Review Article

Lieut-General Sir William Boog Leishman (1865-1926): Discoverer of Leishmania and Pioneer in Bacteriology

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Abstract
The purpose of this article is to present in brief the life and scientific work of Sir William Boog Leishman and to point out his contribution in medical microbiology. Leishman served the Royal Army Medical Corps until 1890 on home stations and was afterwards sent to India, where he served until 1897, where he probably acquired his interest in tropical diseases and microbiology. Original manuscripts of
Leishman were carefully studied, as well as contemporary reviews articles, biographies; a detailed PubMed search was also conducted. We were able to identify Leishman’s most important contributions in the pathology and bacteriology, including his work on vaccination against typhoid. His work on Leishman-Donovan bodies and the protozoan parasite *Leishmania donovani*, which causes the disease (Leishmania), also set the basis of modern microbiology. Undoubtedly, William Boog Leishman is to be considered as one of the most prestigious and eminent scientists of the British Medical school during the 19th century.

Key words: Leishman, bacteriologist, pathologist, Leishmania

His life and studies

William Boog Leishman, the distinguished bacteriologist and pathologist was born in Glasgow on 6th November 1865, the fourth of a family of six children and raised in a highly academic environment. His grandfather was Reverend Dr. Leishman, parish minister of the city of Govan and an uncle, Thomas, was a distinguished divine. His father, William Leishman, was a Glasgow graduate of 1855, who held the chair of Medical Jurisprudence in Anderson’s College, edited the Glasgow Medical Journal and became Professor of Obstetrics and Midwifery at Glasgow University in 1868. His father, Professor William Leishman of Glasgow University, was a man of great distinction and his Manual of Midwifery was for long a standard work on the subject. His mother was Augusta Selina Drever, of Blackrock, County Dublin.

William Boog Leishman followed his father into Medicine. Junior William Leishman was a very gifted student and one who, it seems, had to slow down to comply with the medical faculty’s regulations. After attending Westminster School, he matriculated at the University of Glasgow in the autumn of 1880 to study Greek, Latin and Mathematics. He was still only fourteen, though he anticipated his birthday in November and presented himself as fifteen. The following year he remained -curiously- still fifteen and signed up for Professor John Veitch’s class in Logic. In 1882, now sixteen, he enrolled for classes in the Medical Faculty in Anatomy, Zoology and Chemistry. He obtained his MD near the top of his class, with High Commendation, in 1886 [1, 2].
He entered the Royal Army Medical Corps the year following his graduation and until 1890 served on home stations. He was then sent to India, serving there from 1890 to 1897, where he probably acquired his interest in tropical diseases and microbiology, in the study of which he became so distinguished. In India he was posted to take part in a punitive expedition to Waziristan; he packed his microscope and from then on he began his lifelong research into microbiology and public health [1, 2].

**Leishman settles down his military and academic career**

Returning to England in 1897, he was posted to Netley, then the Head Quarters of the Army Medical School. This was a happy accident for the future of Leishman himself and for the world in general, for here he fell under the spell of Almroth Wright, the professor of pathology to the school, and became attracted to laboratory work under circumstances which could not prove other than inspiring and delightful. From this time onwards his career was a continuous series of successes. On the relocation of the Army Medical School to Millbank, London and the appointment of Sir Almroth Wright to St Mary’s Hospital in 1903, Leishman became professor of pathology at the Royal Army Medical College [1, 2].

In 1905 he was made a Brevet Lieutenant-Colonel in recognition of his scientific investigations; in 1909 he received the honour of knighthood; in 1910 he was elected a fellow of the Royal Society and, in 1911, president of the Society of Tropical Medicine and Hygiene. In 1912, on promotion to the rank of Lieut.-Colonel, he was appointed Honorary Physician to the King. In 1913 he quit his chair of pathology at the Royal Army Medical College to assume the still more important duties of Expert in Tropical Diseases to the Army Medical Advisory Board at the War Office and in the same year he became one of the original members of the Medical Research Committee [1, 2].

On the outbreak of the European war, he quit the War Office for France and in October 1914 was made Advisor in Pathology on the Staff of the Director General of Medical Services of the Expeditionary Force. He received the C.B. (Military), the Legion of Honour (3rd Class) and the American Distinguished Service Medal. In 1918 he was recalled to the War Office and, on the formation of
the new Directorates of Hygiene and Pathology, was made Director of Pathology. In the same year he was also promoted to the rank of Major-General. In 1923, Leishman became Director-General, was promoted a Lieutenant-General, was advanced by the French Government to the grade of Grand Officer of the Legion of Honour and director general of the Army Medical Services, a post he held until his death. He was also a Knight of Grace of the Order of St John of Jerusalem. An even higher acclaim, which gave him great personal gratification, was his election to the Athenaeum Club in 1925 in recognition of eminence in science and aid of public services [1, 2].

He was a member of innumerable societies and committees for the government as well as for scientific societies. At the outbreak of the World War he was assigned as Expert in Tropical Diseases on the Army Medical Advisory Board, and soon after the duties of Adviser in Pathology were added. At the time of his death he was Director-General of the Army Medical Service. He was a prolific writer on tropical diseases and preventive medicine, contributing to well-known journals.

Leishman’s scientific work

From the point of view of scientific output, Leishman’s life falls into three periods: the period of development and of personal research during which his close association, as student and assistant, with Sir Almroth Wright gave such a powerful impress to a mind ripe for opportunity and formed for original investigation; the period of maturity when, succeeding his distinguished chief as professor of pathology at the Army Medical School, he brought all the experience and technical skill gained in collaboration with Wright to the building up of a great teaching department and to the direction of a team of research workers; and finally the War period when, assuming the administrative control of the growing laboratory organization of British forces in France and Flanders, he played the leading part in one of the most interesting periods in the history of British bacteriological and pathological science.

Leishman's first major success was his discovery in 1900 of the protozoan parasite (Leishmania) responsible for the disease known variously as kala-azar and chronic fever ("dum-dum fever"). Leishman made his great discovery in the following way: In 1900, Private B.,
pyrexia, anemia and enlargement of the spleen was admitted to Netley Hospital for investigation and treatment. Among other examinations, Leishman performed splenic puncture, stained the resulting specimen with his stain and saw an enormous number of heavily-stained round and oval bodies in the splenic cells and in the red blood cells. He searched the literature but could find no comparable finding, and he was nonplussed. Many months later he was examining the blood, liver, and spleen of a rat dead of trypanosomiasis; bodies identical in shape, size, and staining reaction to those found in the case of Private B. were unmistakably present [3].

In 1903, three years later, Leishman published a short note of his findings in the British Medical Journal [4]. As he delayed publication until 1903 he was forced to share his discovery with Captain Charles Donovan, who independently repeated his work and confirmed the findings in Madras [5]. Sir Ronald Ross\(^1\) the same year proposed that the bodies be called Leishman-Donovan bodies [6-9], and the parasite *Leishmania donovani*, and this nomenclature has been adopted throughout the world [10]. Thereafter Leishman made a number of other important discoveries in the field of tropical medicine.

Leishman’s discovery was mainly based on his famous stain. In 1901 Leishman published details of his modification of Romanowsky’s stain, now known universally as Leishman’s stain. What was wanted was some technique as easy and as reliable as the Ziehl-Nielsen stain for tubercle bacilli which could be applied in the ordinary course of clinical work. The older methods of staining malaria parasites demanded special skill. Leishman’s stain, though not fool-proof, could be used successfully by any careful medical man and the vast improvement of tropical diagnosis throughout the British army was a speedy testimony to its value [11, 12]. Leishman’s stain is a compound of methylene blue and eosin that soon became adopted as the standard stain for the detection of such protozoan parasites as *Plasmodium* (malaria parasite) in the blood. In the course of the following year, Leishman published in the British Medical Journal a “Note on a method of quantitatively estimating the phagocytic power of the leucocytes of the blood” [13]. This highly ingenious technique was at once appreciated at its true value by

\(^{1}\) Sir Ronald Ross, 1857-1932. Director, Ross Institute for Tropical Diseases, London, proved that malaria was carried by the anopheles mosquito.
Wright, who carried the investigation further and founded on it his conception of phagosomes and the phagocytic index.

These three original contributions to medical science, the Leishman’s stain, the phagocytic index and the discovery of the Leishman-Donovan Bodies constitute the first fruits of Leishman’s entry into pathology. There was more to follow. The greatest honours were yet to come and many of them were conferred in recognition of his outstanding contribution to the health of the soldiers in the Great War. In particular, he had worked for a decade to produce an effective vaccine against typhoid. Leishman also made major contributions to the development of various vaccines, particularly those used against typhoid. By 1896 Wright had developed a safe vaccine of killed typhoid bacilli, which he persuaded the Army to test during the Boer War (1899–1902). Wright, assisted by Semple and later by Leishman, became from 1896 onwards more and more engrossed with a study which promised to be of the greatest importance to the British army. The extent of the protection provided by the vaccine became a matter of violent controversy between Wright and the English statistician Karl Pearson; the Army Council therefore invited Leishman in 1904 to resolve the dispute. By 1909 Leishman was able to report that those inoculated in India carried a significantly smaller risk of dying from enteric complaints (5 died out of 10,378 vaccinated, compared with 46 out of the 8,936 not vaccinated) [14-17].

It was mainly as a result of this work, together with improvements introduced by Leishman in the actual quality of the vaccine, that a policy of mass vaccination was adopted in 1914. When war began in August 1914, 170,000 doses were issued to the troops. It is estimated that, without it, there would have been about 551,000 cases of typhoid and over 77,000 deaths. Following the mass vaccination, only 1,191 deaths due to typhoid were reported by the British Army throughout the whole of World War I. The value of Wright and Leishman's vaccine was finally confirmed under most rigid conditions in the British Guiana, where vaccination gave 75 % protection against the disease [18-20].

**Conclusions**

Lieut-General Sir William Boog Leishman is undoubtedly one of the most eminent and versatile personalities of the
British Medicine of the nineteenth century. Leishman’s findings changed the face of medicine. In particular, the introduction of Leishman’s stain, the discovery of Leishman-Donovan bodies as well as his work on the phagocytic power of leucocytes of the blood inaugurated a novel era in bacteriology and pathology. Moreover, his studies on typhoid vaccination made a great impact on the development of preventive medicine, completely changing the face of public hygiene during the 19th century. Not only did he earn a place in the history of medicine but he set an example as a modest, broad-minded, laborious pioneer in science and society.

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