William Whewell | Encyclopedia.com

Complete Dictionary of Scientific Biography COPYRIGHT 2008 Charles Scribner's Sons
19-25 minutes

(*b*. Lancaster, England, 24 May 1794;

d. Cambridge, England, 6 March 1866), *theology, history and philosophy of science, physical astronomy, mineralogy, tidal theory, science education, political economy, architectural history, moral philosophy*. For the original article on Whewell see *DSB*, vol. 14.

An avalanche of research on William Whewell since the 1970s added considerably to an understanding of him and his nineteenth-century context. Scholars always recognized Whewell as a religious man, for example, but have come to better see exactly how his religion mixed with other areas of thought—especially his philosophy of science, itself better understood in the early twenty-first century. Publications have examined his collaboration with Richard Jones in developing political economic theory, including their debates with other political economists. Much scholarship has addressed the institutional and social contexts of Whewell's life, such as the nature of education at Cambridge University and the creation of scientific societies in Britain. Whewell's conceptual controversies included his rejection of Darwinian evolution, that with David Brewster on the extent of life in the universe, and those with John Stuart Mill involving philosophy, moral theory, and economics.

Cambridge University immersed the young would-be carpenter Whewell in a network of like-minded intellectuals who would collectively contemplate many subjects. He was one of the poor scholarship students (sizars) at Trinity College, all of whom received contributions from better-off students. He took his BA degree in 1816 as second wrangler and second Smith's prizeman, that is, with the second-highest honors in his class. Succeeding the next year in the highly competitive fellowship examination at Trinity College, he virtually guaranteed himself a lifelong Cambridge career, which is what came to pass. He held professorships in two quite different subjects, mineralogy from 1828 to 1832 and moral philosophy from 1838 to 1855. Surely spurred significantly by his own example, he praised the socially transforming power of English universities to enable sons of peasants to become country clergymen. Physically as well as intellectually vigorous, Whewell died when thrown from the horse he was riding near Cambridge when he was nearly seventy-three years old. He outlived two wives, the second dying in 1865. He had no children.

Religion and Science. Theology provided Whewell his deepest knowledge. He wrote religious letters of comfort to his mortally ill sister, who died in 1821. He assured his colleague Hugh James Rose that science would not undermine religion, and in his Cambridge sermons of 1827 he explained that revelation provided more secure theological insights than did natural theology, as valuable as the latter was. In a Cambridge sermon of 1828 Whewell underscored the point he had made to Rose by citing the religion of the likes of Isaac Newton. Natural theology's value appeared strikingly in Whewell's Bridgewater Treatise, *Astronomy and General Physics, Considered with Reference to Natural Theology*, published in 1833 and many times thereafter. Design in the physical world certainly disclosed the existence of a designing God, but it revealed more than that. God also designed man's morality and intellect, for instance. Though decidedly inferior to God's mind, man's mind mirrored God's. Hence, man's degree of pleasure in contemplating a particular scientific theory was a measure of God's own pleasure in creating the world with

that theory in mind. That is, such pleasure suggested, but did not guarantee, the theory's truth. Whewell's theology would provide a context for his philosophy of science, and as master of Trinity he delivered sermons into the 1860s.

Geology was the current science most responsible for disagreements involving science and religion. The conflict, however, was not simply between religion and geology but, even more, between competing views of scripture. Whewell had been reading works by leading geologists as early as 1818, and he went on geological field trips in the 1820s with Cambridge's new professor of geology, Adam Sedgwick. Sedgwick and Whewell established a Cambridge approach to geology that emphasized probing the geometrical form of geological strata and comprehending their configuration in dynamical terms, that is, in terms of the laws of motion. In the early 1830s Whewell praised Charles Lyell's contribution to geological dynamics, but he disagreed with Lyell's "uniformitarian" (Whewell's word) conclusions that the Earth had remained essentially the same, experiencing only nonprogressive and rather gradual changes. Both Lyell and the "catastrophist" (Whewell's word) geologists concluded that the Earth had a vast age, and Whewell agreed. That is, Whewell was not one of the young-Earth, scriptural geologists of the day but one who valued scripture primarily for its revelation of such as God, Christ, and the afterlife. Earth's changing life and the fossil record's discontinuities, however, did bespeak miraculous interventions to Whewell, scripture and geology essentially agreeing in this regard.

Political Economy. Whewell's partner in the study of political economy was Richard Jones, another Trinity man who had taken his degree in 1816. David Ricardo's recent books on economic theory roused their inductivist ire. Compared to mechanics and astronomy, political economy was far too immature a science for Ricardo to make the assumptions and deductions that he did, they argued. Though claiming universal conclusions, Ricardo actually ignored agricultural economic arrangements for most of the world. Contrary to Ricardo, they asserted, there was no perpetual equilibrium, as was disclosed by other sciences. Whewell rejected Ricardo's conclusion that landowners' interests conflicted with those of others in society. Whewell endorsed the English class system as a judicious social control. Jones inductively amassed the evidence that Whewell could draw upon in his mathematical demonstration of Ricardo's errors. Whewell presented papers on political economy to the Cambridge Philosophical Society in 1829 and 1831. Also in 1831 appeared Jones's long-awaited *Essay on the Distribution of Wealth and on the Sources of Taxation*.

Natural Science. In addition to his significant research on mineralogy and the tides, Whewell kept careful track of other physical sciences within an increasingly institutional scientific context. In the early 1820s he was reading French works in physics and taking detailed notes on Michael Faraday's earliest research concerning connections between electricity and magnetism. A few years later Whewell contributed the extensive mathematical portion of Francis Lunn's article on "Electricity" in the *Encyclopaedia Metropolitana*. A Cambridge graduate of 1818, Lunn became a fellow of the Royal Society of London the next year and helped sponsor Whewell's successful application for membership in 1820. Whewell presented his paper on mineralogy to the Royal Society in 1824 and others on the subject to the Cambridge Philosophical Society, which he had helped found in 1819. By around 1830 Whewell strongly advocated the new undulatory theory of light with its concept of a luminiferous ether. The British Association for the Advancement of Science was established in 1831, and Whewell presented to it long reports on the current state of mineralogy in 1832 and on the current state of mathematical theories of electricity, magnetism, and heat in 1835. He became president of the Geological Society of London in 1837, the next year inducing Charles Darwin to assume the burdens of secretary. Though the word *scientist* gained currency only well after Whewell's lifetime, his invention of it in the 1830s symbolized the increasing professionalization of science.

Education. Whewell helped change Cambridge education in important ways. In 1816, instruction within colleges prepared pupils for the university's Senate House examination upon which a Cambridge honors degree depended. Lectures by university professors could be interesting but were generally not relevant to Senate House examination subjects, which were classics, moral philosophy, and especially mathematics. The last included pure mathematics (with Isaac Newton's fluxional notation for the calculus) and mixed mathematics—that is, those successfully mathematized areas of science: mechanics, observational astronomy, gravitational theory, hydrostatics, and geometrical optics. During the previous century French savants using the Continental version of the calculus had dramatically developed Newton's gravitational theory. That was excellent motivation for John Herschel, Charles Babbage, and George Peacock to form their Analytical Society and to try to alter the Cambridge curriculum. Whewell joined their cause with his *Elementary Treatise on Mechanics*(1819) and *Treatise on Dynamics* (1823), both of which employed the Continental calculus. In addition, Whewell essentially separated statics from dynamics, rewriting Newton's laws of motion in the process. More fundamental, he declared those laws to be necessary truths—a conclusion that would eventually provide a basis for his philosophy of science.

Whewell continued to influence Cambridge studies into mid-century. He departed somewhat from the Analytical Society's exuberance for the calculus, arguing that students must first master more elementary mathematics in preparation for logical thinking in other—and ultimately more significant—areas of thought. In his *Principles of English University Education* (1837), he emphasized the university's role in converting undergraduates into Englishmen during that crisis period when youth became man. England was something like a present-day Greece or Rome, and the university bore much of the duty to maintain that reality. He identified permanent knowledge as classics and mathematics, which at Cambridge were the preserve of college instruction. Progressive knowledge included not-yet-mathematized areas of science, which at Cambridge were part of professorial instruction. With both the fate of the nation and his own success in mastering many subjects undoubtedly in mind, Whewell pursued his convictions. He succeeded in getting some questions on heat, electricity, and magnetism included in the mathematical tripos (as the Senate House examination came to be called). As master of Trinity he was one of the examiners for the Smith's prize examination, and his questions included a few on heat, electricity, and magnetism as well as engineering. As chair of key committees in the 1840s he was instrumental in establishing the natural sciences tripos and the moral sciences tripos at mid-century, thus making professorial lectures (including his own) directly relevant to Cambridge education.

Philosophy. Whewell's philosophy of science combined primarily the philosophies of Francis Bacon and Immanuel Kant. Bacon was one of the most famous of Trinity men, and his legacy would have been ever present to the young Whewell. Whewell's diaries reveal his awareness of Kant by spring 1820 and of Kant's nonutilitarian moral philosophy by February 1821, evidently from reading Madame de Staël's advocacy of Kant in her *Germany*(1813). Though the mature philosophy that Whewell formulated in the 1830s would have totally pleased neither Bacon nor Kant, it did explain how an empirical study of nature had led to necessary truths. Not merely a random gathering of information, induction required an active mind, seeking patterns and forming explanations— though without jumping to conclusions or pursuing wild hypotheses. Whewell termed resultant successes the "colligation" of facts and the "consilience" of inductions. Colligation involved one idea explaining different but similar observations. The more powerful consilience required an idea to explain quite different phenomena, the classic example being Newton's gravitational theory, which united the celestial and terrestrial worlds. Moreover, such successful theories could disclose "true causes"—causes known actually to exist in nature, even though unobservable. The luminiferous ether was a prime example. No Kantian-like doubt of a real, external world arose. God had created both humans and nature, designing them for each other.

Whewell's Kantian-like "fundamental ideas" provided necessary truths. The history of science showed that knowledge of such fundamental ideas emerged through long and careful empirical studies of nature. Because of colligation and consilience, laws of motion would appear first as powerful inductive truths that were still subject to refutation. Eventually, though, one recognized their necessity, that their truth depended not upon experience but upon their logical connection to the fundamental idea of cause. Gravitational theory, then, *must* accord with the laws of motion, but not the reverse. That is, gravitational theory was not a necessary truth because, in principle, contrary evidence could disprove it. Whewell identified several fundamental ideas, such as that of affinity for chemical knowledge. However, the existence of necessary truths did not preclude change in scientific understanding. The future could bring additional fundamental ideas, for example, including more inclusive ones that could effect something like a consilience of already known fundamental ideas. Fundamental ideas allowed the human mind glimpses of God's.

Such glimpses of course were relevant to Whewell's moral philosophy. Indeed, he articulated such a view in his *Foundation of Morals*, the published version of four sermons he delivered in Cambridge in 1837. As with the Ten Commandments, revelation provided moral guidance, but scriptural passages such as Romans 2:14 also signaled the presence of innate moral ideas in man's mind. Whewell's prime opponent here was utilitarianism, especially that of William Paley, whose *Principles of Moral and Political Philosophy* (1785) argued that when scripture was not specific enough, the happiness produced by proper behavior indicated the morality of that behavior. Because Paley's book was required reading at Cambridge, Whewell once more confronted the Cambridge curriculum. As professor of moral philosophy and in later publications, Whewell pursued his anti-utilitarian theme. For Whewell, the history of innate ideas in moral philosophy resembled that of fundamental ideas in science.

Controversies. Controversies were not confined to Cambridge. John Stuart Mill disagreed with Whewell not only about utilitarianism but about political economy and induction as well. Whewell's *Of Induction* (1849) responded at length to Mill. The eminent Scottish scientist David Brewster engaged Whewell in acrimonious and entangled debate on the plurality of worlds—that is, on whether the rest of the universe was also inhabited. Supporting the widely held plurality view, Brewster declared, for example, that God would not create wasted worlds, that is, worlds absent life. Geology, Whewell countered, demonstrated that the Earth itself had existed for eons with no life, indicating by analogy that God could create such worlds. In his *Origin of Species* (1859), Darwin quoted from Whewell's Bridgewater Treatise regarding God's law-governed universe. Darwin may have called upon Whewell's formulation of scientific knowledge in defending his theory of evolution, but he was also obviously rejecting Whewell's published opposition to any such theory. Whewell added a preface to the 1864 edition of his Bridgewater Treatise confirming that opposition.

Thus, at an Anglican university where competing theologies vied, William Whewell endorsed a theology that supported a philosophy of human knowledge. It in turn provided what he regarded as the proper understanding of the true science that had emerged historically in the epoch of Isaac Newton. The man who invented the word *scientist* was not himself a scientist in exactly the modern sense of the word. Indeed, he was more interesting than that.

SUPPLEMENTARY BIBLIOGRAPHY

The bibliography in Fisch and Schaffer 1991 (see Other Sources) lists some 130 works by Whewell. The bibliography that follows here includes none of those works nor any in the original DSB *bibliography.*

WORKS BY WHEWELL

Sermons Preached in the Chapel of Trinity College, Cambridge. London: John W. Parker; Cambridge, U.K.: J. & J. J. Deighton, 1847.

Collected Works of William Whewell. 16 vols. Edited with an introduction by Richard Yeo. Bristol, U.K.: Thoemmes Press, 2001. Includes one edition or another of most of Whewell's major works as well as the two-volume biography of him by Isaac Todhunter published in 1876.

Of the Plurality of Worlds: A Facsimile of the First Edition of 1853; Plus Previously Unpublished Material Excised by the Author Just before the Book Went to Press; and Whewell's Dialogue Rebutting His Critics, Reprinted from the Second Edition. Edited with new introductory material by Michael Ruse. Chicago: University of Chicago Press, 2001.

OTHER SOURCES

Becher, Harvey W. "William Whewell and Cambridge Mathematics." *Historical Studies in the Physical Sciences* 11 (1980): 1–48.

Brooke, John H. "Natural Theology and the Plurality of Worlds: Observations on the Brewster-Whewell Debate." *Annals of Science* 34 (1977): 221–286.

———. “Indications of a Creator: Whewell as Apologist and Priest.” In *William Whewell: A Composite Portrait*, edited by Menachim Fisch and Simon Schaffer. Oxford: Clarendon Press, 1991. Explores the complexities for Whewell of the empirical argument from design, including the superiority of revelation as a way of knowing God’s existence.

Butts, Robert E. *Historical Pragmatics: Philosophical Essays*. Dordrecht and Boston: Kluwer, 1993. Reprints thirteen articles by Butts, five dealing with Whewell. Fisch, Menachim. *William Whewell: Philosopher of Science*. Oxford: Clarendon Press, 1991.

———, and Simon Schaffer, eds. *William Whewell: A Composite Portrait*. Oxford: Clarendon Press, 1991. Contains thirteen chapters by thirteen authors.

Henderson, James P. *Early Mathematical Economics: William Whewell and the British Case*. Lanham, MD: Rowman & Littlefield, 1996.

Marsden, Ben. “‘The Progeny of These Two “Fellows”’: Robert Willis, William Whewell, and the Sciences of Mechanism, Mechanics, and Machinery in Early Victorian Britain.” *British Journal for the History of Science* 37 (2004): 401–434.

Reidy, Michael. *Tides of History: Ocean Science and Her Majesty’s Navy*. Chicago: University of Chicago Press, forthcoming 2008. Places Whewell’s tidal research thoroughly within its practical and social contexts.

Ross, Sydney. “‘Scientist’: The Story of a Word.” *Annals of Science* 18 (1962): 65–85.

Ruse, Michael. “William Whewell and the Argument from Design.” *Monist* 60 (1977): 244–268.

Schneewind, Jerome B. “Whewell’s Ethics.” *American Philosophical Quarterly Monograph Series 1* (1968): 108–141.

Smith, Crosbie. “Geologists and Mathematicians: The Rise of Physical Geology.” In *Wranglers and Physicists: Studies on Cambridge Physics in the Nineteenth Century*, edited by Peter M. Harman. Manchester, U.K.: Manchester University Press, 1985.

Snyder, Laura J. “William Whewell.” In *The Stanford Encyclopedia of Philosophy*, edited by Edward N. Zalta. Spring 2004. Available from http://plato.stanford.edu/archives Discusses and evaluates previous interpretations of Whewell’s philosophy of science.

———. *Reforming Philosophy: A Victorian Debate on Science and Society*. Chicago: University of Chicago Press, 2006. Examines the many aspects of the Whewell-Mill debate.

Wettersten, John R. *Whewell’s Critics: Have They Prevented Him from Doing Good?* Edited by James A. Bell. Amsterdam: Rodopi, 2005.

Wilson, David B. “Herschel and Whewell’s Version of Newtonianism.” *Journal of the History of Ideas* 35 (1974): 79–97.

———. “Convergence: Metaphysical Pleasure versus Physical Constraint.” In *William Whewell: A Composite Portrait*, edited by Menachim Fisch and Simon Schaffer. Oxford: Clarendon Press, 1991.

———. “Arbiters of Victorian Science: George Gabriel Stokes and Joshua King.” In *From Newton to Hawking: A History of Cambridge University’s Lucasian Professors of Mathematics*, edited by Kevin C. Knox and Richard Noakes. Cambridge, U.K.: Cambridge University Press, 2003. Indicates various ways in which Whewell’s ideas and committees helped shape the context of two of Cambridge’s Lucasian professors.

Wise, M. Norton, and Crosbie Smith. “Work and Waste: Political Economy and Natural Philosophy in Nineteenth Century Britain (II).” *History of Science* 27 (1989): 391–449. Discusses Whewell at length.

Yanni, Carla. “On Nature and Nomenclature: William Whewell and the Production of Architectural Knowledge in Early Victorian Britain.” *Architectural History* 40 (1997): 204–221.

Yeo, Richard. *Defining Science: William Whewell, Natural Knowledge, and Public Debate in Early Victorian Britain*. Cambridge, U.K.: Cambridge University Press, 1993.

David B. Wilson