Obituary

REBECCA CRAIGHILL LANCEFIELD, 1895–1981

Dr Rebecca Lancefield died at her home in New York on 3 March 1981 at the age of 86. Her career spanned more than 60 years spent almost entirely at the Rockefeller Institute for Medical Research, now Rockefeller University, where she became an Emeritus Member and Professor. Her scientific interests were directed exclusively towards streptococcal disease. When she joined O. T. Avery and A. R. Dochez at ‘The Institute’ in 1918 streptococcal infection was rife. Apart from their separation into haemolytic and non-haemolytic varieties, there was no useful classification of these micro-organisms and no means of knowing which were of importance as a source of human infection. Lancefield’s group classification, introduced in 1933, brought order out of chaos. Henceforth, a simple serological test distinguished between the streptococci associated with human disease (group A) and those chiefly associated with infections of domestic animals (groups B and C). In conjunction with Griffith’s type classification, Lancefield’s work provided the foundation for epidemiological investigations of streptococcal infection throughout the world.

Rebecca Craighill Lancefield was born in Fort Wadsworth, New York, on 5 January 1895. Her father, Col. William E. Craighill, was of Scottish extraction; her mother, born Mary Wortley Byram, claimed descent from Lady Mary Wortley Montagu, still remembered for her championship of ‘variolation’ against smallpox. After majoring in Liberal Arts at Wellesley College, Mass., Rebecca, her father now dead, spent a year teaching in high school to help support her five sisters. She was then awarded a scholarship open to the daughters of deceased army officers and tenable at Teachers’ College, Columbia University. Ostensibly, the scholarship was intended for aspiring school teachers, a career for which Rebecca had no inclination. From her former Wellesley room-mate she had acquired an interest in biology and now sought admission to H. Zinsser’s Department at Columbia. The administrators at Teachers’ College were sympathetic and agreed to her pursuing an M.A. course in Bacteriology. In later years, Rebecca would recount with glee her narrow escape from a teaching career. One further step towards her ultimate vocation deserves mention. In 1918, Zinsser moved to Harvard and was succeeded at Columbia by F. P. Gay. Gay casually mentioned to his new graduate student that a part-time technician was needed by O. T. Avery and A. R. Dochez at the Rockefeller Institute. Rebecca leapt at the opportunity and got the job. It proved to be a turning point in her career.

In 1917, Avery and Dochez had been commissioned by the U.S. Surgeon-General to investigate the high incidence of streptococcal broncho-pneumonia complicating measles in army training camps in Texas. Their immediate objective was to determine whether immunologically distinct types of streptococci were responsible for these epidemics and, if so, whether such infection induced type-specific immunity. By means of mouse-protection tests with rabbit antisera raised against the epidemic strains of haemolytic streptococci, Dochez, Avery and Lancefield showed that at least four immunological types were rampant in the camps and that the immunity following infection was probably type-specific. This investigation was the starting point of Lancefield’s life-work.

With the end of the war, the Surgeon-General’s support was withdrawn and Rebecca resumed full-time work for her Master’s degree at Columbia. At this time, she married Donald Lancefield, a graduate student in T. H. Morgan’s Genetics Department. The first three years of their married life were spent in Oregon where Rebecca worked for two years at the Carnegie Institute and for one at the University of Oregon, but, in 1922, they returned to New York, Donald to Columbia and Rebecca to the Rockefeller Institute where she secured...
an appointment in the Rheumatic Fever Department newly established under the direction of Dr Homer Swift.

A fortunate circumstance that influenced Lancefield’s subsequent career at the Rockefeller Institute was the close proximity of her laboratory to the Pneumonia Department presided over by O. T. Avery. Avery and Lancefield had worked together in 1918 and there now developed a close relationship that continued until Avery’s retirement in 1948. When Lancefield returned to the Institute her immediate objective was to identify the type-specific components in the haemolytic streptococci brought from Texas four years earlier. Avery was now occupied in showing that the immunological type-specificity of pneumococci was determined by capsular polysaccharides. It was clearly of interest to know whether a similar situation obtained with the haemolytic streptococci. At this time Lancefield was working exclusively with strains of human origin. Treatment with hot acid extracted polysaccharides (‘C carbohydrates’) which she tested in precipitin reactions with antisera raised against the four Texas type strains. Contrary to expectation, she found that instead of being type-specific the C carbohydrates from all the strains were serologically identical. She was later to discover in the streptococcal ‘M protein’ the type-specificity that she had expected to find in the C carbohydrates. Puzzled by her present findings, Lancefield turned temporarily to the non-haemolytic streptococci hoping to find them more akin to the pneumococci. It was not until several years later that she chanced to examine some haemolytic streptococci isolated by a colleague from an outbreak of lymphadenitis in guinea pigs. She found that these guinea pig streptococci shared a carbohydrate serologically distinct from that previously isolated from the human strains. This unexpected finding suggested that the specificity of the C carbohydrates might be related to the animal host from which the streptococci were isolated. This hypothesis was confirmed when streptococci from bovine mastitis (group B) were found to share a C carbohydrate serologically distinct from the carbohydrates of human (group A) and guinea pig (group C) streptococci. These findings, published in 1933, provided the basis for Lancefield’s group classification of the haemolytic streptococci. It was left for Maclyn McCarty, Lancefield’s colleague, to show twenty years later that the C carbohydrate is a major component of the streptococcal cell wall. Lancefield established a fourth group, group D, to accommodate haemolytic streptococci isolated from cheese. Group D did not fit readily into the general pattern formed by groups A, B and C. In 1962, this writer, working in Lancefield’s laboratory, showed that instead of being a cell-wall component, the group D antigen is an intracellular glycerol teichoic acid. Lancefield readily accepted this inconsistency. She made no claim that her classification had a basis in formal taxonomy. She regarded the group designations merely as ‘useful handles’ for describing streptococci of diverse origin and differing pathogenic potential.

From the outset, Lancefield’s main purpose had been to identify the type-specific component in haemolytic streptococci from human infections and she did not allow her success with the group classification to deflect her from this objective. In collaboration with E. W. Todd, a visitor from England, she had, in 1928, identified the type-specific components in the epidemic strains from Texas as serologically distinct M proteins. She did not then know whether this finding applied to all strains from human infections. The answer came as a result of collaboration with Dr Fred Griffith. While on sabbatical leave in Cambridge in 1929 Lancefield met Griffith at the Ministry of Health’s laboratory in London, and although they did not meet again they continued to correspond until Griffith’s untimely death in 1941. During this period, Griffith developed a slide-agglutination method for typing streptococci from human infections. He established 29 different serological types and sent representative cultures to Lancefield for group identification. She found that all, save four, belonged to group A; of the remainder, three belonged to group C and one to group G. Griffith did not investigate the chemical basis for his types and it was left for Lancefield to show that, like the types from Texas, they were characterized by serologically distinct proteins. She went on to show that these M proteins were associated with mouse-virulence and type-specific immunity.
Much of her subsequent work was devoted to unravelling the complex antigenic relationships between the Griffith types and led her to define two additional streptococcal antigens, the T and R proteins, responsible for many of the confusing cross-reactions encountered in typing streptococci by slide agglutination. With these findings, most of which she described in her Harvey Lecture for 1941, Lancefield completed the investigation embarked upon with Avery and Dochez in 1918.

Lancefield spent her last years working with the streptococci of group B. Mainly because of their similarity to pneumococci, group B streptococci held a special place in her affections and their attraction as research material became irresistible when they were implicated in neonatal meningitis. Rebecca was investigating their complex type relationships when, at the age of 86, a fracture of the hip brought to a close her regular attendance at the laboratory.

Despite many commitments, Rebecca Lancefield found time to serve as President of both the Society of American Bacteriologists and the American Association of Immunologists. In 1977, the naming of the Lancefield Society, which meets annually in the U.S.A. for the discussion of streptococcal work in progress, testified to the respect and affection in which ‘Mrs L’ was held by her colleagues. She was elected to membership of the National Academy of Sciences in 1970 and was awarded honorary degrees by Rockefeller University and by Wellesley College in 1976. In the U.K. she was accorded honorary status in this Society, in
the Pathological Society of Great Britain and Ireland and in the Royal College of Pathologists.

She is survived by her husband, Donald (Emeritus Professor of Biology at Queen’s College, New York City), a native of Oregon who, over the years, gave her such loyal support, by her daughter, Jane (Mrs George Hersey) and by two grandsons.

S. D. ELLIOTT