Obituary.

MAJOR-GENERAL SIR DAVID BRUCE, K.C.B., F.R.S.

SIR DAVID BRUCE was one of the greatest of the great physicians who deal less in healing of the sick than in the conquest and abolition of disease; he died of a dread disease on Nov. 27, in the seventy-seventh year of his age. His one fear had lately been lest his wife, the comrade of fifty arduous years, should be left helpless, but her release from suffering came four days before his own.

Born in Melbourne (on May 29, 1855) but brought home to Scotland at five years old, Bruce went to Stirling High School, and was sent out into the world, by way of a Manchester warehouse, at the age of fourteen. There he worked for about three years, during which time his wish was to become a professional boxer or footballer, an ambition which those can understand who remember his great figure and his prodigious strength when he was young. About the year 1876–77 he came to the University of Edinburgh and began to study medicine; soon afterwards he was foremost in a little band of friends, of whom Diarmid Noel Paton the physiologist was one, and another helps to-day to write these words. We worked together, fifty-three years ago, at the same table in Turner's old dissecting-room, the ways and appurtenances of which had scarcely changed in two hundred years; and then stepped across the street to see Lister turn up the cuffs of his black frock-coat, and operate under the spray.

Immediately after graduating, Bruce joined the Army Medical Service in 1883, and in the same year he married Mary Elizabeth Steele, a doctor's daughter, of Reigate. The marriage was singularly fortunate. Mary Bruce was a rare helpmeet, tireless and fearless, ready at any moment to follow her husband across the world: growing more and more skilled in all the delicate manipulations of bacteriology, and possessed of no little scientific insight and acumen of her own. Bruce was never tired of praising her, of acknowledging her help, of testifying to her knowledge and ability. Almost his last words were to remind a friend that the story of his own life was never to be told without full credit being paid to Mary for her part therein.

Bruce was a fervid admirer of Pasteur, all his life long. It was Pasteur's example which he followed steadily, to make of medicine "an experimental biological science", and to arrive at "the intelligent, purposive prevention of disease". Pasteur's epoch-making work was already something of an old story when Bruce was a student; but another great epoch was just beginning, with Laveran's discovery of the malaria parasite in the blood corpuscles, and with Koch's discovery of the tubercle bacillus.

In Bruce's presidential address to the British Association at Toronto—an address which seemed to relate every salient fact of modern medicine within the brief compass of an hour—he tells how one day in 1882, in Edinburgh, he heard of Koch's great discovery from a fellow-student just home from Germany. So revolutionary an idea was hard to believe at first; but Bruce sketches the interest and excitement it aroused, in which he shared to the full. The excitement continued: for within two years more the bacilli of glanders, diphtheria, typhoid, and cholera had all been discovered in Koch's laboratory. By this time, in 1884, Bruce—an Army surgeon and a married man—was at work in Malta; and so well did he follow Koch's and Pasteur's example that by 1886 he had discovered *Micrococcus* (now *Brucella*) *melitensis*, and proved it to be the actual cause of Malta (or Mediterranean) fever. This was a cardinal discovery. The bacteriologist of to-day, with his well-stocked laboratory and the experience of fifty years behind him, may well pay tribute to Bruce's splendid insight, which let him see how, by cultivation of a micro-organism from a patient's blood, evidence could be got of the direct relation between the organism and the disease. Bruce went straight to the root of the matter; and his method of blood-culture, a commonplace of to-day, was a pioneer procedure then. The work was done against almost insuperable technical difficulties; the observations were repeated again and yet again. At last, after many disappointments and set-backs, Bruce succeeded in reproducing the disease among his experimental animals.

The discovery of the causal agent of a communicable disease often helps but little towards the finding of means for its prevention; but in this case Bruce's indomitable energy had its ultimate reward. For seventeen years after the discovery of *M. melitensis*, Malta fever continued to prevail. "Almost every sailor who came into hospital even for the most trivial complaint took Malta fever, and after a long illness had to be invalided home." At last the Admiralty and the War Office took alarm, and Bruce was sent out again by the Royal Society, in 1904, at the head of a Commission. After months of hard and disappointing work, Dr. Zammit, a Maltese colleague, happened to examine the blood of a goat—an animal which had been already and repeatedly found immune to the disease; but now it turned out that the goat's blood 'agglutinated' or 'clumped' the micrococcus—a fact which Bruce took to mean that the organism must have been living and multiplying within the apparently healthy goat before this peculiar property of its blood could be brought about. Work went on with new hope and energy; fifty per cent of the island goats were found to carry the micrococcus, and a fifth part of these were actually passing it into their milk. Maltese milk was at once struck out of the dietary; and "from that day to this", said Bruce, "there has scarcely been a case of Malta fever in the garrison. The disease had been blotted out at a single blow." This conquest of Malta fever is one of the greatest, most unequivocal successes of preventive medicine.

In 1894, Bruce began his long study of the

trypanosomes; and the story of his investigation of these, and of the diseases of man and beast which are associated with them, is the chief story of his life. In 1895, a severe epidemic of nagana among the native cattle of northern Zululand was reported to the Natal government. Bruce happened to be stationed in Natal, and Sir W. Hely-Hutchinson, the governor, a wise and friendly man, put the task of investigation into his hands. So Bruce and Mary started off on their long trek by ox-wagon to the scene of the outbreak; and the first thing they did was to discover trypanosomes in the blood of the infected animals. Bruce was a first-class naturalist; he had learned the art of outdoor observation on the Ochils as a schoolboy, and on the Grampians in his college years; and his next step, after discovering trypanosomes in the infected blood, was the work of the naturalist rather than of the physician. There happened to be a 'fly-belt' hard by Bruce's camp, between the high ground and the sea; and Bruce, knowing (as every Scotch boy did) all that David Livingstone had to tell about the tsetse fly, took it into his head to see what actually happened when a beast was bitten by the fly. Natives were told to drive their cattle into the fly-belt, and when they came home it was with no little surprise that Bruce found the blood of the fly-struck animals to contain the nagana parasite. But the natural history of the case was not yet all told. The next thing was to seek and to find the same trypanosome living, but living harmlessly, in the wild game of the country—in antelope and buffaloes, which had become, like the Maltese goats, immune to the disease. Bruce had to do all this work with the most primitive appliances; but he surmounted every difficulty. At last, not only was the specific trypanosome (*T. brucei*) of nagana discovered and its relation to the disease established, but the precise way in which *Glossina morsitans* propagated the disease was made clear. This was the first demonstration of the transmission by an insect of any protozoal disease. It won for Bruce his fellowship of the Royal Society in 1899.

It had needed keen insight and a wide outlook to discern how the wild game of the region might act as a reservoir of infection; and it took a deal of hard work to prove that it did so. Later on, when Bruce came to study sleeping sickness in mankind, the lesson so learned of the possibility, or probability, of the malady lurking continually among the huge herds of wild animals must have seemed to him, lover of animals as he was, an appalling problem.

In 1903, not long after the Boer War was over, Bruce, together with his wife and Dr. David Nabarro, went out to Uganda (again at the instance of the Royal Society) to continue and extend Castellani's work on sleeping sickness, done in the year before. The needful clues were now all in Bruce's hand. He knew that trypanosomes had been found in the cerebro-spinal fluid of sufferers from the disease; and his experience told him that the infection was most likely due to a blood-sucking fly, probably to one of the *Glossina* species. How he showed that the area occupied by *Gl. palpalis* and that infested by sleeping sickness were one and the same, is a romance of science.

Bruce was walking through the forest paths one day with the king of the country, telling him about the fly and its effects, and explaining how useful it would be to know just where the fly lived and how far its range extended. The king listened with great attention, then whispered to his viziers, who in turn slipped one by one from the pathway into the bush. Here on either side, silent and unseen, were the king's attendant messengers; and before Bruce had come to an end of his story these men had set off to all parts of the country, with the king's command that the tsetse flies should be sought for, and brought in from wheresoever they should be found. It was a triumph of organisation, and the dusky king shares the credit with the investigator; it was also a complete scientific success. The remarkable fact had already been discovered that the disease kept to the islands and to a narrow belt of country by the shore of the lake; in no part of Uganda were cases found more than a few miles from the lake shore. It was now shown that the distribution of the disease was identical with that of the tsetse fly, where there was no fly, there was no sleeping sickness.

Bruce came home in the autumn of the same year, 1903, but went out to Uganda again five years later, in order to work at the life of the parasite within its insect-host. He found out, among other things—and it must have been a sad disappointment to him—that many animals can harbour *Trypanosoma gambiense* over long periods: a fact which could only mean that the prevention of sleeping sickness was a well-nigh insoluble problem. He found also that *Gl. palpalis* was the insect-host, or 'vector', not only of *Tr. gambiense*, but also of sundry other trypanosomes besides; and his careful descriptions of these species, and their varying behaviour within the insect-host, were very helpful to the next workers in the field. His last work on this subject was done in Nyasaland, between 1911 and 1914, as head of a commission on trypanosome infections of man and animals in that territory. He came to the conclusion that the human trypanosome of Nyasaland was not identical with *T. brucei* though its vector was *Gl. morsitans*. It is perhaps still an open question whether this trypanosome (commonly called *Tr. rhodesiense*) and *T. gambiense* may not both of them be mere varieties of Bruce's own nagana trypanosome, *T. brucei*. Bruce showed often in his later talk how glad he would have been to go out once more, to solve this final problem.

There is far more to tell of Bruce's great and crowded life than can be told here. Happening to be in Ladysmith during the siege, he turned his hand to surgery, with conspicuous success; and with such love and devotion did he sometimes speak of this part of his life that one felt that a great surgeon had perhaps been lost to make a still greater scientist. His wife became a nurse at the same time, and stood beside her husband in his tireless labours; she earned the Royal Red Cross thereby.

Soon after the beginning of the War in 1914, tetanus made its appearance among the wounded, in so alarming a way that no time had to be lost in grappling with the danger; among many thousand wounded (however slight their injuries might be) some 9 or 10 per cent were attacked by tetanus, and no less than 85 per cent of all those affected died. A committee was appointed in haste, with Bruce at its head; and this committee made the crucial discovery that if the appropriate serum (Kitasato's famous *antitoxin*) be administered *at once*, the wound will lead to no lockjaw symptoms. As Bruce put it, there were 2500 cases of lockjaw in the British Army during the War, and 550 deaths; there would have been 25,000 cases and 20,000 deaths, had matters been allowed to go on as they were during the first months of the War, without the prophylactic serum injections.

During the War, Bruce was Commandant of the Royal Medical College, where his knowledge and immense experience were put to good use in controlling the many varied and even divergent activities of that place. He became chairman of a War Office Committee on Trench Fever, as he had been before of that on tetanus; and once more his driving power and his own industry helped and hastened the investigation. Doubtless a large part of the work was done in this case by others; but the success was just as complete as in the other cases where Bruce worked alone. It was amply proved that the louse, and the louse alone, was to blame for spreading the disease; and (as Bruce said in his Toronto address) this meant that very soon trench fever would have been abolished on the western front. In 1917 it had been the cause of some 20,000 out of a total of 100,000 admissions to hospital in the British Second Army alone.

Besides his scientific work, Bruce played many lesser but important parts. He was president of the Physiological Section of the British Association at the South African meeting in 1905, and president of the Association at Toronto in 1924. He was president of the Royal Society of Tropical Medicine from 1917 to 1919; editor of the *Journal of the R.A.M.C.* from 1904 to 1908; Croonian lecturer at the College of Physicians in 1915; and chairman of the governing body of the Lister Institute from 1916 until his death. Honours came to him in their course, and he wore them proudly, as a soldier should; but at heart he was always the humble student, and the untiring friend and helper of younger men.

Bruce's scientific imagination and intuition were as fine as the simplicity of his heart. He had had little of what we understand by laboratory teaching, little or no apprenticeship to research, in Edinburgh fifty years ago; but he had Lister's great example constantly before him, and Pasteur's to think of, and Koch's to learn of later on. He needed no more than these, and his own brains, to enable him to attack the problems which presently faced him, with all the skilled assurance of a master-hand. He had the gift which belongs to the greatest of scientific men, the true Faraday gift, of putting plain questions to Nature, never two at one time, and always such as she can answer in simple words. His imagination kept him always one step ahead of his observations; his judgment told him where that step should lie; energy spurred him on, and the shrewdest commonsense held him back from unsafe conclusions. He took no regard of riches, he was contented to be poor; but his face was set like flint towards his one ambition, the victory over disease.

Those who knew Bruce best found him stern but most lovable, *sans peur et sans reproche*. His heart went out to all those in sorrow, need, or sickness. He closed his Toronto address with solemn words: "We are all children of one Father. The advance of our knowledge of disease is not for the benefit of one country but for all—for the lonely African native, deserted by his tribe, dying of sleeping sickness in the jungle, or the Indian or Chinese coolie dying miserably of beri-beri, just as much as for the citizens of our own towns."

"It is the duty of science", he said (it was his own rule of life), "to go steadily forward, illuminating the dark places in hope of happier times." He never turned aside or knew discouragement. "On, on, and no regrets", was a phrase he often used; it had been his own watchword, and he passed it on, to be a warning and an encouragement to men who had their lives to live.

Bruce died poor and sorely stricken; he had had his troubles and perplexities withal. But he had also (like Greatheart in the story) had the golden hours when great things happen; and they had brought him the supreme reward of triumphant and beneficent discovery.

D. W. T.
W. J. T.

THOUGH David Bruce, whose recent death removes from the field of tropical medical research one of its most brilliant investigators, made discoveries of the utmost importance in connexion with Malta fever, for which he was elected a fellow of the Royal Society in 1899, his name will ever be associated with Africa, that dark continent where mysterious and dread diseases of both man and animals had brought ruin to expeditions of explorers and loss of hope and too often death to those attempting its development. Malaria and blackwater fever, yellow fever and sleeping sickness took their toll of human lives, while tsetse fly disease or nagana and other obscure maladies wrought havoc amongst the domestic stocks, frequently wiping out in a few days the entire animal transport of some luckless adventurer. It is for his work on two of these diseases, nagana and sleeping sickness, that David Bruce attained his world-wide reputation.

Having been sent to South Africa in 1894 from the post of assistant professor of pathology at Netley, Bruce was requested by the Governor of Natal in 1895 to proceed to Zululand to investigate an outbreak of nagana amongst the cattle. Arriving at Umbobo after an arduous journey, any weaker man would have regarded the usual wattle and daub hut provided for living-room and laboratory as quite inadequate accommodation; not so David Bruce, who, with his courageous and gifted