

IRELAND'S GREATEST MATHEMATICIAN

By

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We are fast approaching the 200th anniversary of the birth of William Rowan Hamilton, the greatest ever Irish mathematician. A child prodigy, he achieved high academic position at a very young age and made mathematical discoveries of the first order. Unfortunately his personal life was unhappy, mainly because circumstances prevented him from marrying his one true love.

William was born in Dublin on the 4th August 1805 to Archibald Hamilton, a solicitor, and Sarah Hutton. William's father was away a lot on legal business and William lived with his uncle, the Rev. James Hamilton, at Trim from 1808 to 1823. James was a gifted teacher and undertook to educate William. He used some unusual methods. It is said that he bored a hole in the wall between William's bedroom and his, through which he passed a length of string. This was attached to one of William's toes when he retired for the night and James would tug the string early in the morning to remind his charge to begin his studies.

William showed prodigious learning abilities and, by the age of 5, had already learned Latin, Greek and Hebrew. His interest in mathematics was probably sparked when, aged 12, he was introduced to the American boy Zerah Colburn, whose prodigious feats of mental arithmetic were being exhibited in Dublin. Hamilton engaged him in tests of arithmetical ability, but usually came off second best.

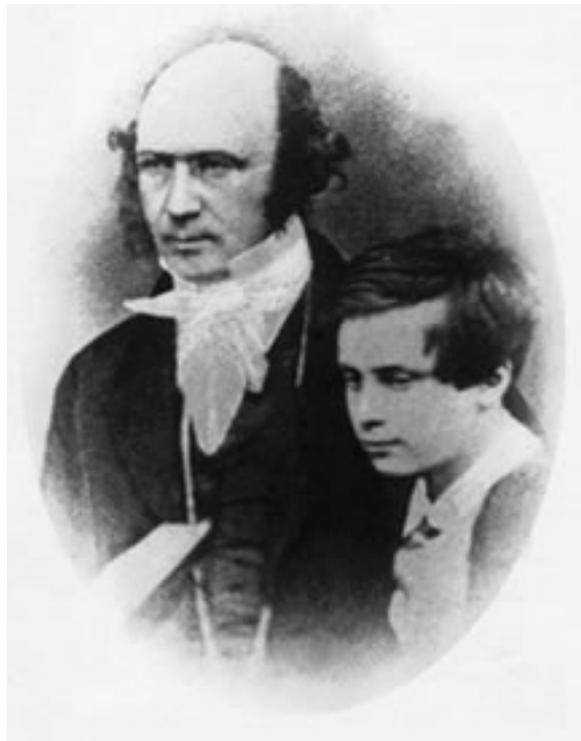
At the age of 15, Hamilton began to study the works of Newton and Laplace. He discovered an error in Laplace's work *Mechanique Celeste* [italics]. This brought him to the attention of John Brinkley, Astronomer Royal of Ireland, who declared Hamilton to be 'the first mathematician of his age'. Hamilton entered TCD at the age of 18 in 1823 and achieved an 'optime' in Classics in his first year, an honour awarded only once in 20 years.

Uncle James took William to visit the Disney family in Summerhill in August 1824, where William fell in love with the Disney daughter Catherine. He longed to marry her but was not in a position to propose since he had 3 years of study left at TCD.

In February 1825 it was announced that Catherine was to marry Rev. William Barlow, 15 years her senior but in a much better position than William Rowan Hamilton to offer Catherine material comforts. Catherine married Barlow in May 1825. William was distraught. He fell ill, contemplated suicide, and started writing poetry, a habit that he continued throughout his life in times of despair.

Hamilton's mathematical studies were going very well. In 1824 he submitted his first paper on mathematics to The Royal Irish Academy. His finals examiner persuaded him to apply for the vacant post of Astronomer Royal at Dunsink Observatory and in 1827 he was appointed Professor of Astronomy at TCD although still a 21 year old undergraduate. Hamilton had little experience in practical astronomical observing. His interest in astronomy waned and he spent almost all of his time doing mathematics.

Hamilton made major scientific contributions in mechanics, optics, geometry and algebra.



Sir William Rowan Hamilton and one of his sons
(circa 1845)

In 1832 he made the daring mathematical prediction that a ray of light passed through a biaxial crystal would be refracted into the shape of a cone. Humphrey Lloyd, a TCD physicist, experimentally confirmed Hamilton's prediction and the news astounded the scientific world. Hamilton was knighted for his discovery in 1835 and awarded a royal pension of £200.

In 1835 Hamilton made his greatest contribution - his general theory of dynamics. He rewrote Newton's Laws of Motion in a powerful general way by expressing the energy of mechanical systems as special variables. The energy when written in this way is called the Hamiltonian. Hamiltonians were crucial to the 20th century development of quantum mechanics.

In 1843 Hamilton invented quaternions, a method of describing rotations in three dimensions. There is an arithmetic principle called the commutative law which says that A multiplied by B is equal to B multiplied by A. But in 3 dimensions the order of actions is important. Think of the three spatial axes x, y and z. If you first rotate something around the x axis and next around the y axis, you end up in a different position to where you would be if you rotated first around the y axis and next around the x axis. Hamilton expressed his invention in the equation $i^2=j^2=k^2=ijk=-1$ [2s are superscripts]. i, j and k are unit imaginaries corresponding to the x, y, z spatial axes and the equation also employs the imaginary number $\sqrt{-1}$ [square root of minus one]. Because there are 4 parts i, j, k and $\sqrt{-1}$ [square root of minus one], he called them quaternions. This leap of creativity paved the way for the introduction of vectors.

Hamilton married Helen Bayley but it was not a match based on love and was ill-fated from the beginning. They had 2 sons and a daughter. William suffered from bouts of depression and started drinking heavily. In 1847 his uncle James died and his TCD mathematician colleague James McCullagh committed suicide. Catherine Barlow began a confused correspondence with him, but, feeling guilty, confessed to her husband and attempted suicide. William became very depressed and his alcohol problem accelerated. Catherine died, plunging Hamilton into deep grief. Nevertheless he continued to work and wrote a new book Elements of Quaternions. He died on 2 September 1865 after a severe attack of gout precipitated by excessive drinking and overeating.

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