MAJOR WALTER REED, M.D., LL.D.

1851-1902

SINCE the days of Washington, the soil of Virginia has seen the birth of many famous sons, whose names have gone to swell the ranks of America's honoured dead, and not least among them, if we take the measure of his services to humanity, is the name of Walter Reed. In a short life of fifty-one years, this true Virginian had the rare satisfaction of seeing the tangible results of his brilliant researches applied, and so ably applied, by the administrative genius of the great sanitarian, General Gorgas, to the fever-ridden lands of the South, that they were henceforth free from the scourge of centuries, yellow fever.

Walter Reed, the sixth child of the Reverend Lemuel Reed and his wife Pharaba, whose maiden name was White, was born on the 13th of September 1851, at Belroi, in Gloucester County, Virginia. Both his parents were North Carolinians by birth and came of English stock, his father being a Methodist minister. Their means were modest, but not so scanty as to deprive their children of a sound education, and Walter Reed, after being at private schools, entered the University of Virginia at an early age, graduating M.D. there in 1868, when he was only seventeen, the youngest graduate on record. From there he went on to Bellevue Medical College, New York, where he took a second medical degree,

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afterwards holding appointments in Brooklyn City Hospital and the City Hospital, Blackwell's Island. He was not yet twenty-one when he became a district physician in New York City, and only twenty-two when he was appointed one of five inspectors of the Board of Health of Brooklyn, so that his connection with the then quite new science of Preventive Medicine, began at an early stage of his career. Entering the Medical Corps of the United States Army in 1874, he received his commission in 1875 and, as assistant surgeon with the rank of 1st Lieutenant, was stationed at Willet's Point, near New York Harbour, and here, after a year, he married Miss Emilie Lawrence of Murfriesboro. He then left New York and saw service in Arizona, Nebraska, Dakota, and in the Southern and Eastern States, in out-of-the-way stations on the frontier, where a scattered population involved long rounds on horseback to visit his patients in their far-distant homes, and where he had to treat every kind of illness single-handed, with none of the facilities which are the heritage of those whose work lies in the city. But the dearth of mechanical aids and the absence of consultation with colleagues bred in him an independence and self-reliance and skill in diagnosis, with habits of accurate observation which served him well in after life. It was, however, a very lonely life and Reed, a student by nature, felt the isolation of the West, the lack of contact with other minds, and the need of keeping in touch with the developments of science. He therefore applied in 1889 for a post in Baltimore, and was appointed examiner of recruits there in 1890.

In Baltimore, Walter Reed's true scientific career may be said to have begun. He studied pathology

and bacteriology, new sciences at that time, under Professor Welch at Johns Hopkins University, and was greatly encouraged by the interest and friendship of this distinguished teacher. In 1892 he published his first scientific paper on "The Contagiousness of Erysipelas," in the *Boston Medical and Surgical Journal*, following it in 1893 with "Remarks on the Cholera Spirillum," in the *North-west Lancet*, St Paul. In this year he was appointed Curator of the Army Medical Museum and Professor of Bacteriology at the new Army Medical School. On account of his excellent judgment, he was often sent on expeditions to investigate the causes of epidemics at military stations; but in spite of the many interruptions that this, and his work as an examiner involved, his output of scientific work, as evidenced by the papers he published from the time he went to Baltimore until he left Washington in 1898, a period of ten years, testifies to his enormous industry and even then established his reputation as an original investigator. "The Germicidal Value of Trikresol" appeared in the *St Louis Medical and Surgical Journal* in 1894, and *A Brief Contribution to the Identification of Streptococcus Erysipelaticus* was published this year. In 1895 two papers on typhus fever appeared, and in 1896 the *Parasite of Malaria* was published, and many others, all of them records of his painstaking experiments.

When the Spanish American War broke out in 1898, an epidemic of typhoid fever ravaged the camps of the Volunteer troops of the American Army, and Reed was appointed Chairman of a commission to inquire into the causes of the fever. His fellow commissioners were Dr V. C. Vaughan of Ann Arbor and Dr E. O. Shakespeare of Philadelphia.

The work of this commission occupied them for a year and was carried out with great skill and attention to detail in the investigation of hundreds of cases of typhoid. Its report revealed many new aspects of the disease, and was of value in proving that typhoid fever can be communicated by contact with infected articles such as clothing, as well as by contaminated drinking water.

Reed was next sent by the Government to Cuba at the head of a commission to investigate the causes of yellow fever. Among the American troops stationed at Havana when the war ended, this disease was taking its usual heavy toll of valuable lives. In association with Dr James Carroll before the war, Reed had already investigated a claim made by Sanarelli that the *Bacillus icteroides* was the cause of yellow fever, a theory which was generally regarded as justified at that time. As a result of the experiments they then carried out, it was conclusively proved that this bacillus is a variety of the hog-cholera bacillus, which is to be found all over the United States, and that even if it is present in cases of yellow fever, it has no connection with that disease. These conclusions were now borne out by Reed and his fellow commissioners, Dr Carroll, Dr Lazear and Dr Agramonte, a Cuban who having had the disease was immune, in their experiments at Havana in 1900, where in the thick of an epidemic they set to work in the small town of Pinar del Rio. That year a distinguished officer of the United States Public Health Service, Dr R. H. Carter, had drawn attention to the fact that, although the incubation period of yellow fever was only five days, yet a house to which a patient was conveyed did not become infected until

fifteen to twenty days had elapsed. The significance of this fact was not lost on Reed and, comparing it to the incubation period of the malaria parasite in the body of the mosquito, discovered in 1897 by Sir Ronald Ross, he decided to seek for the means of transmission of yellow fever rather than for the specific agent which caused the disease, which had hitherto occupied scientists. The minute spiral organism which causes the disease was not discovered till long after Reed's death, when it was observed by the Japanese investigator Noguchi, in 1918. The theory of the part played by the mosquito in the transmission of yellow fever was not new, for Carlos Finlay, a Cuban of English stock, had advanced it as early as the eighties, and had even distinguished the mosquito which was the culprit, but had failed to give experimental proof of his claim, for the reason, not then known, that it is only during the first three or four days of the disease that the blood of a yellow fever patient is infectious. He had selected for his experiments, patients in whom the disease was well advanced and whose symptoms were therefore more pronounced, and so had missed the infective period, and his mosquitoes, fed on the blood of these patients, were unaffected. Had he succeeded in this experiment, thousands of lives would have been saved in Cuba and the Southern States in the twenty years that elapsed before Reed's brilliant work was done. Instead, the theory that infection was conveyed by contaminated clothing and bedding still held the day in 1900, and every year much valuable property was destroyed.

The Military Governor of Cuba, General Leonard Wood, was a man of broad outlook and scientific

training, who appreciated the value of Reed's work, and readily made provision for all the necessary means for the experiments. Rewards were offered to men submitting themselves for trial, and many soldiers of the American Army volunteered. The heroic story of Camp Lazear is famous in the records of science. Dr Carroll was the first to allow himself to be bitten by a mosquito which twelve days previouly had been fed on the blood of a yellow fever patient. He developed a severe attack of the disease, but recovered. Dr Lazear was not so fortunate. He also had allowed himself to be bitten, but did not catch the infection, until, a few days later, in one of the fever wards, he was accidentally bitten, developed the disease in one of its worst forms, and succumbed. In his honour, his comrades named the experimental camp, established at Quemados about four miles from Havana, Camp Lazear. The next experiment was made on a young private, who was kept in camp for two weeks so that there was no risk of his being infected from any source other than that which the experimenters intended. At the end of that time an infected mosquito was allowed to bite him, and in three days he contracted the disease, and was removed to the fever hospital about a mile from the camp. Many other experiments of a like nature proved beyond a doubt that the mosquito was the means of transmitting the disease, but it had also to be shown that the infection could not be caught from clothing. For this purpose, a hut of two compartments, divided by a fine-meshed wire screen, was erected. In one compartment clothing and contaminated linen from the beds of fever stricken patients were placed; in the other some infected mosquitoes were let loose. Three

gallant volunteers, Dr Cooke and two private soldiers, slept for twenty nights on the contaminated bedding, but did not catch the disease. They then went into the next compartment, where they were freely bitten by their mosquito hosts and straightway developed yellow fever.

Many more experiments were carried out until Reed was absolute master of the situation. It was found that the disease could be produced by the subcutaneous injection of blood taken from a yellow fever patient in the first two or three days of his illness and, in all, ten cases of the disease were originated by bites of purposely infected mosquitoes; but no one in that famous camp got yellow fever except at the express desire of the Fever Commissioners, so admirable was the work of these distinguished investigators. General M'Caw has summed up the main conclusions of the Commission briefly and clearly in his monograph, *Walter Reed: A Memoir*, in the following words: "(1) The specific agent in the causation of yellow fever exists in the blood of a patient for the first three days of his attack, after which time he ceases to be a menace to the health of others. (2) A mosquito of a single species, *Stegomyia fasciata*, ingesting the blood of a patient during this infective period, is powerless to convey the disease to another person by its bite until about twelve days have elapsed, but can do so thereafter for an indefinite period, probably during the remainder of its life." ("The mosquito is capable of conveying infection for at least fifty-seven days after contamination and possibly longer," *Kelly's Encyclopædia of American Medical History.*) "(3) The disease cannot in nature be spread in any other way

than by the bite of the previously infected *Stegomyia*. Articles used and soiled by patients do not carry infection." And he adds, "It has been well said that Reed's experiments will always remain as models in the annals of scientific research, both for the exactness with which they were adapted to the points to be proved, and the precaution taken that no experiment should be vitiated by failure to exclude all possible sources of error."

In 1901, Reed returned to Washington and took up his work as Professor of Bacteriology and Clinical Microscopy in the Army Medical School and of Pathology and Bacteriology in the Columbian University. He was an attractive teacher and his lectures were listened to with intense interest.

In the meantime, in Havana, General Gorgas had set to work on the preventive measures, based on the report of Reed's Commission, with the amazing result that in less than a year Havana was free of this scourge for the first time for a century and a half. The benefits to mankind in the tropics which this discovery brought about were incalculable; and to the United States they were hardly less. Epidemics of yellow fever had spread to New Orleans, Memphis, Charleston, Baltimore, Philadelphia, New York and many other towns, leaving desolation in their train. The epidemic of 1878 cost the United States over 15 millions of dollars, and in the epidemic of 1853 New Orleans lost 8000 lives.

In recognition of his services Harvard University conferred upon Reed the honorary degree of M.A. in 1902, and Michigan University that of LL.D.; but he did not live long to enjoy the fruits of his work, for he was taken ill with appendicitis in the autumn

of this year, and, although an operation was performed, he died in Washington on the 22nd of November. His tombstone in Arlington Cemetery bears the inscription: "He gave to man control over that fearful scourge, Yellow Fever." His was a discovery which, as the Military Governor of Cuba said, resulted in the saving of more lives annually than were lost in the Cuban War, and in the annual saving of more money than was expended in the Cuban War from its opening to its end. But the discoverer died a poor man.

REFERENCES.—*Walter Reed: A Memoir*, by W. D. M'Caw, published by the Walter Reed Memorial Association, Washington, 1904. *Encyclopædia Amer. Med. Hist.*, H. A. Kelly, vol. ii., p. 311, Baltimore. *Yellow Fever*, by Walter Reed, U.S. Government Printing Office Publication 5919, 1911.