

## CHARLES JASPER JOLY, 1864—1906.

CHARLES JASPER JOLY was born in Tullamore, Ireland, on June 27, 1864. His father, the Rev. John Swift Joly, was a man of studious bent and author of archæological studies of local interest. It can hardly be said that any of the more nearly antecedent ancestors of Charles Jasper foreshadowed his remarkable gifts. The family is French on the father's side, having emigrated from France so long ago as the middle of the eighteenth century. If heredity is to be appealed to for Joly's mental powers, it is necessary to go back to the seventeenth century, when Claude Joly, an author of distinction, appeared among his ancestors, but not in the direct line. The family claims, however, direct descent from Jacques Joly, a Secretary of State (about 1640), and from Reginald, born 1375, who was "Conseiller" in 1420, as well as from Antoine Joly, of Blaisy-en-haut, a seigneurie in Burgundy, near Dijon, which was erected into a Marquisate in favour of the said Antoine.

Charles Jasper was a brilliant boy at Galway Grammar School, appearing able, when so inclined, to win whatever medals and prizes he aspired to, and even several at one time. In the public Intermediate Examinations he took prizes and honours, but although possessed of this amount of reputation when he entered Trinity College, Dublin, in his eighteenth year, the exceptional powers which he subsequently developed were not indicated in his school career. Even as a student in Trinity College there was nothing accomplished by Joly that has not been accomplished by many a man who subsequently remained without further distinctions through life. He took a mathematical scholarship—by no means on specially brilliant marks—and finally won a mathematical studentship, but, again, without the distinction of the "Large" gold medal. His second subject at this examination was Experimental Science.

After leaving Trinity College he went to Berlin and entered Helmholtz's Laboratory with the intention of making Experimental Physics his life study. There he worked under Koenig's supervision, and would, doubtless, have carried out his intention of giving himself up entirely to the fascination of Physical Research had not the death of his father recalled him to Ireland and rendered it necessary that he should seek some more sure road to a competency. That he altered his intention of devoting himself to Experimental Science was perhaps for the best. For, while he certainly never showed any exceptional originality in that direction, his after career fully justified his diversion to mathematics.

The possibility of attaining to the Fellowship of his own College induced him to pursue the mathematical and mathematical-physics courses required for the mathematical side of this test. The severity of this competition is

intensified by the extraordinary arrangement permitting candidates in mathematics and classics to compete against each other; the successful candidate being the winner of highest marks, where subjects, papers, examiners are different. For this ordeal it is not uncommon for men to read for five or seven years; not, perhaps, acquiring fresh wisdom after the first two or three years' reading, though gradually becoming more proficient in the art of scoring.

Year after year Joly fell short of success. Year after year he read Dante and other masters of literature, and, led away by the facile charms of literary studies, he plunged, forgetful of everything else, into the real or unreal world of poetry and romance. It was at this period that my own more intimate friendship with him commenced. Besides the tie of relationship, we had many tastes in common. In the course of our endless discussions and speculations there was revealed to me a mind both keen, critical, and honest; a nature undemonstrative, sincere, and deeply affectionate.

It was not till 1894 that Joly was successful in his efforts to gain Fellowship. He appears to have attained something more than Scholarship by the long and arduous preparation required for this trying test. He was injured neither in freshness of originality nor in bodily health. He set to work almost immediately he became Fellow on mathematical work, the only holiday intervening being the annual Swiss tour.

A word must be said here on Joly as member of the Alpine Club. His development as mountaineer was as unexpected as his mental evolution. Delicate in appearance, pale in complexion and with rather stooped shoulders, no one would have predicted the athletic prowess he displayed. But two factors were in his favour: he possessed undaunted courage and a power of endurance which must have had its origin also in a marvellous nervous organisation. A very few years later I was with him in circumstances of considerable danger, when on the arête of the Eiger we made our way downwards in the midst of a furious snow storm. Joly led the way with a skill and nonchalance which even in the midst of our troubles claimed our attention. Later, climbing became a passion with him, and his holidays were passed in the Alps, ascending the most difficult peaks. The Dent Blanche, Kleine Zinne, and many others were ascended. (See notice by Dr. George Scriven, 'Journal of the Alpine Club,' February, 1906, vol. 23, p. 58.)

The first work to appear from his pen, "The Theory of Vector Functions," was read before the Royal Irish Academy in the same year in which he got his Fellowship. A second paper on the subject of Vector Linear Functions appeared in the ensuing year, 1895, and two others the next year.

At this period his marriage with Jessie, daughter of the late Robert Meade, took place.

Later in the year 1897 the Board of Trinity College appointed him to the Andrews Professorship of Astronomy and to the post of Royal Astronomer of Ireland. The appointment was a particularly happy one, although at the

time there was some difference of opinion as to his suitability for the office. But not only had Joly considerable training in manipulative scientific work, he was already recognised as highly accomplished in the Mathematics of Hamilton, and possessed of originality and activity. All through his reading for the Fellowship he had been more and more drawn to the use of Sir William Rowan Hamilton's mathematical methods, and it was even stated at the time that his examiners had themselves some difficulty in following the young mathematician in his facile use of Quaternions.

The election accomplished, Joly took up his abode in the historic house of Dunsink, wherein Brinkley, Hamilton, and Ball had done much of their best work. Joly now had the freedom from the too constant invasion of visitors and friends and the quiet and healthful surroundings favourable to mental activity. Never, indeed, had the life of a recluse any charm for him. He associated himself with some of the most important Institutions of the City of Dublin and never failed the committee which had a claim upon him. But he was spared petty interruptions. His teaching duties as Professor of Astronomy were light—one Term in the Session—and an able and careful Assistant was at hand to do the bulk of observational work. The mornings were generally free from disturbance, and, as will be seen, an amazing amount of work was done during the next few years of this quiet life.

Many who read this brief memoir will know the beautiful precincts in which Joly and his predecessors have done such good work. The old House commands from the south windows an extensive view. The panorama of the Dublin Hills—the rounded granite hills of Leinster—rising one beyond the other, invite the imagination into the furthest distance. Between lies a broad and noble valley containing in the near distance the lawns and woods of Phoenix Park, and to the east the City of Dublin. The pastoral element predominates, however, and, seen from this view-point, Dublin might appear to be a city girt with peaceful lawns and forest trees. Further yet, beyond the “towers, domes, citadels,” the Bay of Dublin stretches to the horizon. A more varied sweep of mountains, forest, city and sea it would be hard to find. From the south window of the study an observer lifting his eyes can, at a glance, review it all. Around the house is the fruit garden and shrubbery, planted by Brinkley and Ball, and the old-fashioned box-trimmed flower garden merging into the orchard. Tall trees line the shady walk leading to the gate in the wall where suddenly is revealed to you, across steeply sloping fields, the same majestic panorama of mountains and woods seen from the study window.

In this home Joly lived to the end of his brief life, its quietness and its beauty contributing to his work and to his happiness.

A period of ever-increasing mental activity followed upon his appointment. The great work of editing ‘Hamilton's Elements of Quaternions’ and bringing this vast treatise up to date was already upon his hands. It had now to be completed, but its completion did not hinder Joly from continuing the publication of papers on various mathematical subjects. Thus we have a

paper on "The Associative Algebra Applicable to Hyper-space" in 1897; one on the Congruency of Curves in 1899; and still others in 1900 and 1901. In 1900 he accompanied the Eclipse Expedition sent out by the Royal Dublin Society and the Royal Irish Academy, to Spain, and obtained some exquisite photographs of totality.

In 1899 the first volume and in 1901 the second volume of the new edition of Hamilton's Elements appeared. What the editorial work involved in patient and brilliant scholarship will only be appreciated by those acquainted with the vast and difficult literature which had to be analysed and embodied in the new edition. About 150 quarto pages of new matter were added.

During the couple of years succeeding this editorial work Joly was mainly occupied in extending his reading in Astronomical Science. Two other papers on mathematical subjects, however, appeared during this interval, and the laborious work of editing a new edition of Preston's 'Treatise on Light' was accomplished.

In December, 1902, Joly's paper on "Quaternions and Projective Geometry" was communicated to the Royal Society by Sir Robert Ball and appeared in the 'Transactions.' We ourselves know that the writer regarded this as a great advance and as a hopeful extension of the utility of Quaternions to new fields of investigation. His name was put up for Fellowship in the Royal Society in 1904 and his election followed the same year.

In the year 1905 the Manual of Quaternions appeared. I have omitted reference to various mathematical papers which preceded this work. The Manual appeared in the centenary year of Hamilton's birth. The work was written in a marvellously short space of time—about a twelvemonth. He however, wrote mathematics, worked out examples, and pursued his reasoning with the facility and ease with which a ready writer of fiction might develop the events of a novel. This, about his last great work, was received with commendation on every side; a reception all the more flattering as those who were admirers of Tait's treatment of the subject had to adapt themselves to a somewhat different mode of development before they could appreciate the new writer's work. Indeed, the Hamiltonian method of establishing the laws of Quaternions is here in part abandoned. In this work the author makes use of a wonderfully extensive knowledge of the mathematics of every branch of Physical Science.

In 1905 he took part in the visit of the British Association to South Africa. It was shortly after his return that first his little daughter and then he himself contracted the illness (typhoid) which, after a protracted period of many weeks, during which his strength was slowly sapped, gave rise to a complication (pleurisy) against which he could no longer contend. To the last moment of consciousness he showed the same unselfish consideration for others which was one of his most lovable characteristics. At a little after midnight—early on January 4, 1906—he passed away unconsciously.

In the last year of his life he acted as secretary to a Committee appointed by the Board of Trinity College to enquire into the mode of election to

Fellowship in Trinity College. A serious constitutional evil is undoubtedly existent in the exclusively examinational nature of this mode of selection. Joly never mentioned this matter without disapproval, and the Committee was appointed largely at his request. He gave much time and thought to its work, but the recommendations of the Committee led to no remedial measures. The appointment of a Government Commission, to which he had often looked forward as probably the only hope of drastic reform of this and other constitutional evils, took place a very few months after his death. It would be hard to estimate how much of the time and thought of distinguished Trinity men have been absorbed upon this hitherto fruitless subject of contemplation. It must be remembered that the constitution of their University regulated the lives and surroundings of these men. Every feeling of loyalty to their University as well as every disinterested desire to benefit the higher education of their country, acted to urge into action men of the stamp of FitzGerald and Joly.

His extraordinary powers of mathematical head-work are known to his more intimate associates. The problem stated, Joly's blue eyes sparkled with an expression which might more readily be taken for mirth than for abstraction. A characteristic gesticulation in these moments of thought was the stroking of his short beard. In an astonishingly short time the solution often came—perhaps more than one—and not till then was pen and paper resorted to that the enquirer might have it put before him. Men of very considerable mathematical training who had sought in vain for the solution and got it in this way were naturally impressed. There was undoubtedly a comprehensiveness in his learning which has rarely been excelled even by the greatest of mathematicians, and it must be remembered that almost his entire work was accomplished within the short space of 10 years; far the greater part within the last five years of his life. This rapidity of production indicated both thoroughness of knowledge and swiftness and sureness of reasoning. The remarkable powers of head-work were but the expression of these accomplishments and gifts. He possessed, in common with FitzGerald, a wonderful power of abstraction from immediate surroundings. Much of his work was done while conversation was going on around him. Joly generally reclined on a sofa when writing. The paper was held on his knee. The actual work was done in this attitude. A final copy was then typed.

He wrote a clear and simple style of English, without effort or affectation. Most of his letters might be sent to press without a word of alteration. Full of point, too, are they, and of clever criticism. Much of his correspondence with Sir Robert Ball will be preserved in the Library of Trinity College, Dublin. It largely refers to the Theory of Screws.

It is beyond my powers to convey the impression which Charles Joly made upon me. His books and papers speak for his rare gifts; and his best and most esteemed friend—among many friends—adds to this short notice an estimate of his mathematical work.

The circumstances of Joly's early death are indescribably sad. He was

literally only beginning when life closed for him. A future excelling all his past was assured to him had the toil of youth but met its just reward and the harvest of life been his. The happy domestic life, the rare and precious gifts—honours of life so meekly borne—the whole bright future, all to be laid aside!

When he knew he was attacked by the dangerous illness which ended all, he wrote to a friend: "If the attack is as severe as Jessie's (his little daughter), I know quite well I cannot hold out. For myself I am content, though I should have given much to save the pain that others may feel. I confess also that I should like to be allowed to finish my life's work. Many unsolved problems might have some light thrown upon them if I had a little more time. I might have a useful influence in the affairs of College. I feel it would be a pity"—.

At the time of his death his hands were full of work. He had undertaken the article on "Quaternions" in the new edition of the 'Encyclopædia Britannica,' and had already entered upon the formidable duties of editing the whole of the articles on "Optics" for the same work. An unfinished Elementary Astronomy, having many features of novelty of development, remains behind, as well as a nearly finished Treatise on Solid Geometry. The latter promises to rank among his best writings.

Joly was, at the date of his death, Secretary of the Royal Irish Academy, Trustee of the National Library of Ireland, Member of Council of the Royal Dublin Society, and President of the International Association for Promoting the Study of Quaternions and Allied Systems of Mathematics.

J. J.

Professor Joly's paper on the "Theory of Linear Vector Functions" (1895), T.R.I.A., vol. 30, p. 597, was the commencement of a remarkable series of Memoirs on Quaternions, which has largely extended the applications of Hamilton's splendid invention. At the close of this paper he gives for the first time the relation between the theory of linear vector functions and the theory of screws.

In 1899 the first volume of the Second Edition of "Hamilton's Elements of Quaternions" appeared under the Editorship of Joly, and in 1901 this was followed by the second volume. The important work thus done in rendering Hamilton's masterpiece accessible has been greatly enhanced by the numerous notes and copious appendices which Joly has himself supplied. Attention may also be given to the significant words in the Preface in which Joly says: "My task as Editor has convinced me of the extreme caution with which any endeavour should be made to improve or modify the calculus of Quaternions." Joly, following to some extent the example of Tait, has made very extensive use of the linear vector functions. This beautiful part of the theory is shown to be admirably adapted to many different classes of physical investigation. In a remarkable appendix, Joly also shows how Quaternions provide the most natural method of investigating

the systems of rays, which formed the subject of a famous Memoir of Hamilton in his early days and long before the Quaternions were thought of. Perhaps the part of the appendix which will be most generally appreciated is that on the operator  $\Delta$ , of which many applications to hydrodynamical and other problems are given.

On the conclusion of this great work Joly turned his attention to the further development of Quaternions by continuing his original Memoirs. Such was his industry and so fertile was the method of Quaternions in his hands that in 1902 three important Memoirs appeared. The first contained an entirely novel development in which a Quaternion is represented as a point symbol. The point is supposed to have a weight equal to the Scalar of the Quaternion, while the vector of the point from a fixed origin is the quotient of the vector of the Quaternion by the Scalar. This was followed by another Memoir in which screws were represented as weighted points, and also by another on Quaternion arrays.

The year 1903 was one of still greater activity. An important paper appeared in the 'Phil. Trans.' (vol. 201, pp. 223—327) on "Quaternions and Projective Geometry." In this is developed the theory of the linear Quaternion function depending upon a latent biquadratic as the linear vector function depends on a latent cubic. The investigation exhibits the relation of Quaternions to Projective Geometry in quite a new light. Another Memoir in this year is on the Quadratic Screw System, in which a very large theory is most ably set forth. It was followed by a shorter Memoir on the Geometry of a New System of Screws. Here, again, the theory of linear vector functions is employed with much effect to set forth geometrical problems.

But, doubtless, the most important work in Quaternions with which the name of Joly will be remembered is his "Manual of Quaternions" which appeared in 1905. In this volume he follows at the outset a slightly different procedure from that adopted by Hamilton. Joly makes the result of the product of two vectors a matter of definition. There seems to be much gain from the point of view of the student in this modification. But the student, while he appreciates the facilities thus given at the beginning of his acquaintance with a new subject, will, as he advances, find it advantageous to turn to Hamilton and read his beautiful reasonings on the interpretation to be given to a product of two vectors.

By the excursions which Joly takes into various departments of Mathematical Physics such as the theory of Strain, Spherical Harmonics, Hydrodynamics and Electro-magnetism, the student of the Manual of Quaternions is introduced to regions far beyond those discussed by Hamilton, though not perhaps beyond those to which he foresaw his calculus might be extended. Indeed, the present state of Quaternions, to the advancement of which Joly has so largely contributed, goes far to justify the aspirations of Hamilton himself. Writing fifty years ago to Humphrey Lloyd, afterwards Provost of Trinity College, Dublin, Hamilton, says :—

“In general, although in one sense I hope that I am actually growing modest about the Quaternions, from my seeing so many peeps and vistas into future expansions of their principles, I still must assert that this discovery appears to me to be as important for the middle of the nineteenth century as the discovery of fluxions was for the close of the seventeenth.”

R. S. B.

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Obituary Notices of the following deceased Fellows are in preparation for press, to appear in the B Series of the ‘Proceedings’:—

Sir John Burdon Sanderson, Bart.  
Henry B. Medlicott.  
William T. Blanford.  
Professor Thomas G. B. Howes.  
Baron Ferdinand von Richthofen.  
Captain Frederick W. Hutton.  
George B. Buckton.  
Charles B. Clarke.  
Dr. Lionel Beale.  
Rev. Canon Tristram.

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