CHAPTER 3

J.J. THOMSON'S FIRST TEN YEARS AT THE CAVENDISH, 1885-1894

> My doubt was whether Thomson should be professor of experimental physics. He had done very little experimenting at that time, though enough to show that he could do it. But he has shown since that it was right to appoint him.
>
> Lord Rayleigh[1]

> I had looked on you as a mathematician, not an experimental physicist, and could not at first bring myself to regard you in that light.
>
> R. T. Glazebrook[2]

3.1. The Election of J.J. Thomson

Rayleigh was elected President of the British Association for the Advancement of Science meeting in Montreal in 1884, that association's first meeting outside the British Isles. When he returned in early November, he notified the Vice Chancellor of his resignation from the professorship of experimental physics. Rayleigh's resignation was formally announced on November 17, and election of his successor was scheduled for December 22.[3] Rayleigh left Cambridge on December 13, thus clearly indicating that he would not influence the election.

Expressing interest in the post were a number of ambitious young physicists from both inside and outside Cambridge. For the first time, a true competition for the professorship was about to take place. The "official candidates" registered by the University were Arthur Schuster (Professor of Applied Mathematics at Manchester), Osborne Reynolds (Professor of Engineering at the Victoria University of Manchester), Richard T. Glazebrook (Demonstrator and Lecturer at Cambridge), Joseph Larmor (Professor of Natural Philosophy at Queen's College, Galway), and Joseph John Thomson (Lecturer at Cambridge).[4] Also desiring the post, it was rumored, were William Garnett (former demonstrator at the Cavendish Laboratory) and George F. Fitzgerald (Professor of Natural and Experimental

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[1] Strutt, *Life of J.J. Thomson*, 20.
[2] Ibid., Glazebrook's letter to J.J. Thomson after the election.
[3] *CUR* (18 November 1884): 165 & (25 November 1884): 186.
[4] CUL MSS O. XIX 52, *Elections of Professors from 1826*, vol. 1, 196.

Figure 3.1. Joseph John Thomson, the third Cavendish Professor (1884-1919) [Courtesy of the Cavendish Laboratory].

Philosophy at the University of Dublin). Although all these candidates were well qualified, none had achieved recognition as a first-class physicist. Because the professional reputations of the candidates were well matched, competition for the professorship became fierce. Many suspected that the electors would prefer a senior scholar to a junior one. As Fitzgerald noted in a congratulatory letter to J.J. Thomson after the election:

> I was very much afraid they might appoint one of the senior candidates such as W. G. Adams, or Garnett. . . . I was afraid they might have thought you too junior but I must now express my hopefulness for Cambridge when it does not consider the most important of all qualifications, namely the energy of youth, as a disqualification.[5]

The competition soon narrowed to Glazebrook versus Thomson. A plausible guess was that Glazebrook, the demonstrator of the Cavendish Laboratory who had acted as Rayleigh's deputy, would succeed his former master. Rayleigh in fact had recommended Glazebrook as a safe choice to one of the electors, G. H. Darwin. Electing J.J. Thomson, Rayleigh believed, would be "rash" because of his inexperience in teaching and management.[6]

Nevertheless, on December 22 the electors chose Thomson, a mathematician, the youngest and least experienced of the candidates, as third professor of experimental physics.[7] His election surprised everyone, including himself:

> . . . in December 1884 I was, to my great surprise and I think to that of everyone else, chosen as [Rayleigh's] successor. I remember hearing at the time that a well-known College tutor had expressed the opinion that things had come to a pretty pass in the University when mere boys were made Professors. I had sent in my name as a candidate without dreaming that I should be elected, and without serious consideration of the work and responsibility involved. When after my election I went into these, I was dismayed. I felt like a fisherman who with light tackle had casually cast a line in an unlikely spot and hooked a fish much too heavy for him to land. I felt the difficulty of following a man of Lord Rayleigh's eminence.[8]

Why did the electors make such an unexpected choice? Of the two leading candidates, J.J. Thomson [from now on J.J.] more closely fit the Cambridge ideal. In 1880, he had been a second wrangler (and a second Smith Prize winner), whereas Glazebrook had stood fifth on the list. In 1881, just one year after his graduation, he had been elected a fellow of Trinity College, whereas Glazebrook spent two years at the Cavendish Laboratory preparing his fellowship dissertation. In 1884, just four years after his graduation, J.J. was made a Fellow of the Royal Society, whereas Glazebrook had to wait six years for his election in 1882. J.J.'s outstanding talent also was indicated by his 1883 receipt of the Adams Prize for his essay on "a general investigation of the action upon each other of two closed vortices in a

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[5] See Strutt, *Life of J.J. Thomson*, 21-22.

[6] Strutt, *Life of Rayleigh*, 415. See also Strutt, *Life of J.J. Thomson*, 20.

[7] The electors were Vice-Chancellor N. M. Ferrers, Prof. R. B. Clifton, Prof. G. H. Darwin, Sir W. R. Grove, Prof. G. D. Liveing, Prof. W. D. Niven, Prof. G. G. Stokes, Prof. J. Stuart, Prof. W. Thomson.

[8] J.J. Thomson, *Recollections*, 98.

perfect incompressible fluid."[9] Not only was the subject of vortices in fluid motion a suitable choice of topic for a Cambridge mathematician, but J.J.'s receipt of the prestigious Adams Prize at the young age of twenty-six was an impressive accomplishment. Only Maxwell had won this coveted honor at the same young age, twenty-six; Poynting and Larmor would be considerably older when so distinguished.[10] Also in 1883, J.J. had been appointed as one of the University's first lecturers in mathematics, together with four men who were senior to him: A. R. Forsyth, E. W. Hobson, W. H. Macaulay, and Glazebrook.

J.J.'s talent was recognized by his seniors, including Maxwell, Rayleigh, G. H. Darwin, and Niven. Garnett remembered that after J.J. had been working at the Cavendish "for a very short time," Maxwell who "very quickly estimated the capability of his students" said to him, "Thomson will never know the difference between things that are hard and things that are easy for they all come alike to him."[11] Rayleigh also had highly praised J.J.'s talents. Rayleigh had abandoned his effort to measure the ratio of electrostatic units to electromagnetic units (an experiment crucial to proving Maxwell's theory of the electromagnetic nature of light) when he learned that J.J. was working on it, later remembering that "Thomson rather ran away with it." Although Rayleigh wrote a letter of recommendation on behalf of Glazebrook, it was "not in comparison with Thomson or anyone else." When asked by J.J.'s former teacher, Henry Roscoe of Owens College, to support Schuster as the best candidate for the professorship, Rayleigh answered, "I am not sure that he is the best."[12]

The opinions of the electors Darwin and Niven also carried special weight. Darwin, as an examiner for the Adams Prize, had quickly recognized J.J.'s exceptional talent in mathematics. "The problems you have solved," he informed J.J. in his congratulatory letter, "are of amazing difficulty, and the results of the greatest interest. May you go on and discover a true dynamical theory of chemistry."[13] Niven, who had edited the second edition of Maxwell's *Treatise*, could be expected to back the candidate who could best continue Maxwell's research on electromagnetism, and he was among "one of those who pressed his claims most strongly" in favor of J.J. [14] A special connection existed between Niven and J.J. In the academic year of 1877-78, J.J. had attended Niven's lectures on

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[9] *CUR* (5 April 1881): 446. This topic was announced in 1881, with the suggestion that "the case of two linked vortices should be fully discussed, with the view of determining (1) whether any steady motion is possible, and (2) whether any motion can occur in which there are periodical changes in the forms and dimensions of the vortices." Thomson's essay, a purely mathematical one, won the coveted prize and was published as a separate volume under the title, *A Treatise on the Motion of Vortex Rings* (Cambridge, 1883).

[10] The Adams Prize, established in 1848 to honor John Couch Adams, was awarded every two years "for an Essay on some subject of Pure Mathematics, Astronomy, or other branch of Natural Philosophy." Maxwell won the Prize in 1857, Poynting in 1893, and Larmor in 1899. See *The Historical Register of the University of Cambridge to the Year 1910*, 321.

[11] CUL MSS, ADD 7655, III (d) 5, 41, & also ADD 8385.10, 9.

[12] Strutt, *Life of Rayleigh*, 127, 415 & 413 respectively.

[13] CUL MSS ADD 7654 D4 (25 January 1883): G. H. Darwin to J.J.

[14] Strutt, *Life of J.J. Thomson*, 19.

electricity and magnetism, in which Niven had given "special reference to Maxwell's work."[15] Later, J.J. had assisted Niven in editing the *Treatise*. Niven later "confessed that he was rather afraid of J.J. as a pupil."[16]

The research papers published by J.J. between 1880 and 1884 demonstrated that J.J. fit the mold of the Cambridge-style physicist better than Glazebrook. Of these thirteen papers, eleven were theoretical or concerned mathematical subjects; only two related directly to experiments. Glazebrook's eighteen papers during that period were based largely on his own experiments, and many concerned such practical problems as measurement of resistances. Although Glazebrook also was a competent "Cambridge Mathematician," in mathematical abilities he was overshadowed by J.J.

In their selection of a worthy successor to Maxwell and Rayleigh, the electors chose to give more weight to scientific talent than to experience. Experience—whether in teaching or management (both of which J.J. lacked)—could be acquired, but talent certainly could not. Moreover, in the opinion of some Cambridge dons, Rayleigh's projects had deviated too far from academic subjects; measurement of the ohm easily could be misinterpreted as a practical measurement to the next place of decimals. In the view of some members of the Cambridge elect, the Cavendish Laboratory should leave practical projects to the Engineering Department and encourage the Cavendish researchers to choose more fundamental or theoretical topics, such as experimentally proving the electromagnetic nature of light. Of the two leading candidates, J.J. would be the one more likely to provide research students with such fruitful ideas. The choice of J.J., though it surprised many at the University, was logical and sound. Indeed, as J. G. Crowther noted, that choice was "a manifestation of the quality and health of the Cambridge scientific environment in the 1880s."[17] During the last quarter of the nineteenth century, however, this kind of sound judgment was still novel. In academia, candidate selection often turned more on the job-seeker's patronage and influence than on his talent. The election of J.J. revealed how seriously the electors viewed their responsibility to assure the continuity of the new research tradition at the Cavendish Laboratory.

Joseph John Thomson, now Professor of Experimental Physics at Cambridge University, had been born only twenty-eight years earlier, on December 18, 1856, at Cheetham Hill, near Manchester. His father, a bookseller, had planned an engineering career for J.J. and had sent him to Owens College at age fourteen in hope that he would learn something useful while awaiting a vacant engineering apprenticeship.[18] J.J. later regarded his entrance into Owens College as "the most critical event" of his life. [19] It was there that he first seriously studied science, and he did so under a "brilliant staff of Professors": Osborne Reynolds, Balfour Stewart,

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[15] Strutt, *Life of J.J. Thomson*, 8, & J.J. Thomson, *Recollections*, 42-43.
[16] Strutt, *Life of J.J. Thomson*, 9.
[17] Crowther, *The Cavendish Laboratory*, 102.
[18] For his early life, see J.J. Thomson, *Recollections*, chapter 1.
[19] Ibid, 2.

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