *firmamentum* which means a ‘support’ or ‘prop’ and carries the sense of something solid. Similarly, the Septuagint (the early Greek translation of the Old Testament) uses the word *stereoma* which, again, suggests something solid. It would appear that the ‘science of the day’, which held that the earth was surrounded by a solid dome, determined how the word *raqia* should be understood. Modern translations render *raqia* as ‘expanse’ which seems far better. The root of *raqia* is the Hebrew word *raqa* which means to beat, stamp, beat out or spread out, and is used, for example, to refer to the hammering out of thin sheets of gold (Exodus 39:3). Moreover, in Genesis 1:8, God called this expanse *shamayim*, which is often translated ‘sky’ or ‘heavens’, and is specifically stated to be something that God “stretched out” (e.g. Job 9:8, Isaiah 42:5, Jeremiah 10:12). The *shamayim* includes the place where birds fly (e.g. Genesis 1:20, Deuteronomy 4:17) and therefore cannot be solid.

A more recent example of the magisterial use of science relates to the way the word *asah* is understood in Genesis 1:16. Referring to the creation of the sun, moon and stars on the fourth day of creation, it states that “God made two great lights—the greater light to govern the day and the lesser light to govern the night. He also made the stars.” Hence according to Genesis 1, the earth was created on Day 1 and the sun, moon and stars on Day 4. However, based on the acceptance of Big Bang theory, some argue that Genesis 1:16 should be understood as teaching that the stars ‘appeared’ rather than ‘were made’ on Day 4.<sup>77</sup> It would appear that Maxwell would not have agreed with this as he warned against interpreting Genesis based on the latest scientific hypotheses (see above).

Similarly, the magisterial use of science has led some to argue that none of Genesis 1 should be taken literally. Science, they say, has proven that the earth is billions of years old and that creation did not take place in six days. Such a view has led to new doctrines such as ‘evolutionary creation’ where it is

taught that God used natural processes such as Darwinian evolution to create people of millions of years.

Advocates of the ministerial use of science argue that we should adopt the principle that ‘Scripture interprets Scripture’ rather than ‘science interprets Scripture’. They say that science—and particularly ‘historical science’—is fallible and should be placed under the authority of the Bible which is the Word of God (2 Timothy 3:16, Romans 3:2, John 10:35). The magisterial use of science, they say, leads to error, for example, reversing the order of sin and the Fall. According to Genesis 1:31, the original creation was perfect and declared by God to be “very good”. Everything associated with the Fall—natural disasters, disease, violence and death—came into the world *after* people started to sin. However, acceptance of ‘evolutionary creation’ leads to the belief that, for millions of years, the world was full of such ‘natural evil’ *before* anyone was around to sin. This, it’s argued, would imply that God is responsible for it.

Newton employed the magisterial use of science when, based on his conjectures about how the solar system was formed, concluded that the first ‘days of creation’ would not have been ‘ordinary days’. He suggested that the sun and the earth (along with the other planets) were produced from the same bulk of material, and that on the ‘first day’ what was to become the sun was separated from the rest. Only later, he surmised, was the earth formed into a spherical body and, as such, initially had no rotational motion. If the earth was stationary for the first two ‘days’, he reasoned, they could have been any length of time. Then, he argued, since it would have taken a significant amount of time to accelerate the earth to its present rotational speed, the following ‘days’ would have been significantly longer than twenty-four hours.<sup>78</sup>

Those who argue that ‘Scripture interprets Scripture’, rather than ‘science interprets Scripture’ say that writer of Genesis 1 must have intended their readers to understand that the days of creation were truly 24-hour days as this is confirmed in Exodus 20, when God gave Moses the commandment to keep the sabbath. God said:

“Six days you shall labor and do all your work ... For in six days the Lord made the heavens and the earth, the sea, and all that is in them, but he rested on the seventh day. Therefore the Lord blessed the Sabbath day and made it holy” (Exodus 20:8, 11).

An evening and morning on the first day, they say, can easily be explained without the presence of the sun (which was made on the fourth day). With a light source coming from one direction (Genesis 1:3) and a rotating earth, there would have been ‘night’ and ‘day’ from the beginning.<sup>79</sup>

It would appear that Newton’s placing of reason over Scripture led to him embracing unorthodox beliefs, particularly in respect of the person of Christ who He concluded is not equal with the Father and is not ‘of one substance’ with Him.<sup>80</sup> Professor Robert Hurlbutt noted that Newton “is careful to state that he will not believe what he cannot understand, a standard which caused him to reject the mystical elements in the Trinitarian notion”.<sup>81</sup> Orthodox Christians argue that, had Newton correctly applied the principle that ‘Scripture interprets Scripture’, he would not have fallen into this error. The fallible thinking of men, they say, must be never placed over Scripture which is infallible. Rather, man’s reason should always be placed under, and in submission to, the Bible.

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### Fig. 1: Faraday's generator

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### Fig. 2: Generation of electricity using an electromagnet

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