OBITUARY NOTICE OF DECEASED MEMBER

Oswald Theodore Avery

21st October 1877—20th February 1955

(Plate LXXVII)

Oswald Theodore Avery was born on the 21st October 1877 at Halifax, Nova Scotia, and died at Nashville, Tennessee, U.S.A., on 20th February 1955. With his death there ended the career of one of the most outstanding students of bacteriology and immunology of his time.

Avery came of pure English stock, both his parents having been born in England. According to information in the possession of his family, Avery's paternal grandfather, Joseph Avery, lived at Wolvercote, near Oxford, and there he conducted a paper mill where he manufactured the thin paper used in the printing of Oxford Bibles.

Avery's father, Joseph Francis Avery, who was born at Norwich, Norfolk, is reported to have been attracted by the sermons of an American evangelist who was conducting a series of religious meetings in England, and decided to enter the ministry. He was received into the Baptist Church and then, some three years after his marriage to Miss Elizabeth Crowdy at Summertown, England, in 1870, was called to establish a Baptist church in Halifax. There the young couple made their home for a few years, and there Oswald, their second son, was born. In the same year, 1877, the father was called to the pastorate of a mission church located on the lower east side of New York City, and in that church, which was called " Mariner's Temple ", he served until his death in 1892.

In those days the lower east side of New York was notorious for its rowdyism, and one would scarcely have selected it as an ideal spot in which to bring up children, but the fact remains that young Avery survived any vicissitudes which the neighbourhood may have presented, managed to go to Colgate University (Hamilton, N.Y.), from which he received the A.B. degree, and then entered the College of Physicians and Surgeons of Columbia University, from which he graduated in 1904 with the M.D. degree. After a brief period in clinical work he was appointed a member of the staff of the Hoagland Laboratory in Brooklyn, N.Y., and there he embarked upon bacteriological investigations with the late Dr Benjamin White. It is of particular interest, in view of the nature of Avery's later work, that one of their papers, which appeared in 1912, dealt with the chemical constitution of the tubercle bacillus.

In 1913 Avery, who by that time had become Associate Director of the Hoagland Laboratory, was invited by Dr Rufus Cole, then Director of the Hospital of the Rockefeller Institute for Medical Research, to become a member of its staff. Cole's attention had been directed to Avery by a paper which he had published from the Laboratory, and a visit to Avery confirmed the favourable impression which Cole had gained from reading his paper. The invitation, which followed shortly thereafter, was promptly accepted.

When Avery came to the Rockefeller Institute Hospital in 1913 the principal problem upon which Cole and his associates were engaged was a comprehensive study of lobar pneumonia with a view toward obtaining a specific treatment for that disease. The work of Neufeld and Haendel in Germany had demonstrated (1910) the existence of certain varieties of pneumococcus which were different from one another from the standpoint of their immunological reactions. A. R. Dochez and L. J. Gillespie, working at the Hospital on the pneumonia problem and aware of Neufeld's observations, had studied the immunological relationships of a large number of strains of the pneumococcus isolated from cases of lobar pneumonia and other sources, and had demonstrated that these strains could be differentiated by immunological methods into four separate groups. One of these groups, labelled by the investigators group IV, contained a number of different strains, but each of the other three groups contained only one type-specific strain. Dochez and Gillespie therefore proposed that pneumococci be classified on the basis of their immunological reactions into the four different groups which they had encountered.

Gillespie left the Hospital of the Rockefeller Institute in the summer of 1913, and when Avery, who succeeded him, took up his work there it was natural that he should join forces with Dochez in the immunological attack on the pneumococcus problem. During the next four years these two able investigators worked together as a team on the general problem of the immunology of the pneumococcus, and it was during the course of these investigations that they discovered the presence, in broth cultures of pneumococci, of a soluble substance which was elaborated by the growing organism and was specific for the particular type of pneumococcus growing in the culture.

This fundamental observation, which was published in 1917, formed the basis for most of Avery's subsequent work, but he did not immediately follow it up, partly perhaps because of America's entry into World War I, which brought for him an unexpected complication.

It will be remembered that Avery was born in Nova Scotia of English parents, and was therefore a British subject when he was brought at a very early age to the United States. Upon the entry of America into World War I he sought to obtain a commission in the Medical Corps of the United States Army, but it was denied because, apparently, he had never taken the trouble to become an American citizen! He did manage somehow to get into the American Army,

but only as an enlisted man, and it was some time before he became naturalised and could obtain a commission as Captain.

Following the close of World War I he joined with Dochez and Rebecca Lancefield in a study of the immunological relations of hæmolytic streptococci, but when Dochez left the Hospital of the Rockefeller Institute in 1919 Avery returned to the study of the pneumococcus and, with the late Glenn E. Cullen, investigated the enzymes which that organism elaborated. Pausing for a while to study, with a Norwegian, T. Thjötta, and Hugh Morgan, the nature of accessory substances necessary for the nutrition of bacteria, he finally returned in the early 1920s to a systematic and analytical study of the type-specific soluble substance elaborated by growing pneumococci, having recognised that this substance offered an excellent opportunity to investigate by chemical methods the nature of the mechanism which differentiates one immunological type of pneumococcus from another.

In approaching this problem he had the good fortune to obtain the assistance of Michael Heidelberger, a skilled chemist, and from this team, to which others were added from time to time, there came a series of brilliant studies which revealed that the type-specific substance found in broth cultures of pneumococci is associated with the capsular envelope of the organism and not its body, and that it is a complex carbohydrate, actually a polysaccharide. Further study by Avery and his associates led to the important observation that by treating a non-specific type of pneumococcus according to a particular method with a given specific type of that same organism, it was possible to transform the non-specific type into the specific type of pneumococcus used in the experiment. Moreover, this transformation was stable and permanent, and was transmitted to successive generations of pneumococci derived from the culture containing the original transformed organisms. Finally it was shown that the active principle responsible for this transformation was a particular substance, desoxyribonucleic acid. This discovery, coming toward the close of Avery's scientific career and so important because of its bearing upon genetics, may perhaps be said to be his *magnum opus*.

Avery attained the highest departmental rank it is possible to achieve at the Rockefeller Institute, that of Member, before his official retirement in 1943, but he continued to work there until 1948, when he moved to Nashville, Tennessee, where he could be near his younger brother, Dr Roy C. Avery, who was then Associate Professor of Bacteriology in the School of Medicine of Vanderbilt University. Ernest W. Goodpasture, then Professor of Pathology at Vanderbilt University, placed the facilities of his department at the disposal of Avery, but he did not make extended use of them. At Nashville his life was essentially one of retirement and leisure.

In the summer of 1954 the symptoms of what was to be his final illness made their appearance, and were of such a character as to

necessitate his being evacuated from the island off the Maine coast where he had been accustomed to spend his summers for many years. He was taken first to the Hospital of the Rockefeller Institute and then to Nashville, where an exploratory operation revealed the presence of a tumour of the liver. Although the growth was removed a permanent cure was not effected and after several months of convalescence he began to lose ground and died in Vanderbilt University Hospital on the 20th February 1955.

Many younger men sought the opportunity to work with Avery during his active years, and many of them became his close associates. To them he was a never-failing source of inspiration and assistance. He was an indefatigable worker although his health was frail and he was never a robust person, but he possessed an inner drive that would not let him stop short of a completely satisfactory explanation of the problem upon which he was engaged.

Many honours came to Avery during his lifetime. He was President of the American Association of Immunologists, the American Association of Pathologists and Bacteriologists, and the Society of American Bacteriologists. He was also a member of the National Academy of Sciences and an honorary member of the following foreign learned societies :—Pathological Society of Great Britain and Ireland, Der Norski Videnskaps Adademi (Oslo), Academie Royale de Médecine de Belgique, Société Philomathique de Paris. He received honorary degrees from his alma mater, Colgate University, and from McGill University, New York University, the University of Chicago and Rutgers University, and the following awards and prizes : the Lasker Award of the American Public Health Association, the Passano Foundation Award, the Pasteur Gold Medal presented every ten years by the Swedish Medical Society in Stockholm, the Paul Ehrlich Gold Medal, the Copley Medal of the Royal Society of London, the John Phillips Memorial Medal of the American College of Physicians, the Kober Medal of the Association of American Physicians and a medal given by the New York Academy of Medicine.

Avery never married. As has been said, it was his custom for many years to spend his summers on an island off the coast of Maine where he could indulge his taste for walking, and where he had the opportunity to sail with a friend in the latter's sailboat. Although he became very fond of sailing he never really tried to master the art, but on the other hand rarely missed an opportunity to go for an afternoon sail when the occasion offered. Short in stature and small of body as he was—he could scarcely have weighed much over a hundred pounds—one could not imagine him ever participating in any competitive sport.

To his close friends he was known as " 'Fess ", a contraction of " Professor ", and without exception they were all deeply devoted to him. He was a delightful companion, full of humour, and the very soul of generosity. If one had to describe him with a single

adjective, "lovable" would be the universal choice of his friends. Unhappily they cannot expect to see his like again.

I am indebted to Miss Patricia E. Green, secretary to Dr. Frank L. Horsfall, Jr., of the Rockefeller Institute for Medical Research, for the photograph of Dr Avery and the bibliography which accompany this notice.

ALAN M. CHESNEY.

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