

ALEXANDER ROBERTUS, BARON TODD of TRUMPINGTON
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Alexander Todd was one of the country's most distinguished organic chemists. His great contribution to the chemistry of natural products of metabolic importance was equalled by his role in determining science policy and in higher education. In much of his scientific research he was the leader of a group or groups in which he played a key part in day to day discussions with those involved, and his contribution was a major factor in the success of the work. His intuitive skills and management ability were equally effective outside the laboratory where he played an influential part as a member of many research funding bodies. He was in great demand on government advisory councils and in industrial circles on both research and higher educational matters.

Born in Glasgow on 2 October 1907, the second son of a clerk in the Glasgow Subway Railway Company who later became Managing Director of the Furnishing and Drapery Co-operative Society, he was educated at Allan Glens' School and then at the University of Glasgow, from which he graduated in Chemistry with first class honours at the age of 20. He then joined Borsche's laboratory in Frankfurt where he studied bile acid structure. After obtaining his doctorate there he joined Robert Robinson in Oxford, where he worked on the structure and synthesis of several flower colouring matters of the anthocyanin group; this included the synthesis of hirsutin, perlargonin, malvin and cyanin.

After taking a DPhil at Oxford Todd moved to the University of Edinburgh to work in Barger's laboratory. There he and his group synthesised vitamin B₁ (thiamine). Others had proposed a structure for the vitamin which was synthesised by Todd and shown to be incorrect. They then synthesised the correct structure a month or two later than the other workers in the USA and Germany. However, Todd's synthesis was extremely elegant and simple and was the one adopted for the commercial production of the vitamin.

The work Todd started in Edinburgh was in a field that was of fundamental interest to him, namely the understanding of biological activity in molecular terms. The mechanism of action of vitamins was uncertain at that time, but it was likely that, in view of their essential nature, they had a central role in cellular metabolism, some having been shown to be components of coenzymes. A move with his group to the Lister Institute of Preventive Medicine in London enabled further work to be carried out on vitamins, as the animal facilities essential for such work were well provided there. They completed the vitamin B₁ work, achieved a total synthesis of the two forms of vitamin E and made a start on the study of the active components of *Cannabis indica*.

By that time Todd was recognised as probably the brightest young organic chemist in the country and it was not surprising that he was invited in 1938 to join the staff of the California Institute of Technology where Linus Pauling and other distinguished chemists and biologists were located. After a few months in Pasadena, however, he was offered and accepted at the age of 30 the highly prestigious Chair of Organic Chemistry at the University of Manchester. At that time this Chair was considered to be one of the three most distinguished chairs in Britain. Shortly after his arrival I, an undergraduate reading chemistry, had the personal experience of Alex Todd as a lecturer. It was most stimulating. He delivered a course on natural products to the final honours year and made it so interesting that it seemed like living through the experiments and the reasoning oneself. He treated the individual topics in a semi-historical manner, thereby enabling the class to follow the progress of thought and discovery leading to the structures and limited knowledge of mechanism of action of most of the vitamins, steroids etc. His course became one of the principal attractions in the final year at Manchester and later at Cambridge.

The functions of several of the water-soluble vitamins as components of nucleotide coenzymes were beginning to be understood in the late 1930s and it was there that Todd's interest became centred. He attracted a growing number of research students and staff and the group set about the determination of the structure of the known nucleosides and nucleotides as a preliminary step towards the synthesis of coenzymes. It was also becoming clear that the nucleic acids played a key role in living cells, although their genetic importance was still uncertain. It had not yet been shown that nucleic acids are macromolecular and not all the structural features of nucleosides and nucleotides had been clarified.

Todd's research programme was first to settle remaining uncertainties in the structure of known nucleosides and nucleotides by methods including their unambiguous synthesis, then to synthesise nucleotide coenzymes and to contribute to understanding the structure of the nucleic acids. A start was made in Manchester and in 1944, on his appointment to the Chair of Organic Chemistry in Cambridge University, he and his group ultimately achieved the unambiguous synthesis of all the main nucleosides and nucleotides, adenosine di- and triphosphates (ATP), flavin-adenine dinucleotide (FAD), nicotinamide-adenine dinucleotide (NAD) and uridine diphosphate glucose (UDP glucose). This work established beyond doubt the structures of these fundamentally important biochemical mediators. It is noteworthy that the chemical techniques available then were for the most part incompatible with the solubility and lability of these molecules and new procedures had to be developed, in particular for the preparation of N-glycosides and esters of phosphates and pyrophosphates in aqueous solution. For this work Alex Todd was awarded the Nobel Prize for Chemistry in 1957. In addition, the 3':5' - phosphodiester linkage system was established for the polymer chain of the nucleic acids, thereby enabling Watson and Crick to interpret the X-ray data and propose the double helix conformation for DNA and RNA. Methods were also developed for the synthesis of oligonucleotides; other projects included nematode cyst hatching factors, the structure of vitamin B₁₂ and of aphid pigments. He was a superb research director, always available and enthusiastic or encouraging as the occasion required and abounding with ideas. He received and shared great loyalty with those fortunate enough to collaborate with him.

In his role as Head of Department Alex Todd showed outstanding managerial skill. His ability to select the right personnel, to delegate responsibility and to manage were tested with considerable success in the University Chemical Laboratory in Cambridge. When he arrived in 1944 the Department was run down and undistinguished. It had been without effective leadership for a number of years and the staff lacked both encouragement and facilities. Despite the difficulties of wartime shortages Todd and his group managed, in a remarkably short time, to transform both the intellectual atmosphere and the working conditions, thereby lifting the Department from its former mediocre position to one of the world's leading schools of chemistry, a position it maintains to the present time.

His abilities were recognised outside the University Chemical Laboratory. He played an important part in the life of his college, Christ's, eventually becoming Master and, enhancing its distinguished reputation; he introduced a number of beneficial management changes. He was also effective in other University affairs, resulting for example in the University Press becoming a useful source of income for the University. He played a leading part in the foundation of Churchill College, served as Chairman of the Board of Governors of the United Cambridge Hospitals and as a Governor of the Leys School.

Outside Cambridge his influence on affairs of science and education was considerable. His scientific distinction, his ability to listen to the views of others, his common sense decisions and his determination to see these carried out resulted in his holding high office in many bodies concerned with science policy and research funding. These included President of the Chemical Society, the British Association, the Society of Chemical Industry, the International Union of Pure and Applied Chemistry and of the Royal Society. He was Chairman of a number of advisory bodies including the Advisory Council on Scientific Policy, the Royal Commission on Medical Education and he became Master of the Salters' Company. He was a Director of Fisons Ltd 1963-78 and had been a consultant to a number of chemical and pharmaceutical companies.

Todd's distinction was recognised throughout the world. He was awarded by the Royal Society the Davy, Royal and Copley Medals and the Bakerian and Tercentenary Lectureships. In addition to the Nobel Prize many foreign academies and societies honoured him with membership, medals and named lectureships. He received honorary degrees from the following universities: Glasgow, Melbourne, Edinburgh, Manchester, California, Hokkaido, Kiel, London, Madrid, Exeter, Leicester, Aligarh, Sheffield, Wales, Yale, Strasbourg, Harvard, Liverpool, Adelaide, Strathclyde, Oxford, ANU, Paris, Warwick, Durham, Michigan, Cambridge, Widener, Philippines, Tufts, Hong Kong, Sydney, and the German Federal Republic. He was made a member of the Order of the Rising Sun (Japan). He became a Fellow of the Royal Society in 1942, was knighted in 1954, created a Life Peer in 1962 and appointed a member of the Order of Merit in 1977. He became an Honorary Fellow of the Royal Society of Edinburgh in 1966.

As Chancellor of Strathclyde University for 27 years his interest and contribution was greatly appreciated by staff and students. A pub on the campus has been named after him, a rare honour which delighted him.

In 1937 he married Alison Sarah, elder daughter of Sir Henry H Dale OM, GBE, FRS, Nobel Laureate. They had one son and two daughters. Lady Todd died in 1987. Throughout their long marriage Alison had supported him and devoted her life to her family. Members of Christ's College, Cambridge will be grateful to both for their interest in their welfare and for their friendship. Lord Todd died in Cambridge on January 10th 1997.

JAMES BADDILEY