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J.J. Thomson, 1906 Nobel Prize Winner in Physics

Biography

On December 18, 1856, in Cheetham Hill (a suburb of Manchester), England, a Joseph John Thomson was born. His father, Joseph James, sold and published books for a living and expected his son to become an engineer. At the time, apprenticeship was the means of becoming an engineer; however, no apprenticeship opportunities were available when Thomson grew up, so his father sent him to attend Owens College at the age of fourteen. Two years later, Joseph James died. While J.J. attended Owens College, he studied under esteemed physics professors Osborne Reynolds and Balfour Stewart, who motivated Thomson to pursue a career in the field. J.J. received a minor scholarship to attend the prestigious Trinity College of Cambridge to study mathematics in 1876. During his years there, he earned a sizarship (financial aid for undergraduates at the college) and later an Exhibition (another scholarship based on academic merit). In 1880, he became a fellow of the college when he acquired the positions of Second Wrangler and Second Smith's Prizeman. At the age of 26, Thomson received the Adams Prize for an essay in which he investigated vortex rings.

In 1890, J.J. Thomson married Rose Elisabeth, daughter of Sir George E. Paget, K.C.B. They had a daughter and a son. Their son, George Paget Thomson, won the Nobel Prize in Physics in 1937 for his “experimental discovery of the diffraction of electrons by crystals” (The Nobel Foundation).

Two years after J.J. received his Nobel Prize, he was knighted by King Edward VII. Over his lifetime, he published a total of 13 books and over 200 research papers. He died on August 30, 1940, in Cambridge. He was buried in Westminster Abbey near the resting places of Charles Darwin and Isaac Newton, who happened to also make innovative contributions to the scientific community.

Reason for Nobel Prize

Thomson’s interest in the discharge of electricity through rarified gases began in 1893, when he published in his work “Researches on Electricity and Magnetism.” Unfortunately, J.J. found the implementation of cathode rays in his experiments to be extremely difficult. Fortunately, in 1895, ionization produced by X-rays was discovered. This resolved many of the issues encountered that came with the utilization of cathode rays. The most significant accomplishment of Thomson’s career was the paper that he wrote in 1896 in collaboration with Ernest Rutherford (who happened to take over his professorship at Trinity College after his resignation in 1919). It was in this paper that the duo measured e/m (e being the charge and m the mass) of “corpuscles” in cathode rays. These corpuscles were derived from both thermo-electricity and photo-electricity, and they were divided into two different groups based on these sources for analysis. It was found that the *e/m* of each of the groups were approximately the same (*e/m* = 1.8

10-11 coulombs/kg). Thomson came to the conclusion that this was due to the unit proposed by H.L.F. Helmholtz and coined “electron” by G.J. Stoney. As a result of this experiment Thomson was able to determine the quantity of *e*, and thus figured that *m* must correlate with the mass of a hydrogen atom. He published his findings in his book “The Conduction of Electricity in Gases” in 1903.

Two years later J.J. shifted his focus from negative cathode rays to positive ones. This new focus brought the ability to separate different kinds of atoms and molecules depending on their masses. The switch allowed Thomson to make other famous discoveries in 1912 (although well after his Nobel Prize win).

It was because of these discoveries that the Nobel Prize Foundation issued J.J. Thomson the Nobel Prize in Physics “in recognition of the great merits of his theoretical and experimental investigations on the conduction of electricity by gases.”

Possible Influences

J.J. Thomson did have a religious background that may have led to a greater acceptance by the Trinity College. It also may have led to him rationalizing the work that he did with his faith, because his experiments and discoveries did not conflict with his religious beliefs. A field such as biology would have been much more controversial, especially with the topics such as evolution.

Although Thomson clearly came from a strong Anglican background, he spoke very little of his religion. While his brother and mother spent much of their time at church, J.J. had minimal participation. He did, however, attend the Sunday evening college chapel service every weekend while he was a professor at Trinity College. Once

he became a Master of Trinity, he started attending the morning service as well. He also grew very involved with the Trinity Mission at Camberwell. At home, J.J. practiced daily prayer and read his Bible every night before going to sleep.

The 1890s was a great time for discoveries in physics. Wilhelm Röntgen discovered X-rays and radioactivity was discovered by Henri Becquerel. The reason for this time period being so terrific for progress, whether it be social, economic, or scientific, was because there was little international and domestic (in England) conflict at the time. Instead of focusing on military production, developed nations could promote the discoveries in technology and science. Unfortunately this prioritization shifted with the onset of the first World War, and did not revert back until the Roaring 20s (which then again dissipated with the beginning of the Great Depression in 1930.

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