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Charles Coulson

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Charles Alfred Coulson *FRS* (13 December 1910 – 7 January 1974) was an applied mathematician, *theoretical chemist* and religious author.^{[1][2][3]}

His major scientific work was as a pioneer of the application of the *quantum theory of valency* to problems of *molecular structure*, *dynamics* and *reactivity*. He shared his deep religious belief, as a *Methodist lay preacher*, with the general public in radio broadcasts, served on the *World Council of Churches* from 1962 to 1968 and was Chairman of *Oxfam* from 1965 to 1971.

Coulson went up to *Trinity College, Cambridge* in 1928, graduated in mathematics in 1931 and natural sciences in 1932, going on to receive a Ph.D. in 1936. He married Eileen Florence Burrett in 1938.

Coulson was a Senior Lecturer in the Mathematics Department of *University College, Dundee*, which was administratively part of the *University of St. Andrews* from 1938 to 1945. He held a Fellowship at the *University of Oxford* from 1945 to 1947, when he took up the newly appointed Chair of Theoretical Physics at *King's College London*. He returned to Oxford in 1952 as *Rouse Ball Professor of Mathematics* and Fellow of *Wadham College*. He set up and directed the *Mathematical Institute*. In 1972 he was appointed to the newly created Chair of Theoretical Chemistry, which has since been named for him.

He was elected a Fellow of the *Royal Society of Edinburgh* in 1941 and a Fellow of the *Royal Society* of London in 1950. He was awarded the *Davy Medal* of the Royal Society in 1970, the Faraday and Tilden Medals of the *Chemical Society* in 1968 and 1969 respectively, and received a dozen honorary degrees from English and other universities. He was a member of the International Academy of Quantum Molecular Science.^[4] His books include,^[5] *Electricity*,^[6] *Valence*^[7] and *Science and Christian belief*^[8]

In each of his successive appointments, Coulson attracted an active and enthusiastic group of graduate students, short and long term visitors, many of whom held senior university and industrial positions in England and other countries. Many of his students went on to make major contributions in several fields of endeavour.

Coulson was an excellent cricketer and chess player, a warm family man and had a strong sense of humour. He and Eileen were gracious hosts to his students and his associates. The conference in his honour at Brasenose College in 1967 had an impressive international attendance, despite the difficulty of organizing it during a postal strike.

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Family background and pre-college education

[*edit*]

The parents of Charles Coulson and his younger twin brother *John Metcalfe Coulson* were educators who hailed from the Midlands. The twins were born when their father, Arthur, was Principal of *Dudley Technical College* and Superintendent of the Methodist Sunday School, and their mother Annie was Headmistress of Tipton Secondary School, close by. Dudley is about 25 miles west of Birmingham and 10 miles east of Wolverhampton. Coulson's parents maintained a religious Methodist home.^[9]

When the Coulson brothers were 10, their father was appointed Superintendent of Technical Colleges for the South-West of England, and the family moved to Bristol. Charles attended the XIV Preparatory School. When he was 13, he was awarded a scholarship to *Clifton College*, a Public School in Bristol that placed a strong emphasis on science and mathematics. His hobbies and recreations included stamp collecting, cricket, tennis and chess.^[10]

Coulson's academic success at Clifton earned him an Entrance Scholarship in Mathematics to *Trinity College, Cambridge* in 1928.^[11]

His brother John also excelled at school, and went on to become Professor of *Chemical Engineering* at the *University of Newcastle*, and author of a major series of texts on chemical engineering.^[12]

The Cambridge years

[*edit*]

At Cambridge, Coulson first studied the *Mathematics Tripos*. He was awarded a College Senior Scholarship during his studies, and received a First Class in the university examinations in 1931. He continued to take the Physics Part II examination a year later, receiving another First. He was awarded several College and University prizes during his undergraduate days. *Lord Rutherford*, *J. J. Thomson*, A.S. *Besicovitch*, *Sir Arthur Eddington*, *G.H. Hardy*, *J.E. Littlewood*, *F.P. Ramsey* and *Ebenezer Cunningham* were amongst his teachers.^[13]

In 1932, Coulson started graduate work with *R. H. Fowler* but switched to *Sir John Lennard-Jones*, and was awarded a Ph.D. in 1936 for work on the electronic structure of methane. By this time, he had published 11 papers. He continued as a research Fellow at Cambridge for another two years.

Coulson was accredited as a lay preacher in 1929, but he said his religion was perfunctory until a particular event in 1930, which he described in

a documented sermon that he gave the following year. His religious beliefs were influenced^[2] by the physicist **Sir Arthur Eddington**, the theologian **Charles Raven** and, in particular,^[14] by Alex(ander) Wood, Fellow of **Emmanuel College**, authority on acoustics^[15] and pacifist.,^[16] elected **Labour M.P.** in 1945.

On the social side, Eileen was studying in Cambridge to become a school teacher when Charles was an undergraduate. They came together in meetings of the University Methodists.^[17] They married in 1938.

St. Andrews and Oxford before King's

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In 1939, Coulson was appointed as Senior Lecturer in Mathematics at University College, Dundee. Administratively, this was still part of the University of St. Andrews. Coulson was a **conscientious objector** during **World War II**. He carried a very heavy work load teaching Mathematics, Physics and Chemistry. **E. T. Copson** was Head of Department, on the main St. Andrews campus. Coulson collaborated with C. E. Duncanson at University College, London, brought (George) Stanley Rushbrooke from Cambridge and acted technically as his Ph.D. supervisor, and wrote the first edition of *Waves*^[5]

In 1945, Coulson became a Lecturer in Physical Chemistry, attached to **University College** and, concurrently, held a Fellowship awarded by **Imperial Chemical Industries**.^{[18][19]} Coulson's students at Oxford included

- **H. Christopher Longuet-Higgins**, later, a professor at Cambridge, then Edinburgh.
- **John Maddox**, who went with Coulson to King's College, London, turned to publishing and was knighted.
- **Roy McWeeny**, later, a professor at Sheffield and then Pisa.
- **William E. (Bill) Moffitt**, later on the Chemistry faculty at Harvard.

King's College, London

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In 1947, Coulson accepted a University chair in Theoretical Physics at King's College, London. This was reported as a news item in *Nature*.^[20] The note described him as "among the foremost workers in Great Britain on the wave-mechanical side of quantum theory". It extolled his breadth of interests that took in the action of radiation on bacteria and the theory of liquids and solutions, besides the molecular orbital treatment of small molecules and ions, the approximation methods needed for large organic molecules for studies of bond lengths in **coronene** and conductivity of graphite, chemical reactivity, the treatment of momentum distribution functions and Compton-line profiles and his "well deserved reputation for his kindly and helpful encouragement of younger research workers."

Initially, Coulson's group were assigned offices on the top floor of a building (reached by a rickety wooden staircase) that overlooked the Strand, with considerable benefit when cavalcades paraded by on Lord Mayor's Day and Royal occasions. In 1952, the group moved down to offices in the new Physics Department, interspersed with Biophysics and other experimental groups. With developments in computing opening new vistas for the theoreticians, along with the developments in laboratory methods, the entire department enjoyed the intellectual ferment of the 1950s.

In his account of the official opening of the new Physics Department, **Maurice Wilkins** wrote: "the theoretical group deals with "applications of wave mechanics and statistical mechanics ... the theory of the chemical bond ... questions of chemical reactivity ... stability of crystal structures, biological properties of cancer producing compounds and other molecules, electrical and magnetic properties of metals, ... properties of electrolytes and colloidal solutions, including ... electrophoresis ... more than one hundred papers have been published during the past five years."^[21]

Coulson's group consisted of (1) graduate students who conducted research on electronic structure and valence theory, for a Ph.D. degree directly under Coulson's supervision, (2) students working for a Ph.D. in statistical thermodynamics under the supervision of Fred Booth and, later, in nuclear physics supervised by Louis Elton and then Dr. Percy, (3) students working for an M.Sc. on topics in applied mathematics to be followed by a Ph.D. with another supervisor in the Mathematics Department, and (4) visitors, some of whom held senior academic and industrial appointments. The valence theory Ph.D. students included Simon J. Altmann, **Michael P Barnett**, Aagje Bozeman, Peter J. Davies, Harry H. Greenwood, **Peter Higgs**, Julianne Jacobs, Roland Lefebvre, George Lester, **John Maddox**, Norman H. March, and Robert Taylor. Statistical mechanics was pursued by Geoffrey V. Chester, John Enderby, Alec Gaines and Allan Lidiard. The students who went on to the Mathematics Department included Godfrey Lance, Eric Milner and Geoffrey Sewell. Collectively, these wrote nearly 30 books in later years. Visitors who stayed for months included Professor Inga Fischer-Hjalmars of the University of Stockholm, Dr. John van der Waals of Shell Oil, and Dr. Joop der Heer from the University of Amsterdam.

Oxford after King's

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In 1952, Coulson was appointed **Rouse Ball Professor of Mathematics** and Fellow of **Wadham College** at the University of Oxford. The chair was held previously by **E. A. Milne**, the mathematician and astrophysicist, and **Roger Penrose** succeeded Coulson. His inaugural lecture expressed the following view of applied mathematics: "an intellectual adventure in which are combined creative imagination and authentic canons of beauty and fitness; they combine to give us insight into the nature of that world of which we ourselves, and our minds, are part."

Coulson was active in the formation of the **Mathematical Institute**, and soon became its Director. On the Institute website^[22] Coulson is described as "a man who packed into his life twice as much as any normal academic person ... he had a gift for lucid exposition and was ... indefatigable in his work, not only for science and mathematics, but also on behalf of people, whether black or white, young or old."

In 1972 Coulson was appointed to the newly created Chair of Theoretical Chemistry.

Books and journals

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Coulson wrote several books. *Valence*,^[7] first published in 1952, and reissued posthumously, was the most influential. Coulson also wrote popular works on atomic and molecular structure. He was a founder member of the Board of the journal **Molecular Physics** and its first editor^[23]

Coulson's students at Oxford included

- John Cope
- John Hawgood

Religious and social activities

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Beside his scientific works, he wrote *Science, Technology and the Christian* (1953) and *Science and Christian Belief* (1955), integrating his scientific and religious views. Coulson apparently coined the phrase **God of the gaps**.^[24] Coulson believed religious faith was essential for the responsible use of science. He was a **pacifist** and **conscientious objector**, but championed the development of nuclear energy. He encouraged scientists to help improve third world food production. He was chairman of **Oxfam** from 1965 to 1971.^{[1][25]} Charles' widest religious impact on the general public was in his BBC broadcasts. In these, and in general interaction with people, he conveyed his religiosity in a gentle and

sometimes humorous manner, for example, when he claimed in his inaugural lecture at King's College, that he had received mail addressed to him as Professor of Theological Physics.

See also

[[edit](#)]

- [Valence bond theory](#)
- [Molecular orbital](#)
- [List of science and religion scholars](#)
- [List of chemists](#)

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Categories: 1910 births | 1974 deaths | Old Cliftonians | Alumni of Trinity College, Cambridge | Academics of King's College London | English chemists | Theoretical chemists | English Methodists | English Christian pacifists | People from Dudley | Academics of University College London | Fellows of the Royal Society | International Academy of Quantum Molecular Science members | British conscientious objectors | Faraday Lecturers

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