

THE CENTENARY OF BRITISH MILITARY PATHOLOGY*

BY

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I HAVE used the term "pathology" in the widest sense to include all branches. We have listened for the past ten days to so many scientific discussions that I feel it would be appropriate to have a historical interlude.

Modern science has advanced so rapidly in recent years that certain branches of pathology have just grown up on insecure foundations. Sooner or later a time must come when pathologists will need to call a halt and take stock of their accomplishments, consider what was worth doing and plan for the future. So much good in the past has been forgotten and at times I am surprised about old discoveries which are being constantly rediscovered. I am convinced that when designing experiments, we do not pay sufficient attention to the accomplishments of past workers. I speak feelingly, because I have made this mistake in the past, and many valuable hours would not have been lost in redundant work, a loss of time which could have been prevented had I only read my subject widely enough and taken the trouble to design my experiments adequately.

On 27th April next year it will be a hundred years since pathologists were first appointed as such to the Medical Department of the British Army. I therefore feel that the British Military Pathology Service has now reached that stage of maturity in its existence when Army pathologists should stand back and take stock of what has been accomplished, consider what was worth doing, and plan for the future. Military pathology has indeed been built on firm foundations. Can any instructions be clearer or more definite than those given by the then Secretary for War, Lord Panmure, to Dr. Lyons and his two assistant pathologists, Dr. Aitken and Dr. Doyle, on their new appointment within the Medical Department of the Army with reference to the Pathological Researches about to be carried out in the hospitals attached to the Army in the East? I feel we should have much to gain by paying close attention to some of the injunctions. How many of us fail to remember Instruction No. 4.† "As morbid anatomy is of little value unless studied in connection with the history of the disease, you and your assistants will require to visit the Hospital wards in order to become acquainted with the symptoms and characters of the diseases during their progress; but you will not interfere with the treatment of the patients. In making notes of the cases, the name of the patient, and the number of his regiment, should always be stated, as by this means the nature of his duties, and the

* A lecture delivered at the Armed Forces Institute of Pathology, Washington, D.C., on 15th September, 1954.

† The text of the Instructions is reproduced at the end of this paper.

place where he was first attacked by disease can be more easily ascertained." Nowadays, there is a tendency for the young pathologist to seek a cloistered life in the laboratory, rarely if ever emerging to visit the wards. I should also like to draw your attention to Instruction No. 6. Even at that early date the importance of a microscopical examination is stressed in an era where little was known about the staining of tissues.

The findings of these pioneer Army pathologists were published in the form of a blue book of 120 pages, "The Report on the Pathology of Diseases of the Army in the East," signed jointly by Dr. R. D. Lyons and Dr. W. Aitken, and presented to Parliament in 1857 by order of the Secretary for War.

This report is a most interesting one and morbid anatomical findings are clearly described. What interested me particularly was a differential diagnosis of the different types of gangrene. A clear description is discernible of the condition we know as gas gangrene, though often called hospital gangrene. The differences between the typhoid and typhus fevers are stressed. From a perusal of the description of fatal dysentery cases, one can select those which are obviously of amœbic origin, although the causative origin was not then known.

There is also a catalogue of the specimens collected and sent to the museum of the then important Medical Centre at Fort Pitt, Chatham, which was the Headquarters and the Depot of the Army Medical Staff Corps. Some of these specimens still remain in excellent condition in the museum of the Royal Army Medical College at Millbank. There is an early reference to a museum at Fort Pitt in 1838, some of the specimens in which were said to surpass those in the British Museum.

The next important landmark in the history of pathology was the establishment of the Practical Army Medical School at Fort Pitt, Chatham, in October, 1860. This moved to Netley three years later. The importance of pathology was recognized by the War Office. Dr. W. Aitken was appointed the first Professor of Pathology—there were not many professors of pathology in Britain at that time. Professor Dible tells me the first was at Edinburgh in 1831. This appointment was certainly an apt tribute to the excellence of Dr. Aitken's work in the Crimea.

It is interesting to realize what great difficulties had to be overcome before the Army Medical School was established. Here, again, the Army Medical Service owes much to Florence Nightingale. The following extract, taken from her biography by Mrs. Woodham Smith, is illuminating and throws some interesting light on the gestation period of the college.

"Sidney Herbert had just had a demonstration of War Office power in the matter of the Army Medical School. Miss Nightingale had set out the necessity for an Army Medical School in *Notes on Matters affecting the Health, Efficiency and Hospital Administration of the British Army*. Young men were formerly sent to attend sick and wounded soldiers who *perhaps* had never dressed a serious wound . . . who certainly had never been instructed in the most ordinary sanitary knowledge, although one of their most important functions was

hereafter to be the prevention of diseases in climates and under circumstances where *prevention* is everything." The school was designed to provide training in military hygiene and military surgery. Miss Nightingale drew up the regulations in consultation with Sir James Clark, and the nomination of its professors was left entirely in her hands. The third of the four sub-Commissions which Sidney Herbert extracted from Lord Panmure was concerned solely with it.

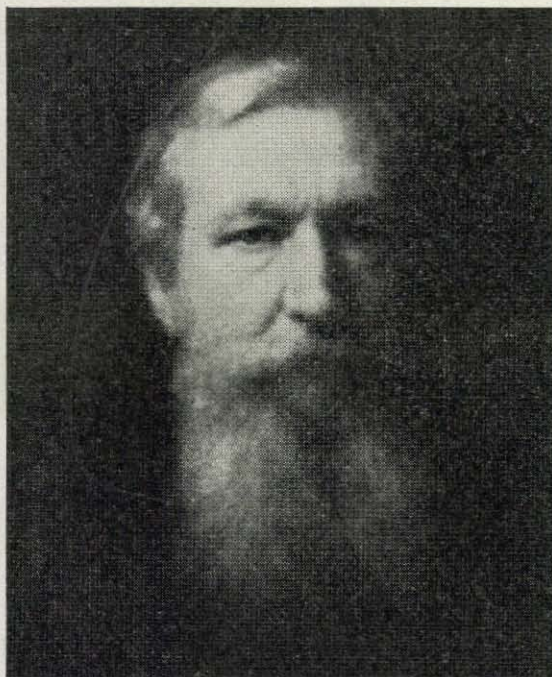
The nominations were made in 1857. Dr. Parkes, the great military sanitarian, was to be Professor of Hygiene and Dr. William Aitken, later Sir William Aitken, to be in charge. Panmure could not be got to the point of making the appointments; he would not actually appoint anyone "even if the Angel Gabriel had offered himself, St. Michael and all angels to fill the different chairs," wrote Sidney Herbert. Panmure went out of office and General Peel succeeded him, but still nothing was done. Then General Peel was succeeded by Sidney Herbert, who wrote that something should be done about the Army Medical School "at last." He converted nominations into appointments, but delay continued; the officials in the War Office were not yet defeated. Premises were selected at Fort Pitt, Chatham, yet work on them did not begin; the professors were appointed, but their salaries were not paid; requisitions were sent in for instruments and equipment, but they were not filled. Month added itself to month, it was a year, it was two years, it was nearly three years since the original authority for the establishment of the school had been given, and still nothing had been accomplished. In 1860 Sidney Herbert insisted on fixing a date for the opening of the school. Three letters sent by Miss Nightingale to Douglas Galton, in August of that year, relate what occurred. The first from Dr. Aitken, marked "Wail no. 1," states: "No work even begun." The second, also from Dr. Aitken, marked "Wail no. 2," states: "No money for instruments." The third from Miss Nightingale herself, dated 3rd September, 1860, marked "Wail no. 3," relates the "disaster of the opening day": "On Saturday I had a letter from the Professors of the Medical School quite desperate . . . the authority for the instruments and the money had not yet come. Ten of the students arrived. They stared at the bare walls and in the absence of all arrangements for their work concluded the school was a hoax."

Such were the foundations of the Army Medical College. The first stage in building up the Army Pathology Service may be considered to have coincided with the period 1860-1892, when William Aitken was the first Professor of Pathology.

This period also happens to be that of the development of the Army Medical Service; and the realization of the importance of and necessity for conserving manpower by the prevention of disease and the treatment and cure of the sick and wounded acted as the stimulus for research work which was to lead to the subsequent discoveries made in bacteriology, protozoology and immunology.

SIR WILLIAM AITKEN had a long and distinguished career. His appointment as first Professor of Pathology in October, 1860, was the outcome of the experience of the Crimean War, and one for which his early training and matured experience in the military hospitals of the East particularly fitted him and which

his subsequent career at Netley justified. He held the Chair of Pathology for thirty-two years until his death in April, 1892. It is said that as a teacher he was eminently successful in his method of imparting knowledge ; his reasoning was scientific and practical, his demonstrations lucid and convincing. William Aitken was elected a Fellow of the Royal Society in 1873, and knighted in the Queen's Jubilee Year, 1887. He made numerous contributions to pathology and medicine, and at that time was best known for his great work on the *Science and Practice of Medicine*, published in 1857, which reached seven editions, was



SIR WILLIAM AITKEN

for a long time the favourite textbook of students, and in its day the work most consulted by general practitioners throughout the kingdom and in every colony where English is the language of the people.

It is recorded that no pathologist of his time could conduct post-mortem examinations with more knowledge and dexterity. Netley men all over the world, particularly those who passed through the Army Medical School in the days of Sir William Aitken, well remembered his teaching.

It was thus natural that the interest of Army Medical Officers should be stimulated into research work by the father of military pathology, who made his influence felt on the rising generation of young Army pathologists who were to contribute so much to unravelling the mysteries of tropical diseases. It would indeed be difficult to over-estimate the influence of the Army Medical School

on the course of tropical pathology and medicine in the world at large through the work of Army pathologists like Bruce, Ross, Leishman, Semple, Cummins, Lewis, Boyd, and many others. The application of their work to the health of the soldier in peace and war must be an inspiration to all Army pathologists, irrespective of their nationality. The rewards were theirs in life, their work remains.

It is of interest to reflect on the remarkable achievements of the early pioneers of military pathology, when considering the magnitude of the research work carried out under difficult conditions with the limited laboratory facilities and equipment then available, and particularly the type of microscopes in use.

Effort in research tended to be somewhat more individual than it is today, though urgent problems such as those presented by the ravages of typhoid fever, Malta fever, and sleeping sickness called for a combined effort resulting in the formation of Commissions of the Royal Society to attack the problem and solve it. The South African War and two World Wars have profoundly influenced the advance of military pathology in a way no other circumstances could. New problems and diseases demanded new techniques and new methods for diagnosis.

After the death of Sir William Aitken, Surgeon (later Major-General Sir) David Bruce, who had been appointed Assistant Professor of Pathology in 1889, temporarily officiated as professor until Dr. (afterwards Sir) Almroth E. Wright, at the early age of thirty-one, was appointed second Professor of Pathology on 1st September, 1892.

The second stage, continuing until the outbreak of war in 1914, and perhaps the most glorious era in the history of military pathology, was now to follow—discovery succeeded discovery. Some of the more important of these can well be mentioned.

Anti-typhoid Vaccine

Early in 1893 Haffkine visited Netley and demonstrated his method of inoculation against cholera by injection of live cultures of the causative vibrio. It seems possible that this suggested to Wright and his co-workers the practical possibilities of anti-typhoid vaccination. After Bruce's departure for South Africa in 1894, Wright was joined by Semple, and in 1897 by Leishman on his return from India, to form the team which was largely responsible for the introduction of anti-typhoid vaccine into the Army.

In 1898 a trial of the vaccine was first instituted on a large scale in volunteers in the British Army in India. It is recorded that these volunteers had to be bachelors! In the following year, 30,000 men were inoculated against typhoid fever on board ship, the majority being *en route* for South Africa. I have noted from a photograph upstairs* that the first typhoid fever vaccine injection in the U.S. Army was given in this building in 1909! I don't know whether these volunteers were also bachelors.

Subsequent to the South African War, inoculation against typhoid was held

* A laboratory in the building of the Armed Forces Institute of Pathology.

in abeyance until the results of further experimental work were ascertained. The fact that further experiment and experience did lead to some improvement in the vaccine originally devised by Wright and Semple does not detract from their pioneer work. This further experimental work was carried out in the Pathology Department of the Royal Army Medical College in London by Leishman and others—Leishman had succeeded Wright as Professor of Pathology in 1903. This work was eventually successful in producing what was then accepted as statistical proof of the protective effect of the vaccine. With this, it was possible in 1909 to convince the Army authorities, both medical and military, that typhoid inoculation was a safe and successful procedure and permission was accordingly regranted for its general employment, but always on a voluntary basis.

The continuous and original research of many officers of the R.A.M.C. in India and elsewhere at this time contributed greatly to the advance in laboratory methods of diagnosis of enteric group infections.

Brucellosis

Malta fever was a serious drain on the manpower of the Army and Navy in Malta over a period of years. Military interest in Malta fever had begun many years earlier, an admirable clinical account, though one which makes no contribution to ætiology and pathology, by Assistant Surgeon J. A. Marston having been published in the Report of the Army Medical Department for 1863.

This interest is not to be wondered at when it is realized that the average duration of an attack is four months. Little advance had been made in the control of the disease since the discovery of the organism by Bruce in 1887, its method of entry into the body having defeated all attempts at solution. Wright and Semple of the Army Medical School by means of the agglutination test did much to demonstrate that the distribution of the disease extended widely beyond the confines of Malta and the Mediterranean, and to differentiate this infection from enteric, malaria and other specific fevers. But as late as 1904 no one had found the parasite in "external nature." There were various theories as to its mode of spread and at one time drinking water was blamed.

In 1904 a commission was appointed with Bruce as chairman, and in the following year the problem was solved by the discovery that the goat was a highly susceptible animal. Prior to this the goat had been presumed immune and in no way involved in the spread of the disease, as it had not been found possible to infect it with artificial cultures. Investigation showed that half the goats in Malta were infected and 5 per cent. of them had infected milk. This discovery enabled preventive measures to be taken.

Leishmaniasis

The finding of a new protozoon in the spleen of a soldier suffering from "Dum-dum fever" by Major W. B. Leishman, R.A.M.C., was one of the most interesting and important discoveries of the early twentieth century. One must

pay tribute to the keen observation which enabled Leishman to detect these minute bodies in the splenic pulp. There can be little doubt, too, that an excellent staining technique contributed to his success, because at this time he was working on the Romanowsky stains, and was to publish his note on his method of staining in the following year (1901). Leishman thought at first that these bodies might be fragmented nuclei of trypanosomes and did not place his observations on record till some three years later. Some time after, in the Army Medical School, Wright found Leishman-Donovan bodies in the lesions of "tropical ulcer," establishing the ætiology of this condition. It was not, however, until some years later that successful transmission of kala-azar by the bite of the sandfly was effected by the notable work of members of the Indian Medical Service. The sandfly had been incriminated on epidemiological grounds for many years as the transmitter of *Leishmania* infections, but it was only during the recent war that this was proved by workers in India, who successfully infected volunteers by sandflies which had been kept alive by a newly discovered method of feeding.

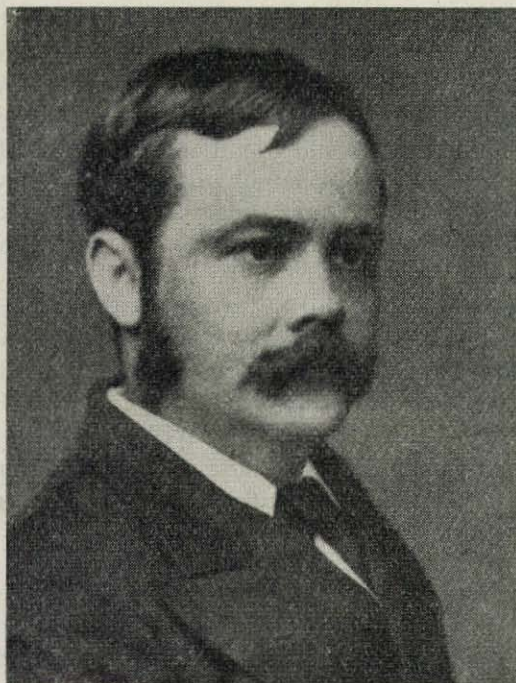
Sleeping Sickness

The following announcement appeared in the *London Gazette* of 18th December, 1903: "The undermentioned Lieut.-Colonel to be Brevet Colonel—David Bruce, F.R.S., M.B., R.A.M.C., in recognition of his services in investigating the cause of 'Sleeping Sickness' in Uganda, as well as in consideration of the distinction already attained by him in researches connected with Malta fever and tsetse-fly disease." This was the first brevet promotion to be awarded for distinction in original research. Our knowledge of medical trypanosomiasis dates back to the discovery of a trypanosome in the blood of rats by Surgeon-Major T. Lewis, F.R.S.-elect, in the 1870's. In 1903 Bruce joined the Commission on Sleeping Sickness already established in Entebbe, Uganda, and, with his work on tsetse-fly disease in cattle fresh in his mind, was quick to appreciate the significance of Castellani's discovery of a trypanosome in the cerebrospinal fluid of cases of sleeping sickness, seized upon it and pursued it in collaboration with Castellani, to whom Bruce was the first to give credit for the discovery of the parasite.

Other members of the R.A.M.C. working under Bruce at this time on the Sleeping Sickness Commission were Captains Hamerton and Bateman. We must also pay tribute to the memory of Lieutenant Forbes Tulloch, R.A.M.C., another member of the Commission, who was infected with trypanosomiasis in Uganda and died of a virulent form of sleeping sickness in London in June, 1906. Published works of the Commission included studies on the development of *T. gambiense* in *Glossina palpalis*, on trypanosomes found in the blood of wild animals, and on trypanosomes as a cause of disease in domestic animals. They found time, moreover, to study a disease of the native known as "mukinyo," which proved to be undulant fever, and a disease of cattle known as "amakabe," which was in fact the same as East Coast fever and was due to the presence of a piroplasma in the blood.

I have given you a brief résumé of some of the accomplishments of the Army Pathology Service before the first war, which I think you will agree are noteworthy achievements that have influenced the course of pathology and medicine. By the outbreak of the First World War we had advanced a long way from that date in 1855 when pathologists were first appointed to the British Army. What kind of men were these pioneers and early stalwarts of military pathology, who had made these advances?

As early as July, 1862, JOHN DAVY, M.D., F.R.S., Inspector-General of Army Hospitals, published a book entitled *On Some of the More Important*



SURGEON-MAJOR TIMOTHY RICHARDS LEWIS

Diseases of the Army, with Contributions to Pathology. In this interesting book are included chapters on the pathology of cholera, fevers, peritonitis, cellular inflammation and coagulation of the blood. Even at that early date the microscopic appearances of the blood corpuscles in yellow fever are discussed.

SURGEON-MAJOR TIMOTHY RICHARDS LEWIS was born at Crinow, Narberth, Pembrokeshire, on 31st October, 1841. After studying at first in London, he went to Aberdeen, where he proceeded to the M.B. and C.M. degrees of that University, graduating with honours in 1867. He joined the Army Medical Department in February, 1868, at the age of twenty-seven and passed first in order of merit into the Army Medical School at Netley, where he was later to have a close association with Sir William Aitken.

Lewis was sent to India in January, 1869, for special duty with the Sanitary Commissioner of the Government of India, and from that time until January, 1880, he was entirely occupied in investigating cholera and kindred inquiries. He published numerous papers dealing with leprosy in India, oriental sore, micro-organisms found in the blood of man and animals, a helminth (*Filaria sanguinis hominis*) in the blood. This was the first recorded instance of a nematode hæmatozoon having been found in man. When investigating flagellated organisms in the blood of animals he discovered in the blood of healthy rats a trypanosome which now bears his name, *Trypanosoma lewisi*. From his published description and drawings illustrating the macroscopic and microscopic pathological appearances of cutaneous Leishmaniasis (Delhi boil), I have little doubt that had Leishman's stain been then available to him, he might have discovered the causative protozoon many years before Leishman and Donovan. In 1883 he was appointed Assistant Professor of Pathology at Netley. On reaching Netley he found that his old friend and teacher, Professor Aitken, was seriously ill with nephritis, and at once took upon himself the whole of the duties of the Professor for that session, preparing the pathology lectures required for the surgeons on probation, in addition to conducting his own work in the "microscopical class."

Shortly before his death the value of his many years of patient and laborious work was recognized by the Council of the Royal Society, who recommended him for election as one of the Fellows for that year, and had he but lived a few weeks more, Lewis would have actually received this, the Blue Ribbon of Science. He died at the early age of forty-five on 7th May, 1886.

Lewis is described as being one of those men "who go on and on working and full of work and vigour for the Truth's sake"; and he imbued the minds of those he taught with this same keen love of work.

DR. (LATER SIR) ALMROTH E. WRIGHT was born on 10th August, 1861, in the Yorkshire village, Middleton Tyas. At the age of seventeen he entered Trinity College, Dublin, to study Modern Literature—he took his B.A. with first-class honours in 1882. While still reading for his Arts degree he enrolled in the Medical School, and a year after graduating in literature (1883) qualified in Medicine and Surgery.

In 1892, at the age of thirty-one, Dr. Almroth Wright succeeded Sir William Aitken to become the second Professor of Pathology at the Army Medical School at Netley, and there he came into contact with the men, "Wright's men" they have been called, who were later to become outstanding figures in the medical world. He held this appointment from 1892 until his resignation in 1902 to become pathologist to St. Mary's Hospital.

Prior to his appointment at Netley, Sir Almroth had worked in the Medical Research Laboratories of the Royal College of Physicians and had been Demonstrator of Pathology in the University of Cambridge as well as Professor of Physiology from 1889 to 1892 at the University of Sydney.

As mentioned previously, Haffkine visited the Army Medical School in 1893 to demonstrate his method of inoculation against cholera by the injection of

live cultures of the causative vibrio. The method of preparing the vaccine was later demonstrated to his class by Sir Almroth.

It is probable that this visit played an important part in suggesting to Wright and his co-workers the practical possibilities of antityphoid immunization, as it was at this time that he commenced his intensive work which led to the discovery of the all-important fact that killed typhoid bacteria are active immunizing agents.

The scale of his activities was wide and varied, comprising studies in typhoid, anthrax, tuberculosis, pneumonia, plague, cholera, and in microscopy, hæmorrhage and other subjects. His *Technique of the Teat and Capillary Glass Tube* is known to all laboratory workers, and there can be few medical officers who are not familiar with a Wright's capsule.

Almroth Wright was one of the great pioneers. His name will be linked with those of Pasteur, Koch, Ehrlich, and his own pupil, Fleming.

Wright's work which originated at the Army Medical School, Netley, has been of paramount importance to the Services. But he did more for the Army. Who can doubt that the impact of his personality on the young men embarking on a service career did much to determine the course of many of them in scientific medicine?

MAJOR-GENERAL SIR DAVID BRUCE was born in Australia on 29th May, 1855, just over a month after the first appointment of pathologists to the Army Medical Department. He came to Scotland as a child, and after leaving school worked in a warehouse before entering Edinburgh University, where he graduated M.B., C.M., in 1881. On 4th August, 1883, already a married man, he was appointed surgeon, A.M.S.

In 1884 he was posted in Malta, where his work on Malta fever led to his recognition of an organism named by him *Micrococcus* (now, in his honour, *Brucella*) *melitensis* as the causal agent [*Practitioner* (1887), 39, 161]. He also in 1884 carried out an inquiry into an outbreak of cholera, his report on which drew the favourable notice of the Government. He produced other papers on Malta fever, a clinical account being published in the *British Medical Journal* (1889), 1, 1101.

From 1889 to 1894 he was Assistant Professor of Pathology at Netley, under Aitken and Wright, where he continued his work on Malta fever and, after studying under Koch in Berlin, introduced in the Army Medical School the first course in systematic bacteriology to be given in an English Medical School. In 1894 he went to South Africa for seven years of science and soldiering.

He was seconded in 1895 for an expedition to Zululand to investigate Nagana, tsetse-fly disease then being thought to be a different condition. He demonstrated their identity, proved the causal organism was a trypanosome and its vector a fly of the genus *Glossina*. This was the first occasion on which insect transmission of the pathogenic protozoon had been proved.

He then reverted to duty and took part in the defence of Ladysmith, being promoted to Lieutenant-Colonel for his work there, and after its relief on 28th February, 1900, was made a member of a commission to investigate the

relationship between dysentery and enteric. The commission sat from 1900 to 1901, its report being presented to Parliament in 1902.

After his return to England in 1901, most of Bruce's service was spent in seconded employment. In 1903 he went to Uganda as a member of the Sleeping Sickness Commission, where with Aldo Castellani he demonstrated the pathogenicity of *Trypanosoma gambiense*, its transmission by *G. palpalis*, and the importance of game as a reservoir.

From 1904 to 1906 he was chairman of a Royal Society Commission inquiring into Malta fever; this commission, under Bruce's leadership, completed his work of twenty years before by showing the infectivity of goats' milk. Following Bruce's original discovery of the *Micrococcus melitensis*, Wright at Netley had developed a serum agglutination reaction for it which had led to the diagnosis of "Mediterranean fever" being made official in the Navy in 1897.

In 1908 he became chairman of the Sleeping Sickness Commission and in that capacity worked in Uganda from 1908 to 1910, and in Nyasaland from 1911 to 1914, investigating the connection between the parasitic vectors and diseases affecting game animals, stock and man.

Less well known is his work during the First World War, when as Commandant of the R.A.M. College (1914-1919) he served on the War Office Pathological Committee and on the Committee for the study of Tetanus and Trench Fever, and in the latter capacity was mainly responsible for the demonstration, by statistical methods, of the efficacy of prophylactic injections of antitetanic serum for the prevention of tetanus.

General Bruce retired in May, 1919, and died on 27th November, 1931.

His work on Malta fever and on trypanosomiasis needs no comment, though it must be given to few men to prove a causative agent of disease and demonstrate its complete cycle twenty well-filled years later. Bruce's work was his wife's also: she worked in his laboratory in every job he did, with the sole exception that while he fought in South Africa she nursed, but none of his scientific investigations was undertaken without her assistance.

I mention here, not in connection with Bruce's work but only as a means of bringing the fact to your notice, that Lady Bruce's first cousin, General Sir Walter Bedford, is credited with having designed the R.A.M.C. badge.

Bruce was a very human man, as can be gleaned from the following entry in his record of service: "Reported for using ungentlemanly language to the Railway Officials at Portsmouth Harbour, His Royal Highness the Field-Marshal Commander-in-Chief as a mark of his displeasure curtailed his leave to two months (he had been granted four)."

His imposing and commanding figure, his somewhat brusque and incisive manner, and his brilliant record will long be remembered. The work of Bruce was of world-wide interest and of lasting value in bacteriological research.

COLONEL SIR DAVID SEMPLE was born on 6th April, 1856; he qualified M.A., M.Ch., from Queen's College, Belfast, in 1881, and was commissioned Surgeon, Army Medical Staff, on 3rd February, 1883. He took the Cambridge D.P.H. in 1892 and in 1893 spent his leave in Cambridge studying bacteriology

under Sims Woodhead, the virtual founder of the Pathological Society of Great Britain and Ireland. In 1894 he was appointed Assistant Professor of Pathology at Netley under Almroth Wright in succession to David Bruce.

Here he continued the work Wright and Bruce had begun on anti-typhoid vaccines and on Malta fever, though with neither is his name strongly associated.

In 1899, on relinquishing his appointment at Netley and before leaving for India, Semple spent his leave in Paris studying anti-rabic treatment under Pasteur, and from this time his life's work really begins.

In 1900 he founded the Pasteur Institute at Kasauli, the first of its kind in the British Empire, which he directed until his retirement from the R.A.M.C., after twenty-two years' service, in 1905.

He then accepted service under the Government of India and at once, in 1905, founded and became first Director of the Central Research Institute, also in Kasauli. This was a logical continuation of his work at the Pasteur Institute, where in addition to production and trial of a carbolized dead vaccine for therapeutic use in cases of rabies, he had worked on vaccines against typhoid, diphtheria and tetanus, as well as on production of an anti-venene against cobra venom. The issue of this started in 1903 and was later augmented to protect against the bite of Russell's viper.

His first task (1905-1907) as Director of the Central Research Institute was the conduct of an inquiry into typhoid fever in India, with especial reference to the means by which the disease was contracted. His work pointed the importance of spread by convalescents and carriers and led to the establishment of convalescent camps for typhoid cases, to the implication of coolies and food-handlers as prime sources of infection, and to the introduction of serum-agglutination tests for their recognition and elimination. A great reduction in the disease in the Army soon resulted from the preventive measures adopted.

From 1909 to 1912 he was a member of the Central Committee for the Study of Malaria in India, and from 1911 to 1913 a member of the Advisory Committee on Medical Research in India.

In 1913, under Indian Government regulations, he retired on grounds of age, resigning his Directorship at Kasauli, and was immediately appointed, at the age of fifty-seven, Director-General of the Egyptian Public Health Department, an appointment which he held until 1918, doubling it between 1915 and 1918 with work as a Colonel A.M.S. for the British Army in Egypt, when he finally retired from public life.

Semple has no eponymous memorial, either written or builded. His greatest work was produced by the combination in him of a trained, disciplined, scientific outlook and an inspiring gift for leadership and administration of his contributions to medicine. First place must be given to his carbolized rabies vaccine, though his work on protective and therapeutic inoculations against enteric, diphtheria, snake bite and tetanus, mainly done as leader of a team, rank high for their value to the health of the British Army and as foundation stones for the work of others.

Sir David Semple died on 7th January, 1937, at the age of eighty. He was

of a very quiet and somewhat reserved nature, but a sound and reliable worker and a loyal colleague. His full worth was only known to a few who gained his confidence and had the privilege of his friendship.

LIEUTENANT-GENERAL SIR WILLIAM BOOG LEISHMAN was born in 1865, the son of the Professor of Midwifery in Glasgow. He qualified M.B., C.M., there in 1886 and was commissioned Surgeon A.M.S. in 1887. He served in India, 1890-1897. It is notable how many accounts of his life stress his having taken a microscope with him—an indication not only of their common absence from the baggage of medical officers, but also of their scarcity as items of military supply!

On his return to England he was posted to Netley for duty in the medical wards, and in 1899 he was appointed Assistant Professor to Wright in succession to David Semple. In 1903, on the move of the Army Medical School to London, he was selected to succeed Sir Almroth Wright as Professor of Pathology, a chair which he retained for nearly eleven years. This period from 1899 to 1913 was virtually his working life as a practising pathologist, as in October, 1914, he went to France as Adviser in Pathology to the D.M.S., B.E.F., and remained there until his return to the War Office in 1918 as Adviser to the D.G.A.M.S. In June, 1919, he became the first Director of Pathology and in July, 1923, D.G.A.M.S.

He died in office on 2nd June, 1926.

His principal contributions to medicine are three: the work on kala-azar, to which the devising of Leishman's stain was ancillary; his improvement of anti-typhoid vaccines; and his demonstration of the life cycle of *Borrelia duttoni* in the tick *Ornithodoros moubata*.

Chronologically, Leishman's stain comes first—the happy result of combining eosin and methylene blue rather than using them separately. An account of this work was published in 1901, but the stain was in use some time earlier, as it was the improved staining that it permitted which allowed his critical work on Leishman-Donovan bodies.

The latter he had found in 1900, not as an original observation, as they had been described though falsely interpreted at least twice before, the first occasion being by Cunningham in Delhi boil in 1885. Leishman's work was not published until 1903, almost simultaneously with that of Donovan, after he had noted the similarity of appearance between the parasites of trypanosomiasis in laboratory rats and those which he had found in human spleens in a number of cases of cachexial fever. He suggested that the human parasite (named *Leishmania* by Sir Ronald Ross in 1903) was an involuted form of the trypanosome. This combination of retentive memory application, coupled with imagination and refinement of technical method, seems to have been characteristic of all Leishman's work. It is illustrated again in his investigation of spirochætes, which began in an attempt to resolve, on morphological grounds, European from African species, with reference particularly to the organisms of syphilis, yaws and relapsing fever. This proved largely abortive, but in following up Dutton's work on the "granular phase" of *Borrelia duttoni*, he was able to

demonstrate the complete life cycle of this organism in *Ornithodoros moubata* (published 1909 with later papers in 1910 and 1911).

His third chief work was the improvement, so great that his obituaries, in 1926, referred to it still as "the perfection," of anti-typhoid vaccine. This research arose from the unfavourable reports on the vaccine in use during the South African War: it was a task for which his training under Wright fitted him well. The insight which led him to include paratyphoid organisms is well in keeping with his genius and his assiduity; and its results upon the health of the British and Allied Armies during the war of 1914-18 probably outweigh in value all his other work.

Lesser known investigations included "The Phagocytic Power of Blood" (1902)—strongly reminiscent of Almroth Wright; cell inclusions in blackwater fever; protective inoculation against influenza; investigations of tetanus and especially of tetanus antitoxin, and in his early Netley days diphtheria antiserum.

All this was his own personal research. In addition, he was during the same period teaching medical officers on first joining the R.A.M.C., and returning for the Senior Course, and it is clear that he did this uncommonly well. Every medical officer who joined the Corps between the outbreak of the South African War and the beginning of 1914 passed through his hands, and the uniformly high standard of attainment in his classes has been the subject of remark.

His obituary notices and recollections of him include references to his "lucidity of expression, charm of diction, disciplined imagination, and remarkable technical ability."

There remains only to consider his work in committee. He was an original member of the Medical Research Committee (later the Medical Research Council to which he was re-elected only a few months before he died); a member (1913-1915) of the Colonial Office Yellow Fever Commission; on the Scientific Advisory Committee of the British Empire Cancer Campaign; chairman of the Ministry of Agriculture's Foot and Mouth Disease Committee; and in strictly military circles, chairman of the War Office Committees on Trench Fever and Nephritis. These show a wide variety of informed interest.

With none of these has his name been specially linked in later years and his contributions to their deliberations are not now clearly discernible; it would, however, be out of keeping with the pathologist whose work still lives and with the administrator that as Director-General he showed himself to be, had they been insignificant.

The Science of Medicine and the Corps suffered an irreparable loss by the sudden death of Sir William Leishman. He died, while still in harness, from a gastric ulcer hæmorrhage. His disciplined imagination, intense love of truth, and tenacity of purpose enabled him to make discoveries which are known wherever the English language is spoken. His rewards and honours were many. His infinite tact, sane outlook and breadth of view enabled him to perform his duties as an administrator when Director-General with the greatest distinction. Such was the man who belonged to that small body of men who in little more than two decades built up what we know as modern Tropical Medicine.

THE ARMY PATHOLOGY SERVICE

It was during the period preceding the 1914-18 war that the importance to the Army of a well-organized Pathology Service in the diagnosis, prevention, and treatment of disease was gradually becoming recognized, and the training of regular pathologists had been proceeding steadily, so that the number available at the outbreak of war was more than enough to fill the few pathology posts authorized.

The First World War

In the next or third stage, the war of 1914-18, the building-up of the Army Pathology Service saw the development of three types of laboratories in use in the field: (1) mobile bacteriological laboratories; (2) hospital laboratories, and (3) research laboratories. The mobile laboratory was something entirely new as bacteriological investigations had never before been carried out so near the front line in any previous war. These laboratories performed a most useful function in the carrying out of routine clinical pathology, carrier tests and investigations into new and little-known forms of disease, such as trench fever, spirochætal fever, gas gangrene and trench nephritis.

Tetanus

The first anxiety in this war was the unexpected prevalence of tetanus and gas gangrene, and tetanus was one of the early problems faced by Colonel Sir William Leishman on his appointment to the Expeditionary Force in October, 1914, in an advisory capacity. The incidence of tetanus had been negligible in the South African and Russo-Japanese Wars and it suggested that tetanus was unlikely to be an element of great importance, but in this war there were approximately 2,500 cases as a result of the fighting in France and Belgium, and the incidence was greatest in the early days. Incidentally, the incidence of 8 per 1,000 during the early months of the war was an incidence similar to that recorded for the northern theatre in the Franco-German War from 1870 to 1871. Anxiety was great and the War Office appointed a committee under the chairmanship of Sir David Bruce to investigate the problem. Prompt administration of a prophylactic dose of tetanus antitoxin to all wounded men was responsible for reducing the incidence of tetanus to about 1 per 1,000. It was clearly shown that serum prophylaxis prevented the onset of tetanus completely in at least five out of six men. Bruce calculated that some two million doses were administered in England alone, and it is worth recording that there were only eleven cases of anaphylactic shock, and not one was fatal. The high value of passive prophylaxis would appear to be the outstanding fact in the history of tetanus in this war.

Gas Gangrene

The second early cause of anxiety was gas gangrene, which also had been negligible in South Africa. It soon obtruded itself in unpleasant fashion at the battles of the Marne and the Aisne, occurring in 10 to 12 per cent. of the

wounded. Its ætiology was then unknown, and it rather tended to be looked on as a "hospital infection" until the investigation of Sir Anthony Bowlby and Sydney Rowland in one of the new mobile bacteriological laboratories proved that the gangrene occurring among the wounded was a "traumatic infection" originating at the time of wounding, that it was due to the entry of an organism from the soil, and that it was in no way related to sloughing phagedæna or so-called "hospital gangrene." It was not, however, until 1918 that antitoxic sera were available for use in the British Army, and then they were limited in scope and not very potent in effect. An efficient method of manufacturing the highly potent polyvalent serum, available to us in such generous amount during the recent war, had not then been discovered. But as a result of the work done at this time it was established that most promise lay in the use of serum in prophylaxis, that the serum should be active against several organisms of the gas-gangrene group, that it should be given as a routine, and that in treatment serum must be regarded as an adjuvant and not a substitute for efficient surgery.

Wound Sepsis

The war of 1914-18 provided the first opportunity since the introduction of aseptic surgery of studying grossly contaminated wounds on a large scale. Suffice it to say that there were two distinct schools of thought, and much laboratory and clinical work was expended by both of them. One school placed its faith in "physiological" methods and rejected the use of antiseptics. Sir Almroth Wright was the protagonist of this school. Lorrain Smith and Dakin upheld the second school which trusted more in germicides of one kind or another.

Other Investigations

Investigations were also carried out into wound shock, enteric group infections, bacillary dysentery, amœbic dysentery, typhus, trench fever, Weil's disease, and cerebrospinal fever. Army Medical Officers were awarded D.S.Os. for bravery when dealing with typhus fever in prisoner-of-war camps in Austria.

In 1916 paratyphoid A and B were added to the typhoid vaccine. This caused a marked reduction in the incidence of paratyphoid fever.

Chemical Warfare

One is apt to overlook the important part pathologists took in solving problems leading to adequate defensive measures being taken to protect men against this weapon of mass destruction. Their work determined the pathological effects of the chemical agents in use and, working together with physiologists, they were able to determine the mode of their action, and to advise on the best lines of treatment. This led to pathologists becoming advisers on the medical aspects of chemical warfare, a position they have retained since that time.

The Inter-War Years, 1919-1939.

The next stage is that of the inter-war years, when the pathology service was well established and pathologists had to undertake certain administrative duties. The war of 1914-18 had demonstrated the necessity for central direction

of pathology in the Army. Experimental procedures carried out in the preceding sixty-three years had become standardized. What were previously experimental procedures in immunology had now been accepted as routine practice. It was evident that in addition to purely laboratory work, military pathologists would have to undertake certain administrative duties connected with the prevention of disease. There was also a need to co-ordinate and supervise the training of pathologists and technicians. The Pathology Directorate was formed at the War Office in 1919, and Sir William Leishman, who had been adviser first in France and later at the War Office, was appointed first Director of Pathology. In the same year the Army Pathology Advisory Committee came into being—the chairman being the Director of Pathology. The function of this Committee was to advise the Director-General on all aspects of pathology and concern itself with fundamental inquiries into the origin and prevention of disease, rather than with work of a routine nature in connection with any one special condition. One of the original members was Professor Mervyn Gordon, best known for his work on cerebrospinal fever in the First World War. He died in 1953 at the age of eighty-one. This remarkable pathologist never missed one of the seventy meetings held during his lifetime—a truly remarkable feat.

The Director of Pathology is represented by senior administrative pathologists in all home and overseas commands—Assistant Directors of Pathology. These pathologists are in charge of the principal laboratory of the Command and are also advisers to the Director or Deputy Director of Medical Services in all matters pertaining to pathology. These officers are also responsible for supervising the training of pathologists and technicians.

During this period a great deal was done in reconstructing and building laboratories both at home and overseas—particularly in India, where the laboratories were of excellent construction and good design. Research work continued. Brigadier J. S. K. Boyd's classical work in India and the work of others on the dysentery bacilli placed our knowledge of the group on a firm basis. This work demonstrated the inadequacy of the previous system of classification and enabled a new and more scientific classification to be made.

Pathologists were closely associated with physicians in carrying out investigations which established the value of two drugs introduced by the Germans—plasmoquin and atebriin—in the treatment and prophylaxis of malaria. These findings were to be of inestimable value for the campaigns in the Far East in the war of 1939-45.

Military pathologists collaborated with the research work which led Colonel Shortt of the I.M.S. to establish the virus origin of *Sandfly fever*.

Two other important advances were made during this period: One, the value of selected virulent typhoid strains in vaccine production was demonstrated at the R.A.M. College by Lieutenant-Colonel (later Major-General) H. M. Perry and his co-workers. This was the result of a series of investigations carried out when the typhoid component of the vaccine—the Rawlings strain—which had been employed since 1900, came under suspicion a few years prior to 1934. The second was the development of tetanus prophylaxis by the use of tetanus toxoid.

Tests on dosage and the optimum interval which should elapse between doses were carried out by Brigadier J. S. K. Boyd at the R.A.M. College. Immunization prior to proceeding on active service was adopted and there is little doubt that this active immunization was responsible for the low incidence of tetanus in the Second World War.

The War of 1939-45.

On the outbreak of war, a well-developed and efficient pathology service was in being. An adequate number of senior pathologists with administrative experience was available to co-ordinate and supervise the activities of the pathology service, which was greatly expanded by our civilian confrères. A special research organization was also established. Teams were formed from this organization as and when essential to investigate special problems. Laboratory facilities and equipment were provided on an as-required basis. Central laboratories with special consultants and facilities for research were established in all theatres of operations.

The Army Blood Transfusion Service under the direction of Sir Lionel Whitby will probably rank as an example of outstanding achievement in the Second World War. From small beginnings the Service developed into an enormous organization—blood transfusion from being a procedure confined to hospital practice was introduced to front-line units and given anywhere. New products were made, new methods introduced and new units formed to function in the great expansion of this service.

The Second World War is relatively recent, and the research work carried out by both U.S. and British Army pathologists, often working in collaboration, is so well known that it is unnecessary to do more than briefly refer to some of the problems investigated.

Penicillin research was well organized and co-ordinated between surgeons, pathologists and technicians; there must have been scarcely any laboratories at home or abroad in which the pathologist did not devote such time as he could spare at the bench to the practical study of penicillin in all its aspects. Their investigations form the basis of modern antibiotic therapy.

Research teams were formed to study shock, typhus, anærobic infection, influenza, infective hepatitis, effects of heat, effects of immunization, diphtheria, and bacillary dysentery.

In *India* there was a remarkable expansion of the pathology service from a total of 27 laboratories in 1938 to a total of over 120 laboratories all over India and Burma. The volume of research work carried out was great. Valuable new information was obtained about nutritional anemia and sprue; the effects of malnutrition on repatriated prisoners of war and scrub typhus were among the host of subjects investigated.

I do not think that there is any doubt about the success and efficiency of the pathology service in the Second World War. Pathologists often carried out their investigations under conditions and with limited resources very reminiscent of the early pioneers.

I have been asked to say a few words about the Royal Army Medical College, where Army pathologists are trained. I have already mentioned that this College was first established at Fort Pitt, Chatham, in 1860 and moved to Netley, near Southampton, in 1863, where it remained until 1903, when it was transferred to London and occupied the present site in 1905. It is situated to the west side of the Tate Gallery, the military hospital being situated on the east side. There are fine laboratories for all departments and facilities available for research. Prior to the Second World War, vaccine production was carried out, but on the outbreak of war this department moved to the David Bruce Laboratories in the country (then called the Emergency Vaccine Laboratory). The College also houses a fine library. Attached to the College is the R.A.M.C. Headquarter Mess, which has also sleeping accommodation for some eighty officers. One of the most impressive rooms is the Victoria Cross Room. Here there is a painting of every Medical Officer who has won the highest British award for bravery under fire. The Medical Corps has won this decoration on thirty-one occasions, including two double V.C.s., the highest number in any corps or regiment—all won for saving life and very often awarded posthumously. It is a record we are very proud of.

The Post Second World War Period

In conclusion, I should like to say that this last decade of the century is in the post Second World War period, which I hope will not be another inter-war period. We have gone a long way in this 100 years, but I feel that the prime object of Service pathologists must always be, as it was, to assist in the prevention of disease and the treatment and care of the sick and wounded. It is not possible to comment at present on any accomplishments of this last decade. These must await the judgment of the future. One event of importance did, however, occur. At the end of 1947 service in India for the R.A.M.C. came to an end, and service pathologists have lost a valuable training ground.

The advent of weapons of mass destruction will only increase the responsibilities of pathologists and raise more problems which will, I am sure, be faced with the same success as in the past. But I should like to remind you that the capabilities of any pathologist are directly related to his technical background. I therefore in conclusion make a plea for pathologists not to become super-specialized in a narrow branch of the subject before they have an adequate background of medicine and pathology in all its branches. Let us take as our example the pattern of the work of the early pioneers.

ACKNOWLEDGMENTS

I must acknowledge the information obtained from obituaries in the *Lancet*, *British Medical Journal* and the *Journal of the Royal Army Medical Corps*, and, in addition to the references quoted in the text, to the following:

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APPENDIX

WAR OFFICE,
April 27, 1855.

SIR,

I am directed by Lord Panmure to transmit herewith, for your guidance, a Copy of the Instructions which have been drawn up with reference to the Pathological Researches about to be made by you in the Hospitals attached to the Army in the East.

I have the honour to be,

Sir,

Your most obedient Servant,

(Signed) B. HAWES.

DR. LYONS,
&c., &c.

INSTRUCTIONS TO DR. LYONS

1. You will proceed without delay to Scutari, and report yourself, on your arrival, to the Commandant, Lord William Paulet, who will be apprised of the objects of your mission, and instructed to place you in communication with the principal Medical Officers of the Hospitals at Scutari.

2. You will have the entire and uncontrolled direction of the *post-mortem* researches on the bodies consigned to you for examination ; but you will be required to demonstrate the Morbid Appearances discovered to such of the Medical Officers as may feel disposed to attend. In order that these gentlemen may have the full advantage of your Pathological researches, you will arrange with the principal Medical Officer of the Hospital as to the time which will be most convenient to the Medical Officers to attend your demonstrations.

3. You will have under your directions two able Assistants (one First, and one Second), and both accustomed to and versed in the operations of the dead house.

4. As Morbid Anatomy is of little value unless studied in connection with the history of the disease, you and your Assistants will require to visit the Hospital wards in order to become acquainted with the symptoms and characters of the diseases

during their progress ; but you will not interfere with the treatment of the patients. In making notes of the cases, the name of the patient, and the number of his regiment, should always be stated, as by this means the nature of his duties, and the place where he was first attacked by disease can be more easily ascertained.

5. The Medical Officers of the Hospitals will be instructed by the principal Medical Officers to afford you every facility in visiting the wards ; and it is hoped that they will be able to supply you with notes of the symptoms and progress of the more urgent cases.

6. It is expected that you will not content yourself with the simple dissection of the subject, and the demonstration of the morbid parts, but that you will submit them to microscopical examination.

7. As you are provided with all the appliances necessary for your researches, it is expected that you will take full advantage of the opportunities which present themselves to prosecute your inquiries in this direction to the fullest extent ; and as you are also provided with the means of preserving such specimens of disease as you may deem necessary for the illustration of your researches, you will naturally avail yourself of them, and take the necessary steps for having them transported to England.

8. Although in all probability you will find at Scutari ample opportunities of completing your Pathological observations, you are not to confine yourself entirely to the Hospitals in that place ; should the information which you receive from reliable sources lead you to believe that more favourable opportunities present themselves in the Hospitals at Kululee, or elsewhere, on the Bosphorus, you may use your own discretion in transferring your researches, for a time, to such Hospitals, acquainting the Commandant of your intention, and the Superintendent of the Hospital you propose to visit.

9. With the view of rendering your researches more complete, it is desirable that you should observe the nature of the diseases of the Russian prisoners ; and it would further be desirable that you should visit the French Hospitals and ascertain the results of the researches of the French physicians in the diseases of their sick.

10. If, after having completed your researches in the Hospitals on the Bosphorus, you should be of opinion that you might acquire additional information, to render your researches more complete and useful, by observing the character and effects of the diseases prevalent in their earlier stages and more acute forms in the Crimea, you are at liberty to apply to Lord William Paulet for a passage for yourself and one or both of your Assistants and labourers to Balaclava ; upon obtaining his approval, you will, upon your arrival, report yourself and explain the object of your mission to the Head of the Medical Department of the Army in the Crimea.

11. Should your health unfortunately suffer so as to render you unable to continue your researches, you are to commit the charge of carrying them out to your first Assistant, giving him these instructions as his guide : and if he should require further assistance, application may be made to the principal Medical Officer at Scutari, or elsewhere, for such assistance, or to the Superintendent of any of the Civil Hospitals in the East.

12. In the event of either or both of your Assistants being unable, from sickness, to render you the assistance you require for the successful prosecution of your researches, you are to apply to the principal Medical Officer of the Hospital where

you may be for one or more assistants, or to the Superintendent of the Civil Hospitals in the East.

13. If, unfortunately, both yourself and your senior Assistant should be attacked by sickness, the circumstances should be immediately communicated to the principal Medical Officer at Scutari or elsewhere, or to Dr. Parkes, Superintendent of the Civil Hospital on the Bosphorus, who has one Assistant Physician at least capable of carrying out the Pathological researches on which you will be engaged.

14. As the office to which you are appointed is new in the Medical Department of the Army, it is possible, although not probable, that some difficulties may arise in the prosecution of your researches. If, by your own prudence and conciliatory conduct, you fail to overcome any such difficulties, you will apply to the Commandant of the Hospital at Scutari or elsewhere; and should he not afford you the support which you require, you will report the circumstances to the Secretary of State for the War Department with as little delay as possible. You will, however, under any circumstances report, from time to time, to the Secretary of State for the War Department the progress made in your researches.

15. When you shall have completed these researches, you will draw up a full report thereof, for the information of the Secretary of State for the War Department, to whom it should be addressed.

16. Although not strictly limited to time, it is presumed that a period of about four months will be sufficient to enable you to accomplish the object of your mission; as soon as you have so accomplished it, you will return to England without delay, in order to present the report of your researches to the War Department, it being important that no time should be lost in making known this report, as it may be the means of elucidating the nature of the diseases affecting the Army in the East.

17. On application to the Commandant at Scutari, a passage will be afforded you in one of the first Government vessels returning to England; and immediately on your arrival you will report the same to the Secretary of State for the War Department.

18. Should one or both of your Assistants desire to remain in the East, and should it prove that his or their services are required, the Superintendent of the Civil Hospitals will be authorized to employ his or their services, if he should think fit to do so. If, on the contrary, either or both should prefer returning to England with you, a passage will be afforded to him or them on application to the Commandant. The same option, with the approval of the principal Medical Officer, or Superintendent of any Civil Hospital, may be given to your two English porters, if willing to take the duties of orderlies; or if it be found that they can otherwise usefully be employed.

(Signed) PANMURE.

LONDON,
April 27, 1855.