James Joule (1818–1889)

The Great Experimenter Who Was Guided by God

by Ann Lamont on March 1, 1993

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James Prescott Joule was born at Salford, near Manchester, England, on December 24, 1818. He was a great experimenter who was guided by God.

He was the second of five children born to a wealthy brewery owner. As a child, James was weak and shy, and suffered from a spinal disorder. Because of these limitations, he preferred studies to physical activity. Although his spinal problem later improved, it affected him throughout his life.

James was educated at home until he was 15. He then went to work in the family brewery. However, he and his older brother continued their education part-time with private tutors in Manchester.

> *HE SAW NO CONTRADICTION BETWEEN HIS WORK AS A SCIENTIST AND HIS CONFIDENCE IN THE TRUTH OF THE BIBLE.*

From 1834 until 1837, they were taught chemistry, physics, the scientific method, and mathematics by the famous English chemist John Dalton. (Like James Joule, Dalton was a Bible-believing Christian.) James gratefully acknowledged the key role that Dalton played in his becoming a scientist. "It was from his instruction that I first formed a desire to increase my knowledge by original researches," Joule said.[1]

When their father became ill, James and his brother took over running the brewery. James therefore did not have the opportunity to attend university. However, his great desire was to continue to study science, so he set up a laboratory in his home and began experimenting before and after work each day. James saw this desire to study science as a natural consequence of his Christian faith. As he later wrote, "it is evident that an acquaintance with natural laws means no less than an acquaintance with the mind of God therein expressed."[2]

Exciting Experiments

In 1839, Joule began a series of experiments involving mechanical work, electricity and heat. In 1840, he sent a paper entitled "On the Production of Heat by Voltaic Electricity" to the Royal Society in London—probably the most prestigious association of British scientists.

In this paper, he showed that the amount of heat produced per second in a wire carrying an electric current equals the current (I) squared multiplied by the resistance (R) of the wire. The heat produced is the electric power lost (P). (That is, $P=I^2R$.) This relationship

is known as Joule's Law. The Royal Society showed little enthusiasm for Joule's paper, and published only a brief summary of his findings.

In 1843, Joule calculated the amount of mechanical work needed to produce an equivalent amount of heat. This quantity was called "the mechanical equivalent of heat." Again he presented a paper on his findings—this time to the British Association for the Advancement of Science. Again the response was unenthusiastic. Several leading journals also declined to publish papers on Joule's work.

Many British scientists were hesitant to accept his work, but Joule patiently persisted. New ideas often take time to gain acceptance, especially if they are put forward by an amateur in that field. Joule's findings challenged the caloric theory of heat which most physicists believed in at that time. In the caloric theory, heat was believed to be a fluid substance.

Another stumbling block to the acceptance of Joule's findings was a disbelief of the incredible accuracy of his measurements. But Joule was patient and ingenious in his experiments. These attributes greatly assisted him in avoiding errors and in obtaining results far more accurate than those of previous experimenters.

Important Endorsement

Joule's work on the relationship of heat, electricity and mechanical work was largely ignored until 1847. His work then came to the attention of William Thomson. (Thomson, who was later known as Lord Kelvin, was another famous scientist who was a committed Christian.)

Although only 23 years old at the time, Thomson was already Professor of Physics at the University of Glasgow. Thomson recognized that Joule's work fitted in with the unifying pattern that was beginning to emerge in physics and he enthusiastically endorsed Joule's work. (In fact, Joule's work made a significant contribution to the process of unifying the fragmented sections of physics.)

Other enthusiastic supporters of Joule's work were Michael Faraday and George Stokes. Both were famous scientists who were committed Christians. This endorsement by a few eminent supporters opened doors which previously had been closed to Joule. The Royal Society was now prepared to give him another hearing. In 1849, Joule read his paper entitled "On the Mechanical Equivalent of Heat" to the Royal Society, with Faraday as his sponsor. In the following year, the Royal Society published Joule's paper and he was elected a member of its prestigious ranks.

New Scientific Discipline—Thermodynamics

The principle of energy conservation involved in Joule's work gave rise to the new scientific discipline known as thermodynamics. While Joule was not the first scientist to suggest this principle, he was the first to demonstrate its validity. Although Thomson and a number of other scientists later made significant contributions to thermodynamics, Joule is correctly recognized as the chief founder of thermodynamics. He showed that "work can be converted into heat with a fixed ratio of one to the other, and that heat can be converted into work."[3]

Joule's principle of energy conservation formed the basis of the first law of thermodynamics. This law states that energy can neither be created nor destroyed, but it can be changed from one form into another.

Isaac Asimov called this law "one of the most important generalizations in the history of science"[4] It means that the total amount of energy (including matter) in the universe is constant. As S.M. Huse points out in his book, *The Collapse of Evolution*, "This law teaches conclusively that the universe did not create itself! … The present structure of the universe is one of conservation, not innovation as required by the theory of evolution."[5]

While evolutionists cannot explain how this constant amount of energy/matter originated[6], the Bible does provide an explanation—only God can create out of nothing. The Bible also teaches that God sustains what He created. All other changes, either by man or the forces of nature, are merely rearrangements of what already exists.

Joule was aware of the religious implications of his findings. He wrote that "it is manifestly absurd to suppose that the powers with which God has endowed matter can be destroyed any more than they can be created by man's agency."[7] The law of conservation of energy was completely consistent with the Bible, whereas Joule considered that some aspects of the caloric theory had not been consistent with the Bible.

On another occasion, Joule wrote that "the phenomena of nature, whether mechanical, chemical, or vital, consist almost entirely in a continual conversion … into one another. Thus it is that order is maintained in the universe—nothing is deranged, nothing ever lost, but the entire machinery, complicated as it is, works smoothly and harmoniously … the whole being governed by the sovereign will of God."[8,9]

Landmark Paper

In a landmark paper published in 1848, Joule became the first scientist to estimate the velocity (speed) of gas molecules. This early work on the kinetic theory of gases was later extended by others, especially outstanding Scottish mathematical physicist James Clerk Maxwell (another dedicated Christian).

Joule was one of the first scientists to recognize the need for standard units of electricity, and he strongly advocated their establishment. This standardization was later done by the British Association for the Advancement of Science under the direction of Maxwell. Joule became president of the British Association in 1872 and 1887.

In recognition of Joule's contribution in relating heat and mechanical motion, the unit of energy (or work) in physics was later named the "Joule."

Joule-Thomson Effect

In 1852, Joule began working in cooperation with Thomson. The two scientists complemented each other perfectly—Joule, the accurate and resourceful experimenter with only limited training in mathematics, and Thomson, the mathematically talented physicist concerned with extending the theory underlying physics.

Tragically, Joule's wife died in 1854 after only six years of marriage, leaving him with their young children. Shortly afterwards, Joule's family sold the brewery. Joule then led a relatively secluded life. He was now able to devote himself more fully to his scientific work.

For the next eight years, Joule worked with Thomson on a number of important experiments to confirm some of the predictions being made in the new discipline of thermodynamics. The most famous of these experiments involved the decrease in temperature associated with the expansion of a gas without the performance of external work. This cooling of gases as they expand is known as the "Joule—Thomson effect." This principle provided the basis for the development of the refrigeration industry.

Gifted Experimenter

During his association with Thomson, Joule humbly took on the practical role of experimentally investigating theoretical issues raised by Thomson. This was the less prestigious role in the fruitful partnership, but Joule was more concerned with achieving worthwhile results than with gaining recognition.

However, it should be remembered that Joule had earlier made great theoretical contributions in his own right. As H.J. Steffens says in his biography on Joule: "He was certainly more than 'just an excellent experimenter.'" His experiments led and shaped his speculations, but his speculations stood boldly against accepted scientific theory and postulated a new, exact order in the universe."[10]

Joule displayed an amazing clarity in conceiving, executing, describing and explaining his experiments. Unlike many scientists, it was rare for Joule to follow blind alleys or make incorrect observations. In most cases, his original notes were almost clear enough for publication without subsequent revision. This demonstrated his extraordinary clarity of mind.

Trusted in Bible

Joule was a sincere Christian, known for his patience and humility. He believed in finding God's will and obeying it.

He saw no contradiction between his work as a scientist and his confidence in the truth of the Bible. Many of his fellow scientists shared his views. "In response to the tide of Darwinism then sweeping the country … 717 scientists signed a remarkable manifesto entitled *The Declaration of Students of the Natural and Physical Sciences*, issued in London in 1864. This declaration affirmed their confidence in the scientific integrity of the Holy Scriptures. The list included 86 Fellows of the Royal Society."[11] James Joule was among the more prominent of the scientists who signed the document.

From 1872 onwards, Joule's health deteriorated and he did little further work. He died at Sale, Cheshire, England, on October 11, 1889.

Joule firmly acknowledged God as Creator. His own words set out the priorities by which he lived—"After the knowledge of, and obedience to, the will of God, the next aim must be to know something of His attributes of wisdom, power and goodness as evidenced by His handiwork."

Footnotes

1. J.P. Joule in a brief autobiography written in January 1863. Published in *Memoirs and Proceedings of the Manchester Literary and Philosophical Society*, vol. LXXV (1930–1931), no. 8, p. 110.
2. J.P. Joule, in a paper found with his scientific notebooks, as cited in: J.G. Crowther, *British Scientists of the Nineteenth Century*, Routledge & Kegan Paul, London, 1962, p. 139.
3. *Encyclopaedia Britannica*, 1992, Vol. 28, p. 612.
4. I. Asimov, *Biographical Encyclopaedia of Science and Technology: The Lives and Achievements of More Than 1000 Great Scientists from Ancient Greece to the Space Age*, second ed., 1982, Doubleday & Co. Inc., Garden City, New York, p. 399.
5. S.M. Huse, *The Collapse of Evolution*, Baker Books, Grand Rapids, Michigan, 1983, p. 59.
6. The "big bang" theory makes no attempt to explain how its hypothesized concentration of matter originated.
7. J.P. Joule, quoted in: O. Reynolds, *Memoir of James Prescott Joule*, Manchester Literary and Philosophical Society, 1892, p. 27.
8. J.P. Joule in a brief autobiography written in January 1863. Published in *Memoirs and Proceedings of the Manchester Literary and Philosophical Society*, vol. LXXV (1930–1931), no. 8, p. 110.
9. H.J. Steffens, *James Prescott Joule and the Concept of Energy*, Folkestone, Dawson, 1979, p. 142.
10. H.M. Morris, *Men of Science, Men of God*, Master Books, El Cajon (California), 1982, pp. 74–75.
11. J.P. Joule, in a paper found with his scientific notebooks, as cited in: J.G. Crowther, *British Scientists of the Nineteenth Century*, Routledge & Kegan Paul, London, 1962, p. 138.