

Stamp Vignette on Medical Science



R. R. Porter— The 4-Chain Structure of Immunoglobulin G

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Rodney R. Porter was born at Newton-le-Willows, Lancashire, in northwestern England, on October 8, 1917. In 1939, he received a degree in biochemistry from the University of Liverpool (England), where he began post-graduate studies on phospholipids. During World War II (1939-1945), he served with the Royal Engineers in the Mediterranean theater of operations. While hospitalized after a laboratory accident at Cambridge University (England) in 1946, Porter read *The Specificity of Serological Reactions* by Karl Landsteiner (1868-1943), which delineated the remarkable range of antibody specificity. This book furthered Porter's interest in immunochemistry. In 1948, he obtained a PhD degree from the department of biochemistry at Cambridge University, where he was the first research student of future Nobel laureate Frederick Sanger (1918-).

At the National Institute for Medical Research (London, England), Porter learned the techniques of protein chromatography from Nobel laureate Archer John Porter Martin (1910-). Porter realized that antibody molecules must be cleaved into smaller fragments before meaningful structural work could commence. He became fascinated by antibodies; in his 1972 Nobel address he stated, "This combination of an apparently infinite range of antibody combining specificity associated with what appeared to be a nearly homogeneous group of proteins astonished me and indeed still does."

In 1950, Porter began fractionating antibodies with catalytic enzymes and subsequently utilized ion-exchange chromatography. In 1960, he became the first professor of immunology in the United Kingdom when he accepted the Pfizer chair at St Mary's Hospital Medical School (London). He used papain to cleave rabbit IgG antibody into 2 identical

Fab fragments and 1 Fc fragment. The latter fragment was so named because it crystallized. Ironically, Porter had been throwing the Fc crystals down the laboratory sink for several months because he believed they were simply crystals of cysteine. Gerald M. Edelman (1929-) had demonstrated that antibodies were multichain proteins. Analysis of the separated heavy and light chains with antisera to the Fab and Fc fragments had a critical role in providing evidence for the 4-chain model (2 heavy chains and 2 light chains joined by disulfide bonds) of IgG proposed by Porter in 1962.

Porter was appointed to the Whitley Chair of Biochemistry at Oxford University (England) in 1967 when Sir Hans Krebs (1900-1981) retired. Porter then set up one of the few protein-sequencing facilities in England. He believed that the immune system could be understood only after the molecules involved had been purified; thus, he began to study complement. Using the latest techniques in protein chemistry, he determined the structure of C1q and its binding to antibodies. He found that its 6 globular heads and collagenlike stem resembled a bunch of tulips. He next studied C4 and, at the time of his death, was interested in the genetic polymorphism of C4.

His straightforwardness made him quotable. He advised, for example, "Only read the Methods and Results, they can put anything they want in the Discussion." When asked by a student how much papain should be added to cleave IgG, he said, "Enough to go on a sixpence." When a senior colleague told him that she had conceived a good idea while in the bath, he said, "You should bathe more often." In addition to his teaching, administration, and scientific committee work, Porter was an avid gardener and became a curator of the Botanic Gardens at Oxford University.

Porter shared the Nobel Prize in physiology or medicine with Gerald Edelman of the Rockefeller Institute (New York) in 1972. A decade before, Edelman and Joseph A. Gally (1938-) had proved that in the serum of the same patient, Bence Jones proteins are identical to the light chains of the myeloma protein.

Porter died in an automobile accident on September 6, 1985, at the age of 67 years, just before his retirement from the Chair of Biochemistry at Oxford University. He had planned to return to the Medical Research Council Immunology Unit that he had founded in 1967. Porter was honored on a stamp issued by Maldives in 1995.