The stool had been passed about one hour before the first examination. A second cover-slip preparation was therefore made one hour later. The stool, which was faintly alkaline to litmus paper, was covered by a cloth between the two examinations; the temperature of the laboratory was 80° F. and the atmosphere was moist, so that the general conditions would appear to have been favourable to survival.

The change seen in the second preparation was startling. In place of swarms of lively protozoa there were a very few sluggishly moving parasites rolling to and fro in one spot, as described above. Amongst the red blood corpuscles were numerous small clear areas. Some of these contained the whole or part of the ectoplasm of a protozoon, enclosing some refractile granules, while the remainder were empty of all visible contents, but, judging from their size, may have been filled with perfectly clear protoplasm from disintegrated protozoa.

It seems then that one of the reasons why infection by Balantidium coli is not found more commonly may be the difficulty of microscopical diagnosis due to the very rapid breaking up of the vegetative forms. On the other hand it is possible that these were adversely affected in this case by the unusually large quantity of blood present, the result presumably of the erosion of a vessel in an ulcer.

The patient, an Indian grass cutter, denied any association with pigs, but his occupation would appear to have exposed him to the possibility of infection from their droppings.

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**Echoes of the Past.**

**THE ARMY MEDICAL SERVICE IN INDIA, 1840-53.**

By Lieutenant-Colonel G. A. KEMPTHORNE, D.S.O.,
Royal Army Medical Corps.

_(Continued from p. 238.)_

**THE GWALIOR WAR OF 1843.**

This war, the result of a dispute about the succession, was decided in two battles fought simultaneously at Maharajpur and Panniar on December 29, by two columns led by Sir Hugh Gough, the Commander-in-Chief in Bengal, and Sir John Grey respectively. In the first the Mahrattas put up a stiff fight, our casualties being eight per cent, half of which were borne by the 39th and 40th regiments. Superintending Surgeon Andrew Wood and Field Surgeon Alexander Chalmers of the Company's service were mentioned in Sir Hugh Gough's despatches, and also Assistant Surgeon Stephens of the 63rd, on the Commander-in-Chief's staff. Stephens we may be sure well earned this distinction,
if only for the fact that the Governor-General and a party of ladies were present as Sir Hugh's guests. The elephants which carried the ladies came at one time under heavy fire, and the ladies got out of hand. As the honour "Maharajpore" or "Panniar" is borne by five British regiments, the names of the regimental medical officers engaged may be recorded so far as they have been ascertained. Maharajpore: 16th Lancers, Samuel Currie, Charles A. Gordon; 39th (1st Dorsets),1 Charles H. James; 40th (1st S. Lancs.), James McAndrew, Henry Mapleton, John H. Brummell. Panniar: 9th Lancers, Arthur Wood, W. G. L. Staunton; Buffs, Robert Stevenson, John A. Bostock; 50th (R. West Kent), Jas. Davidson.

THE FIRST SIKH WAR, 1845.

The death of Ranjit Singh in 1839 left the Punjab in a state of anarchy, with a powerful and well-trained army ready to engage in any enterprise where loot could be acquired. The menace to the peace of British India was clear, but to avoid precipitation of hostilities by a too obvious

1 Their Surgeon, Robert Starke, M.D., died of cholera at Agra during the concentration.
concentration, our troops were kept somewhat widely dispersed along the frontier.

When in December, 1845, the Sikh army crossed the Sutlej and invaded our territory, there were small garrisons at Ludhiana and Ferozepore, but the nearest assemblage of any considerable body of troops was at Ambala. Ferozepore was at once partially invested, and Sir Hugh Gough, the Commander-in-Chief in India, set out for its relief. Lord Hardinge, the Governor-General, accompanied the Army, which, in spite of the great difficulty in collecting transport at short notice, was hurried forward by forced marches. Having accomplished 100 miles in five days, the force reached the village of Mudki, about twenty miles from Ferozepore, on December 18. Stragglers had been numerous, and both British and Indian troops were much exhausted. The number of doolies attached to each of the Queen’s regiments should have been seventy-five, but these were very deficient. One unit secured twenty-four, only half of which came in at the end of the march.

In accordance with custom, the Medical Board detailed a Superintending Surgeon and a Field Surgeon of the Company’s establishment to accompany the Army, but all arrangements were made difficult by the failure to form any depot of medical or surgical stores within easy reach of the threatened point. In the first two engagements of the war there were neither instruments nor material to form a field hospital, other than those carried by the regimental surgeons.

On the evening of the 18th the Sikhs attacked in force. The country, which was dead level, was covered with confused jungle. After an hour’s hard fighting, a general advance was made and the enemy retired. The number engaged on our side was 16,700. There were 872 casualties, 506 of whom were Europeans. Sir Robert Sale was mortally wounded. Assistant Surgeon Alexander Graydon of the 50th, who received a bullet wound of the abdomen, died after removal from the field.

After the engagement the wounded and stores were left at Mudki with a guard of Indian troops, while the rest pushed on towards Ferozshah, a village about nine miles from Ferozepore, where the Sikhs had fortified a position. The Superintending and Field Surgeons remained behind. No written orders were issued even to the divisional commanders. “The Army was one unwieldy battalion under one C.O. who had not been granted the power of ubiquity.”1 On the afternoon of the 21st, Gough’s army, 16,500 strong, found itself in the presence of the enemy and an immediate assault was ordered. There was a most obstinate resistance. When darkness fell only a corner of the entrenchment had been secured, all reserves had been thrown in, and the situation of the Army on a flat plain swept by the medium artillery of the Sikhs was precarious. The men passed the night without food or water under constant fire; the

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1 Autobiography of Sir Harry Smith.
wounded lay on the ground uncollected. In the morning the line was reformed and the position carried. The fight had lasted thirty-six hours.

The aspect of the battle and its sequel from the point of view of a regimental medical officer is described in a private letter received and sent to the *Lancet* by George Guthrie, the great surgeon.

"December, 1845. I have just brought in the wounded of our regiment to this station [Ferozepore] where there is a commissariat and some accommodation. They are 175 in number. I am here single-handed, the regiment being encamped about four miles off. The labour I have undergone has been excessive. I am one of four, three of whom are absent. One claimed the sanitary depot, a second was left at Kassowlee, a third is in camp with the regiment, and I am here alone. How can I be expected to practise scientific surgery surrounded by 175 wounded men all clamouring and beseeching for assistance? I have no time to do anything satisfactorily. I have, however, managed to do four amputations to-day, and dressed the greater number of serious cases, including two amputations I brought off the field, and am weary of the bloody work. We had in the field with us a quantity of water, some brandy, wax candles, and a fair proportion of medical and surgical stores, and followed close in rear of the regiment till the men began to drop around us chiefly with horrible wounds from cannon shot which the enemy fired with wonderful rapidity. We halted under a tree, the only shelter to be had, the country being a sandy plain as level as a table, and the hospital soon became a dreadful scene of mangled bodies. The men of the band brought in the wounded, and we were getting on well when a great misfortune befell us. I do not know, nor can I believe, that ours was the only field hospital of the division, but certain it is we were soon besieged by wounded from every corps. Cavalry and artillery came galloping in and carried off our dhoolies. When it was discovered we had water there was an end of all order. We could only save one small vessel full by placing it in charge of a sentry with a loaded musket. When it became dark we lighted our candles, but we had scarcely done so when an order came to put them out or the Sikhs would be down on us. Shortly after this we were told to join the regiment, but in the dark no one could tell where it was. It was said to be on the right, but by sad mischance we wandered down to the Sikh camp, when the enemy began to fire on us. We all made off as fast as we could, the dhoolie-bearers throwing down their loads, which ended our hospital establishment. We could not with our deficient means carry off the wounded from our field hospital, and we saw many poor fellows lying near the entrenchment we could not remove."

Our losses were 700 killed and 1,720 wounded, of whom far the greater proportion were Europeans. The 62nd lost half their strength. Assistant Surgeon R. B. Gahan of the 9th was wounded on the second day, and died after amputation of the thigh. Dr. Hoffmeister, surgeon to Prince Waldemar of Prussia, was shot through the head. Surgeon W. L.
McGregor of the Bengal European Regiment, in his description of the battle, also comments on the absence of any medical organization. The walking wounded tried to make their way back to Ferozepore, where several arrived on the evening of the 22nd. A panic started among the camp followers at one period of the battle, and practically all the doolie bearers threw down their loads and bolted. The Commissariat Officers at Ferozepore, by the most commendable exertions, managed to collect fresh bearers, elephants, and bullock carts, by which the wounded were eventually got in to the entrenched camp at the cantonment. On the morning of the 23rd some of the regimental surgeons having returned from the field, they were moved into the barracks of the 23rd regiment. Here they were by the personal exertions of the Governor-General, provided with every comfort possible, and by his orders a commissary was detailed to attend to their feeding. Meanwhile the P.M.O. appears to have been still at Mudki. The enemy recrossed the river, and our troops advanced another five miles. Diarrhoea was prevalent, ascribed to the contamination of the wells at Ferozshah with gunpowder. The horrible taste of the water and its ill-effects may equally well have been due to excess of natural salts, a common enough phenomenon in the surface water of the district.

During the first weeks of January the Commander-in-Chief was awaiting reinforcements and heavy artillery, and no move was made. Towards the end of the month the Sikhs began to threaten our communications at Ludhiana, and Sir Harry Smith was despatched with a part of the force to effect a junction with the garrison. Crossing the front of the enemy’s army at Buddiwal on the 21st, a considerable part of the transport was lost, and the wounded from the engagement, with whom was Assistant Surgeon R. Banon of the 62nd, fell into the hands of the Sikhs. It is feared that most of the wounded were murdered. Banon, after much maltreatment was eventually released and lived to become a Deputy Inspector-General. On January 28, Sir Harry Smith, with 12,000 men, attacked the enemy’s camp at Aliwal, and drove the Sikhs over the river with heavy casualties. The official despatch states that “owing to the judicious arrangements of Dr. Murray, Field Surgeon, every wounded officer and soldier was placed under cover and provided for soon after dark; and to the zeal displayed by this able and persevering medical officer and to the several regimental surgeons are the wounded and our country deeply indebted.” The following day a hospital was opened at Ludhiana.

Meanwhile the main body of the Sikh army was entrenching itself on both sides of the Sutlej round Hariki and Sobraon. The heavy guns having arrived, the position on the south bank was carried on February 10 after an intensive bombardment. Our losses in a force of 17,000 were 320 killed and 2,063 wounded. The medical arrangements appear to have been satisfactory. Dr. B. W. Macleod, the Superintending Surgeon, Field Surgeon Graham and the Medical Department generally were thanked in despatches, as well as Assistant Surgeon J. E. Stephens, who accompanied
Sir Hugh Gough into action, always a risky proceeding, and Dr. Walker, the Governor-General's personal surgeon, of whom it was remarked that "his ability is only to be equaled by his zeal and humanity."

This was the last battle of the war. The wounded were removed to Ferozepore, whence they were transferred later to convalescent depots at Meerut, Landour and Sabathu. Men with amputation stumps were sent down the river for transfer to England.

Speaking of the surgery of the campaign, Surgeon McGregor says, "The necessity for promptitude [in amputation] was well exemplified by what occurred in some regiments, where hardly an amputation succeeded when performed at a late period. In all engagements, in India at least, the sooner a limb is lost after it has been wounded, the greater will be the chance of success. Hence the necessity for a field hospital is an important point which will not, it is hoped, be overlooked in future wars." Regarding the work of the regimental surgeon during an action, he wrote, "In whatever situation a battle may take place in India the duty of the regimental surgeon is to be with the wounded, no matter whether they be in the field or at a depot near at hand, until all capital operations are performed." He deprecated the view, apparently held by some commanding officers, that the surgeon should leave this work to an assistant rather than fall behind the regiment.

In India up to this time there was no surgical staff to supplement the regimental establishment other than the Superintending and Field Surgeon. The former was both administrative medical officer and consultant, the latter controlled the field hospital, if one was formed, under the Superintending Surgeon's orders, and did major operations, assisted by such junior regimental officers as could be spared. The system did not allow for two engagements fought within three days of each other in different localities. The muddle at Ferozshah, where neither Superintending Surgeon nor Field Surgeon were within twenty miles of the action, was resented at home, and in the next campaign an Inspector General was appointed for the Queen's troops.

Except that the staff was usually inadequate and overworked, the field general hospitals were well run, and the treatment received by the wounded at the hands of the Company's surgeons was beyond criticism. Sir Herbert Edwardes, who, as a subaltern, was wounded at Mudki, testified to the comfort and cleanliness of the field general hospital and the good attention he received from both surgeons and subordinates. It is probably correct to say that our field hospitals throughout the nineteenth century were the envy of all other nations. The hospitals criticized by Dr. Russell at Scutari, in 1854, and by Sir Garnet Wolseley in 1882, were field hospitals overcrowded through no fault of the doctors, and expected, with their limited

1 W. L. McGregor. "History of the Sikhs."
resources, to perform the rôle of the present-day general hospital. Comfortable base hospitals were no doubt gradually evolved as the war proceeded, and also in many of our wars from the Peninsula onwards, but to send them out specially equipped beforehand is a comparatively modern development.

**Medical Officers, British Service, First Sikh War.**


**The Second Sikh War, 1848-49.**

After the Sutlej campaign a brigade of British troops was stationed at Lahore, but there was no real settlement of the Punjab. The second Sikh war commenced with the murder of two of our political officers at Multan, the investment of the town by General Whish and a temporary withdrawal on account of the defection of the Sikh auxiliaries under Sher Singh, who were supposed to be co-operating. Multan was eventually assaulted and occupied on January 29, 1849, our casualties in a force of 15,000 being 210 killed and 928 wounded. The General stated in his despatch that "Superintending Surgeon T. E. Dempster had uniformly and successfully applied his talents and assiduity to the promotion of the health and comfort of the sick and wounded, and been ably supported by the medical officers of every corps and department." Meanwhile Sir Hugh Gough had engaged the Sikh army, now openly hostile, at Ramnagar (November 21) and Sadulapur (December 3), after which he crossed the Chenab, and on January 13 fought one of the most stubborn fights in the history of the British army at Chilianwala. Our losses in a force of 12,000 were 731 killed and 1,446 wounded, by far the greater proportion of the casualties were among the European regiments. The action terminated at night, and was indecisive. Owing to the absence of water and supplies our men were withdrawn after the battle, but not before every wounded man had been collected. The night was one of incessant labour to the surgeons, and the rain descended in torrents. On the morning following the dead were piled on camels and carried to the rear, where the officers were laid in one trench and the men in another. Besides Dr. Charles Renny, the Superintending Surgeon and Dr. J. Macrae, the Field Surgeon, a Deputy Inspector, H. Franklin, was present as Inspector of Hospitals for the Queen's troops. Though the
regimental dressing stations came under fire there were no casualties among medical officers. A field hospital was formed sufficiently close up to be temporarily thrown into disorder by the unfortunate retrograde movement of Pope's cavalry brigade, which rode through it and upset several of the doolies.

The Queen's and the Company's troops appear to have had separate field hospitals during the Punjab campaign. Of the work done by the British field hospital there is, unfortunately, no record. A report was published on that of the Indian army, showing that it was well provided. The staff comprised a field surgeon, storekeeper and 13 assistant surgeons, all commissioned officers; 2 uncovenanted physicians, a sub-assistant surgeon, 2 apothecaries, 3 stewards, 10 hospital apprentices, 6 native doctors and 2 hospital sergeants. This hospital received no more than 504 surgical cases. Of these 284 were Europeans.

The war ended with a decisive victory at Gujrat on February 21. The good services of Renny, Franklin, and Macrae were referred to in despatches. Franklin was among the first batch of army surgeons to receive the C.B. in 1850.

There was no adverse criticism of the medical arrangements during the war. Some of the lessons of the Sutlej campaign were evidently applied, and with good results.

Medical Officers, British Service, Second Sikh War.

Inspector of Hospitals: Deputy Inspector Henry Franklin.

The Second Burmese War, 1852-53.

The Burmese war of 1824 with its phenomenal death-roll was one of the most costly, worst thought out, and worst found expeditions ever undertaken by the Government of India. The campaign of 1852, fought under much the same exhausting conditions of damp heat, amid tropical jungles and swamps, claimed inevitably many victims from disease; but, in the arrangements made for the maintenance of the Army, we can note a definitely increasing appreciation of sanitary problems, and some genuine and well-directed effort towards their solution. Credit for this was due

1 *Lancet*, December 14, 1850.
to Sir John Godwin, the Army Commander, but also to Lord Dalhousie, the Governor-General, who maintained throughout a keen personal interest in the men’s welfare.

The first expedition had been started during the rains, with the idea that the increased depth of the Irrawaddy would facilitate navigation. The expeditionary force of 1852 was timed to arrive before Rangoon at the beginning of April, six weeks before the monsoon broke. The rations were good, a large stock of cattle was procured to allow of the issue of fresh meat; and wooden huts in sections were sent over from Moulmein in which to house the troops. The problem of clothing was unfortunately not dealt with. The tight coatees and leather stocks, which had proved so conducive to ill-health in China, were retained. Lord Wolseley mentions in his “Story of a Soldier’s Life” that the officers of the 80th wore their tight shell jackets and forage caps; some head protection was afforded,
however, by winding pugri cloth round. Their trousers were of Indian drill dyed blue. At this time the Company’s officers had begun to adopt helmets, which were much envied, but it was a point of honour with the Queen’s regiments to look European.

The original force consisted of about 6,000 men, of whom nearly half were British. A complete and efficient field hospital under Dr. William Montgomerie, the Company’s Superintending Surgeon, was embarked on the hospital ship “Tubal Cane,” for which, in addition to a subordinate staff, five assistant surgeons were detailed. On arrival, a convalescent hospital was at once established in Amherst, a healthy site across the bay. Steamers were used in this expedition, and the Royal Navy took an active part in the proceedings. Judging from the experience of the 51st (1st K.O.Y.L.I.), the arrangements for sea transport were still primitive. Though the weather was fair, their twelve days’ voyage from Madras in the Company’s steam frigate “Feroze” was most uncomfortable. “Both officers and men were restricted to the upper gun deck, which had not always even the protection of an awning from the intense heat of the sun by day and dew by night. All had to lie down where they stood with only their great-coats for cover. The paddle-boxes were covered with native followers, and such was the crowded state of the decks that the crew were almost unable to pass about the vessel.” There was a death from cholera but, providentially, the disease did not spread.

Sir Joseph Fayrer, one of the staff of the field hospital, has left some of his impressions of the war. The hospital ship having arrived at the mouth of the Irrawaddy, was towed towards Rangoon by H.M.S. “Hermes,” and after a bombardment from the river the troops and the field hospital were put on shore. The fortifications of the town were carried on April 14, with a loss of 17 killed and 132 wounded. It was the hottest month of the year, and there were numerous casualties from heat stroke; two officers died from its effects on the field. “Here and there were to be seen on the ground for the advance, to the left of the White House stockade (the enemy’s main position), the medical officers and their subordinates administering relief by pouring water over the patients.” That night the 51st bivouacked among the burning ruins of the town surrounded by heaps of dead bodies, the stench from which was intolerable. Upwards of fifty men were seized with cholera, of whom forty-two died before morning.

The field hospital was by this time established in a temple. All the sick and wounded were collected at this spot. Assistant Surgeon Fayrer, who was the senior medical officer of the staff, appears not only to have run it very efficiently, but to have fully maintained the dignity of his

1 H.M. 18th, 51st, and 80th Regiments, the 40th Bengal N.I., 4 battalions Madras N.I., 5 companies of Artillery, and 2 of Madras Sappers and Miners.
2 Wheater. “Record of the Services of the 51st.”
3 W. Laurie. “Our Burmese Wars.”
position. Having administered a severe snub to the Brigade Major, who ventured to interrupt when he was making representation to the Brigadier, and gained his point, he was next called upon to receive the Army Commander, a veteran in a wig, whom he handled with no less success. "As it happened," he states, "there was no commissioned officer to receive the General when he arrived. When I got to the steps, he was talking to a subordinate medical officer. On hearing who I was, he turned angrily to me and said, 'There is no one to receive me,' and added something about neglect of duty. I was indignant, and told him there was no neglect of duty; we had worked very hard, and, it seemed to me, satisfactorily. One of my brother officers was sick; of the others, one was in the native hospital and one engaged on some important duty. He said no more then, and we proceeded round the hospital. The sick and wounded, considering the circumstances, were wonderfully comfortable, but we were badly off for clothing. Noting one man whose shirt looked dirty, he said, 'This man has a very dirty shirt. Why is it?' I replied, 'Because, sir, the commissariat is so ill-provided that I have difficulty in getting what is necessary for the wounded. There are no flannel shirts to be had; I am glad you noticed this.' He immediately turned round and said, 'God bless my soul, sir, I am extremely obliged to you for telling me this; I will have some flannel shirts sent.' I had supposed myself in his bad books, but he was a fine gallant old soldier, and very just, though hot-tempered. On leaving he embraced me, much to my surprise. I added, 'I am much obliged to you, my dear sir, for all your kindness to my sick and wounded.'"

A period of inaction followed the capture of Rangoon, during which there was much dysentery and malaria. Bassein and Pegu were occupied, but lack of land transport much impeded the progress of the campaign. This was eventually made good by the importation of elephants from Assam. River transport was frequently available for the part evacuation of casualties, in which the somewhat primitive steamers played a useful part. Otherwise doolies were the regular form of conveyance.

In September the Army was augmented to a strength of 20,000, the reinforcements including the 84th regiment and the Bengal and Madras Europeans. A series of operations was carried out with varying success under trying conditions. The most arduous of these was a campaign of twenty-four days through swamp and dense forest by a mixed force of 1,150 men under Brigadier-General Sir John Cheape against the stronghold of a chief named Myat-Toun. The casualties were 230, of which 100 were due to cholera. Fighting ceased in the spring of 1853, when the whole of Southern Burma passed into our hands.

No official statistics of the loss from sickness in the war were published. The battle casualties were by no means heavy. Of the Royal Irish, 16 other ranks were killed; and 349 died of disease, giving a sick mortality of something like 169 per 1,000 per annum. The deaths from all causes in the 51st were 7 officers and 333 other ranks.
The following served as regimental medical officers in the second Burmese War: 18th (Royal Irish), James Stewart, J. H. Dwyer, W. K. Chalmers; 51st (1st Kings Own Yorkshire L.I.), G. S. Beatson, Thomas Crawford, G. C. Meikleham; 80th (2nd S. Staffordshire), M. W. Murphy (wounded), J. R. Taylor, B. Lane; 81st (2nd Loyal N. Lances), G. Auchinleck.

George Beatson was P.M.O., India, 1863-68. Sir Thomas Crawford was Director-General of the Army Medical Department 1882-89. Sir Joseph Fayrer, of the Hon. East India Company's service, who in later life attained almost every possible distinction within his reach, commenced his Army career as an officer of the British Ordnance Medical Department. He died in 1907.

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**Current Literature.**


Mr. Elsby stated that in no industry manufacturing or using finely divided silica is the atmosphere completely free from silica dust, and maintained that the weakness of all legislation concerning dust collection lies in the fact that no limiting concentration of silica dust in the atmosphere has been specified.

This omission seriously handicaps both the factory inspector and the manufacturer in deciding what are satisfactory working conditions.

Mr. Elsby discussed in some detail recent work carried out in America by A. E. Russell and co-workers, which had been published in *U.S. Public Health Bulletin* No. 187, and which leads to a permissible dust standard of 10,000,000 particles of granite dust per cubic foot of air being proposed. As this dust contained 30 to 40 per cent silica in the form of quartz, the limiting concentration calculated in terms of 100 per cent silica of particle size less than 10 μ and correctly estimated, would be 3,000,000 particles per cubic foot of air; a figure which can be obtained in industry if correctly designed plant is installed and maintained.

The determination of the amount of silica dust in the atmosphere is a matter of some difficulty and the Impinger method described in *U.S. Public Health Bulletin* No. 144, was advocated in preference to Dr. Owen's Dust Counter, owing to the advantages of chemical analysis of the dust collected, of more accurate dust counting, and greater efficiency at high concentrations.

Whilst the correct designs of hoods and ducts are now well known, it was pointed out that allowance must be made for loss in air velocity between the source of dust and the hood, an all important point which is too frequently missed.

Failure of dust-collection systems was generally due to the installation of unsuitable dust-collectors. The cyclone collector was recommended in