

DOCTORS OF THE MINES

Electronic Copy by David W. Stanton
Version: 1.0 December 2003



Major-General A. J. Orenstein, C.B., C.M.G., C.B.E., LL.D., D.Sc., M.D., F.R.C.P., F.R.S.H., the sole surviving member of the group of doctors who founded the Mine Medical Officers' Association in 1921.

DOCTORS OF THE MINES

*A commemorative volume published in 1971
to mark the 50th anniversary of the
founding of the Mine Medical
Officers' Association of
South Africa*



*With a History of the Work of
Mine Medical Officers*

by

A. P. CARTWRIGHT



PURNELL

CAPE TOWN

JOHANNESBURG

LONDON

NEW YORK

PUBLISHED BY PURNELL AND SONS (S.A.) PTY., LTD.,
KEEROM STREET, CAPE TOWN

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SBN 360 00110 6

FILM SET IN 12 PT. ON 13 PT. MONOTYPE BASKERVILLE
PRINTED AND BOUND IN SOUTH AFRICA
BY THE RUSTICA PRESS, PTY. LTD., WYNBERG, CAPE

Foreword

This is a history of the Mine Medical Officers' Association of South Africa, a body founded fifty years ago to serve as the representative organization of the group of medical practitioners whose task it is to watch over the health of that great army of Bantu men—at present 400 000 strong—who do the manual labour in South African mines. In the early days of these mines the health organization was sketchy. White miners had, and still have, their own sickness benefit organizations with the usual provision for medical attendance. The African workers were looked after by part-time 'mine doctors' who carried on their private practices at the same time and often acted as government district surgeons as well.

No one will be surprised to learn that this system proved unsatisfactory. The time came when the mining companies appointed full-time medical officers whose whole duty was to attend to the African mineworkers. This was rapidly to bring about a spectacular improvement in the health and clinical care of the men.

In 1921 some of the doctors who had been appointed to do this work felt the need for a body that would meet regularly for an exchange of views, publish its proceedings and, if it were necessary, speak for all of them on matters where they thought their views should be heard. Thus was founded, under the aegis of the old Transvaal Chamber of Mines, the Transvaal Mine Medical Officers' Association, its original title.

This history is published to mark the 50th anniversary of the founding of the Association. However, it must be emphasized that the history of this body is essentially the record of the work of the individual members in the conservation of health and the treatment of the sick and injured of the largest congregated body in the world of primitive, illiterate workers.

For convenience of presentation of this record the latter part of the book is divided into chapters headed, for example, 'Pneumonia', 'Tuberculosis', etc.

But it is emphasized that this is not for the purpose of discussing the diseases or injuries but to present the problems with which the mine medical officer is faced in dealing with each of these and to record the means evolved or adopted to solve them.

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As there are persons who mend garments, so there are physicians who heal the sick; but your duty is far nobler and one befitting a great man—to keep people in health.—XENOPHON.

PART I

**A HISTORY OF
THE ASSOCIATION**

A History of the Association

Almost 100 years have elapsed since South Africa's first payable goldfield was discovered. In the intervening years new discoveries, a higher price for refined gold and improved mining methods have increased the output to the point where 77 per cent of the free world's annual production of gold now comes from South African mines.

But gold is not won easily in South Africa. To produce bullion worth R780-million every year the mines have to crush 80-million tons of rock a year, much of it hauled to the surface from great depths.

This calls for an immense labour force. The mining companies now employ some 40 000 white men and more than 400 000 unskilled Bantu mineworkers. This army of Bantu is drawn not only from the tribes of South Africa but also from Lesotho, Botswana, Malawi, Swaziland and Mozambique.

It is the mining companies' responsibility to house these men, feed them and look after their health. This system of supervision and care began at the end of the nineteenth century.

However, it must be remembered that gold-mining in South Africa got under way a comparatively short time—some twenty years—after the end of the Crimean War. In those days ideas on the housing of soldiers, labourers and orphans were primitive in the extreme.

In South Africa reforms began with the early acceptance by mining companies of their responsibility for and the vital importance of the health of their workers in ensuring the success of their operations. There were really never enough Bantu mineworkers to meet the demand. The size of the gold output, therefore, came to depend on the willingness of the men to work and their physical fitness to do so.

Thus the health services soon became an integral part of the system and they have been expanding and improving for the past sixty years. The health of the Bantu mineworker became almost an obsession with the mining

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companies. World-renowned specialists from Britain, among them Sir Almroth Wright, the bacteriologist, were brought to Johannesburg to investigate the high mortality rate of men brought into contact with pneumonia for the first time. Surgeon-General W. C. Gorgas, the hero of Panama, who won the Nobel Prize for his work on yellow fever, was asked to report on the health services as far back as 1913. His comments led to sweeping changes.

The South African Institute for Medical Research, initiated and largely financed by the Transvaal Chamber of Mines, was established in 1913 and has since done invaluable work in medical research and producing vaccines, much of this work being of great value in maintaining the health of the mineworkers, in the prevention of certain diseases and in therapy, all described in this book.

Today, while the white inhabitants of some of the bigger cities clamour for improved hospital services, many of the most up-to-date hospitals in the country have been built to serve the Bantu mineworkers. There is no waiting for admission to these hospitals and no shortage of beds.

The number of mine medical officers, appointed for the sole purpose of looking after the Bantu, has grown to 226, with specialist consultants also available. It is not generally understood even in South Africa that these doctors treat white miners only in emergencies. They are there to care for the health of the unskilled Bantu who, before they come to the mines, have in most cases never been examined by a doctor or had civilized medical treatment of any kind.

The Chamber of Mines has established a system of travelling fellowships under which, in alternate years, South African mine medical officers visit hospitals abroad and distinguished physicians and surgeons from other countries visit South Africa.

A recent visitor under this scheme was Dr. Marcus J. Stewart, Associate Professor of Orthopaedic Surgery in the University of Tennessee and orthopaedic consultant to the Surgeon-General of the United States Army.

Having visited the mine hospitals in 1969 he had this to say:

‘The mining industry's system of hospitals was by far the best and most unique I have seen anywhere in the world. . . .’

He complimented the industry on the *esprit de corps* of ‘its intelligent, well-trained, efficient and happy medical men’.

The pages that follow tell the history of the South African Mine Medical Officers’ Association, which was founded fifty years ago and is celebrating

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its jubilee this year. They also describe the remarkable achievements of this health service which cares for one of the world's largest labour forces under unified control. It is a force which is made up almost entirely of men who are in transition from a pastoral society to the work that waits them in an industrialized environment. What makes the task even more complicated than it sounds is that most of the men work out a contract of nine months to a year and then return to their villages. This means that the annual turnover is virtually 100 per cent.

The health service's main achievements have been:

To reduce the mortality from diseases from 24 per 1 000 sixty years ago to less than 2·0 per 1 000 at the present time.

To eliminate almost entirely typhoid fever, hookworm disease and scurvy.

To supervise the training of some thousands of Bantu nurses and male hospital orderlies who now serve in the mine hospitals.

To have taught the elementary principles of first aid to close on 2 million of the men who have come to the mines. In many cases these men have carried their knowledge and their acquired skill in treating injuries back to some of the most remote corners of Africa where there has never been medical care of any kind.

One of the lasting achievements of the mine medical officers is the success they have had in getting some tens of thousands of illiterates to accept civilized medical practice. Many of these Bantu mineworkers have had virtually no contact with civilization. Their tribal customs are based on superstition and their belief in witchcraft is strong. Most treatments of the sick in their homelands are even now based on primitive customs of which the exorcision of evil spirits is one.

The medical services provided by the mines and the contact with properly trained medical men may in time banish the practice of witchcraft from Africa. The process has already begun.

Apart from all this the balanced diet of their meals and the healthy lives they lead while employed on the mines almost invariably result in a gain in weight and an improvement in the general health of the mineworkers. It is of importance to many of the African communities south of the Equator that so many of their men return to their villages after a sojourn in South Africa in far better physical condition than most of them were when they left home.

The development of the goldmines of the Transvaal and Orange Free State, and their profitability, have always depended on this supply of unskilled labour. Since the members of the Mine Medical Officers'

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Association have played a vital part in safeguarding the health of these 400 000 workers, the history of the Association is bound up with the history of the system of migratory labour on which the industry was founded and on which it has flourished for nearly eight-fifty years. This narrative, therefore, must begin with a brief description of how this system evolved and became part of the pattern of life for the men of most of the Bantu tribes south of the Equator.

At first it was not easy to persuade the tribesmen to leave their womenfolk, their cattle, their crops and the life of comparative idleness they led in their villages to work for the white men in what they regarded as the senseless occupation of burrowing into the ground like antbears. But once there were taxes to be paid the cash wages that were offered, plus assurances that they could return to their kraals once they had completed a comparatively short term of manual labour (six to nine months), soon proved attractive to adventurous young men who wanted to buy cattle to pay the bride price for their wives.

When the first of these men returned to their kraals and described the treatment they had received, and when they displayed the various articles they had been able to buy, the word soon spread that, though the work was hard, the food was good and that this was the way to acquire 'cash money' (they were paid in gold sovereigns in those days). Thus the number of recruits grew very rapidly.

The system by which these men were brought to the mines was a somewhat rough-and-ready one and it is perhaps best not to inquire too closely into the methods employed by the recruiters who delivered the first 'kaffirs', as they were then called, at so much per head. However, whatever the abuses may have been, they certainly were not as gross as they had been in other parts of Africa where there were regions where all physically fit men fled on the approach of a recruiter with offers of employment.

In South Africa the flow of labour steadily increased. The time came when Bantu men were prepared to walk hundreds of miles, living as best they could on the journey, to offer themselves for work on the mines. Some of them came from as far afield as Mozambique and the shores of Lake Nyasa (now Lake Malawi) in the hope of earning the 'cash money' the bush telegraph had told them the mines paid out for less than a year's work.

The only available labour statistics for the nineties date back to the year 1893. That may be regarded as the year when deep-level mining began on the Rand with an enormous expansion of the claim areas worked and a consequent increase in the number of mineworkers. The figures show that

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between 1893 and 1898 the number of Bantu employed on the mines rose by an average of more than 9 000 per annum. They were as follows

<i>Year</i>	<i>Bantu Employed</i>	<i>Increase</i>
1893	25 049	—
1894	35 611	10 562
1895	45 287	9 676
1896	53 910	8 623
1897	60 234	6 324
1898	73 354	13 120

These figures show that there was not, at that time, any very serious shortage of labour. They become impressive when it is realized that, owing to the brevity of the 'mine boy's' period of service, there was a turnover of virtually 100 per cent per annum, so that during the five years covered by these statistics at least 200 000 men must have passed through the mine compounds.

Clearly this large increase in the labour force must have raised many problems for the mining companies. For some of these problems of expansion they were prepared. Their consulting engineers had been able to give them fairly accurate estimates of the number of men who would be required once the development of the deep levels began; and the necessary arrangements for housing and feeding these men presented no great difficulty. We know that, because there was keen competition among the developing mines for the available labour supply, mine managers saw to it that their 'boys' were adequately fed (with an extra ration of meat for those whose tickets showed that they had done more than the average amount of drilling in any particular shift).

A mine which had a good reputation in this respect, and whose compound manager was renowned for fair dealing, never lacked labour. Indeed the 'good' and 'bad' reputations of the mines of those early days have become part of the fireside legends of the Bantu and are even commemorated in song. So are the names of some compound managers, men who died long ago.

However the provision of adequate food and accommodation and the training of the new recruits were comparatively minor matters. The real problem was the incidence of disease in this very large body of men, brought from rural areas where they had very little contact with the diseases to which civilized communities have become partially immune, and herded together under conditions that invited infection. And the constant stream of

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Dr. A. J. Orenstein, as he was when he became the first Vice-President of the Association in 1921.

non-immunes kept alive the fires of respiratory infection. The importance of these factors was, at that time, not appreciated.

As this history will show disease was the really serious problem with which neither the mining companies nor the medical men of that day were equipped to deal. This was not because of reluctance to spend money on necessary health measures. Very largely it was the result of the ignorance of the doctors then practising of how to prevent the diseases that killed so many Bantu mineworkers before ever they had begun work. For this they were not to blame. The medical profession throughout the world had much to learn then. The training of doctors was concentrated on treatment and taught them virtually nothing about prevention. However it must also be recorded that the health measures adopted were largely inept, principally because no one thought of making an intensive epidemiological study of the

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prevalent diseases nor made any effort to learn what was already known in other countries.

The South African War, 1899-1902, led to the closing down of all the mines and the dispersal of the labour force. Johannesburg itself was in the hands of the Republican forces for only seven months. Nevertheless it was not until 1903 that most of the mines resumed crushing.

It immediately became apparent that both the new British administration and the mining companies faced a very serious shortage of unskilled labour. While the hostilities lasted both sides had issued warnings to the tribes to 'stay quietly in the kraals', and not to attempt to interfere. The Bantu, seriously worried by what they regarded as tribal warfare between the two groups of white men they knew, and by what they saw and heard, took this advice to heart. After the Treaty of Vereeniging was signed in 1902 they remained uneasy and were in no hurry to return to Johannesburg. In their experience such wars were continuous affairs and they had no intention of being caught in any cross-fire that might follow the armistice of which they had vaguely heard.

When at last they did begin to trickle back to work they found that there was more than one avenue of employment open to them. The reconstruction of the battered economy of the Transvaal was under way. There were railways and bridges to be built and good wages to be earned for work less strenuous than that in the mines.

On the other hand the Milner Administration, and nearly everyone else, looked to the mines to produce the revenue that was sorely needed to get the country on its feet again. The Chamber of Mines pointed out with some force that at least half the stamps on the Rand were idle because there wasn't sufficient Bantu labour to enable them to develop the ore bodies that would produce the profits. They added that once they had an adequate labour force they would be in a position to double the number of white men employed.

The statistics show that the situation was indeed extremely serious. Whereas in 1888-99 the total number of Bantu employed had been rising steadily towards the 100 000 mark, in 1902 the peak was 37 000. This increased slowly to 50 000-odd in 1903. Yet the Chamber said that for the full and efficient working of the mines it required 100 000 men.

It was at this time (1902) that the South African Inter-Colonial Conference met at Bloemfontein and decided that 'the native population of South Africa south of the Zambezi does not comprise a sufficient number of adult males capable of work to satisfy the natural requirements of the

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several colonies and at the same time furnish an adequate amount of labour for the large industrial and mining centres’.

The conference therefore resolved that all the British possessions in South, Central and East Africa should be ‘an open field for labour recruiting’.

Its final resolution read: ‘That in the opinion of this Conference the permanent settlement in South Africa of Asiatic races would be injurious and should not be permitted but that, if industrial developments positively require it, the introduction of unskilled Asiatic labourers, under a system of government control providing for the indenturing of such labourers and their repatriation at the termination of their indentures, should be permissible.’

It is difficult to decide how the conference arrived at its wholly erroneous conclusion on the subject of labour at a time when three of the colonies were still in a highly disorganized condition as a result of the war. However, the resolution on the importation of indentured Asiatic labourers was taken as authority for a vigorous campaign, led by Sir George Farrar, chairman of East Rand Proprietary Mines, for the importation of Chinese. This campaign eventually won the approval of most of the mining companies represented by the Chamber of Mines, and in 1903 the Chamber began an investigation into the feasibility, and the cost, of bringing indentured Chinese to the Rand.

It had no sooner been announced that the Transvaal mining companies were thinking of taking this step than an astonishing number of letters began to arrive in Johannesburg from firms of one sort and another who specialized in providing this service to companies anywhere in the world. The word ‘containerization’ had not been coined at that time, but this might almost have been the right name for these proposals for the shipping of indentured labourers to Durban at incredibly cheap rates. One firm even went so far as to quote its charges ‘per Chinaman f.o.b. . . .’.

The Chamber was offered not only Chinese but also large contingents of Russians, Finns, Austrians, Spaniards, Japanese, Indians, Malays and Moors. The Moors were the subject of a prolonged correspondence which included a letter giving the views of a member of the editorial staff of *The Times* who at one time had been captured by Moors in some obscure campaign in Morocco. He said that it would be no use importing them as ‘they would spend their entire time crying until they were repatriated’.

There was even a letter from the then Duke of Devonshire, who recommended the peasants on his estates in Lombardy.

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*Dr. H. T. H. Butt.
First President of the Association.*

The Chamber had already dispatched a mission to China by the time most of these missives arrived but it gave them all careful consideration. However, the excellent reports received from the employers of Chinese in many parts of the world finally decided the issue and, the Lieutenant-Governor of the Transvaal having given his approval and various mandarins having been 'squared', elaborate plans were drafted for the reception of some thousands of Chinese, who were to be indentured for a period of three years and then returned to the land of their birth.

A company called The Chamber of Mines Labour Importation Agency Limited was established with virtually every mining company on the Rand putting up a proportion of the capital. This organization began valiantly to struggle with an ever-growing list of the special requirements of Chinese labourers, all of which, so it was stated in letters from the agents in Hong Kong, were absolutely vital to the health and happiness of what they persisted in calling 'the Chinaman'.

There must have been times when the staff engaged in setting up the very

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Dr. A. I. Girdwood.

elaborate organization that was required may well have wondered whether they were engaged in the prosaic task of importing labour or whether they were about to produce a very elaborate musical comedy. Among the listed requirements were: padded coats, Chinese fireworks, gongs, joss-sticks, chopsticks and rice-bowls, conical hats, preserved ginger, dried fish, special Chinese writing paper, Chinese wine, paper fans, special cooking ovens, bamboo shoots and a host of other exotic articles too numerous to mention.

There were also a number of special arrangements necessary that eventually filled a fair-sized book for the guidance of mine managers. These included separate dining-rooms, each with its own cook, where groups of the 'coolies' could take their meals in the manner to which they were accustomed, and special instructions about making sure that they wrote home to their families enclosing printed, gummed labels that could be used by Chinese mammas who wanted to write to their absent sons and would be understood by the postal sorters of the Transvaal.

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In no circumstances was anyone ever to beat a Chinese. The explanatory note on this point said:

‘Physical violence is an abhorrence to the Chinese and anyone offering it to them at once loses caste in their eyes and becomes to them a despicable barbarian and unworthy of respect. Further, an exhibition of violence might lead to the whole of the men of any mine refusing to work and to general disturbances. It will be necessary to have this fact thoroughly impressed upon the European employees, especially the miners.’

It was to turn out that, though the Chinese had this horror of fisticuffs, they were prepared at times to cut one another’s throats with specially sharpened knives and even to use dynamite to blow up compatriots who failed to pay their gambling debts.

Suitable clothing presented difficulties. Said one expert: ‘Underclothing. . . This is not generally worn and, if worn at all, consists only of cotton drawers and a vest. . . . One blanket per man will be sufficient for the voyage’ (which took five to six weeks).

The suggested ration for the train journey from Durban to the Rand was one loaf of bread and one tin of sardines per man.

Yet another, expert thoroughly startled the directors of the Central Mining and Investment Corporation by saying in a letter: ‘From my knowledge no Chinese coolie will work properly without having his pipe of opium, one in the morning and one in the evening. This opium he is accustomed to be supplied with from the company’s store at cost price. I cannot quite agree, therefore, with Mr. Ross Skinner’s remark that the coolies will be quite satisfied with their own tobacco saturated as it is with opium. . . .’

There were to be special holidays when no work would be done. These included the Chinese New Year (three days) and the Dragon Boat Festival (one day).

Boxes were to be set up in the compound in which the workers could place petitions to the management (apparently an old Chinese custom). And finally it was suggested that there would have to be a regulation that, if any Chinese died on mine property, his body would have to be embalmed and sent back to China. But to this suggestion the mining companies gave a firm ‘No’. Someone pointed out, with heavy sarcasm, that this privilege might have to be extended to shareholders.

It was considered essential, and with this the Chamber agreed, that not only should there be interpreters and headmen, but also that for every 200 to 250 coolies there should be a Chinese doctor and that the hospitals in the compounds should be equipped with Chinese medicines. ‘This was not quite

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as expensive an addition to the burden borne by the importation agency as it may sound for the Chinese doctors' salaries ranged from approximately £4 10s. (R9) to £8 (R16) a month. One labour agency wrote to the Chamber to say: 'Perhaps it will be as well to get one *good* doctor and a few cheap and inexperienced ones. . . . In case of sickness doctors are to care for the patients free of charge.' (It will be noted that, some sixty-five years ago the Chinese had begun to think on the same lines as today's medical aid societies.)

These Chinese doctors were classified on their arrival as 'medical assistants' and did very useful work, using their own methods in many cases and acting as interpreters when there were descriptions of symptoms to be clarified. But the part-time medical practitioners then employed by the mining companies provided a clinical service for all the Chinese and also advised on the hygienic measures required in the compounds.

The Chinese were the most stoical patients that any doctor could wish to have. On the other hand they feared all forms of amputation more than they feared death. An abdominal operation worried them not at all but they would violently resist the removal of a gangrenous finger or toe. This was because they believed that when they reached their celestial resting place all the deformities that had beset them on earth would still be with them and, fully to enjoy the delights that awaited them there, they wanted to be whole men.

The circular issued to part-time mine doctors and district surgeons on this subject is worth quoting:

'In China there are very strong prejudices against post-mortem examinations, the idea being that the deceased goes to his spirit land with his defects.

'Post-mortem examination would never be allowed if any person of position died, and is one of the principal reasons why Chinese fear to go to foreign hospitals in China.

'Post-mortem examination is being done all along the Rand and, if done quietly, need never affect the labourers' opinions. Being a class who do not bother about worshipping at their temples and, who as a rule, do not trouble much about each other (unless such work is done openly when there will surely be strong opposition) the present system need not be changed, only it should be done quietly. After a time the idea will die out and they will not notice any case of post-mortem examination.

'Another thing doctors should not trouble about is closing the eyes. In fact it would be best if they made a point of not closing the eyes. The Chinese, in China, have an idea that foreign doctors use the eyes for medicine.'

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There were various other points on which Chinese opinion and South African opinion disagreed. One of these concerned what was edible and what was not. Certain Chinese 'delicacies', specially suitable for festivals, were shipped to Durban with each cargo of 'coolies' embarked for South Africa. Among these was a highly prized comestible, described in the ships' manifests as 'fish in oil'. This more than once incurred the displeasure of the port health authorities in Durban and at least one consignment was seized and destroyed.

This high-handed action drew the following complaint from the agency in China: 'apparently it is not understood [in Durban] that, owing to the manner of preparation, all Chinese fish stinks. As a consequence consignments of fish were reported to be smelling most offensively and, although reported by Chinese members of the crew to be in a wholesome condition, were destroyed as unfit for human consumption. . . .'

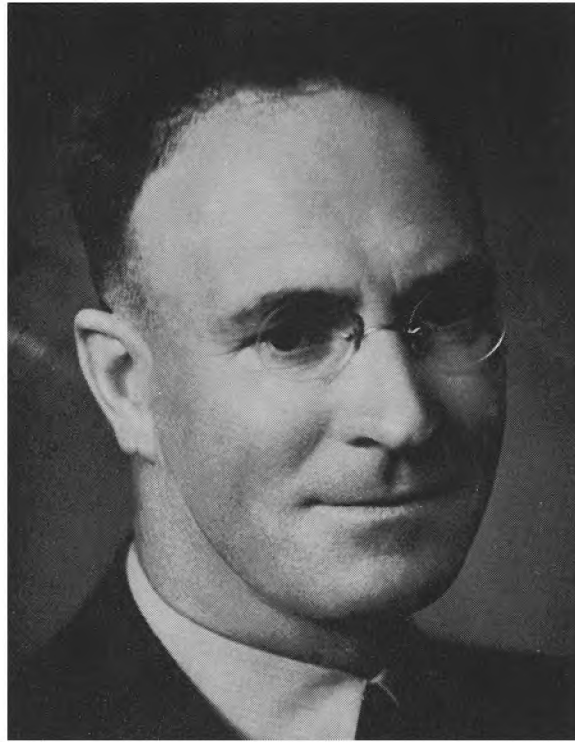
Despite these minor difficulties anybody who studies the voluminous correspondence and the exceptionally detailed regulations that were laid down for the care of the Chinese cannot but come to the conclusion that the officials of the Chamber of Mines who ran the importation agency did a superlative job in organizing the operation. As for the Chinese, the conditions under which they worked on the Rand were so much better than the state of near starvation in which they existed in their own country that many of them regarded the compounds as a paradise on earth. Indeed, to this day there are legends in north China of the wonderful time grandfather had when he went to work for the foreign devils in far-off Africa.

However there was strong opposition to the importation of the Chinese both in South Africa and in Britain. One of the leaders of the protest movement in South Africa was a mine manager, F. H. P. Creswell, then manager of the Village Main. His disagreement with the policy of the Chamber of Mines on this Point was to lead to his resignation. He severed his connection with the mining industry and became leader of the South African Labour Party. F. H. Monypenny, then editor of *The Star*, also resigned his position and returned to England because he found himself opposed to the Chamber's labour policy.

Later the predominantly Afrikaner Het Volk Party, led by Generals Botha and Smuts, was to make the repatriation of the Chinese one of the main planks of its election policy.

The Liberal Party in Britain chose what they called 'Chinese slavery' in

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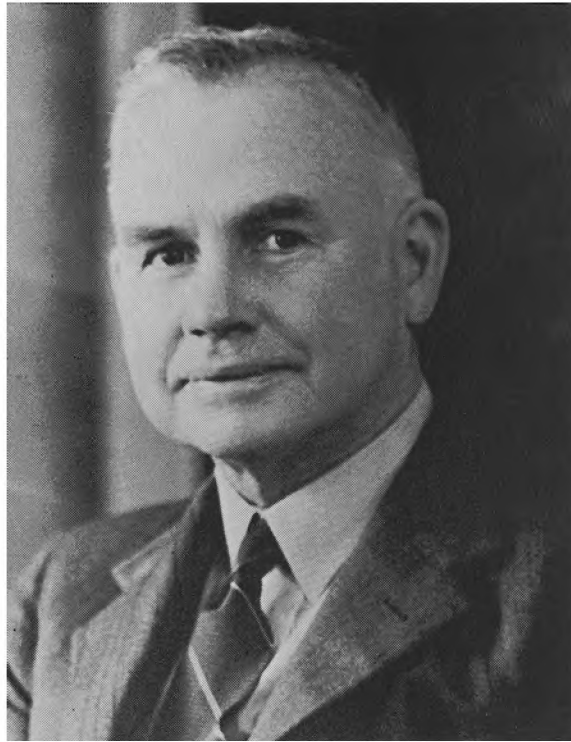


Dr. Alexander Smith.

the South African mines as a stick with which to beat the Tory Government. Ignoring the fact that Indians were being brought to Natal to work in the sugar plantations at half the pay of the Chinese and that several other British colonies were employing indentured Chinese—men, women and children—at starvation wages, they fought a very successful election campaign with this as their battle-cry. And, in 1906, they defeated the government and took office.

The propaganda war that was waged on this subject—and it was an extremely effective political campaign—was an ill wind for the Tories in Britain and for the mining companies, who found themselves represented as ruthless capitalist organizations. But it was of the utmost benefit to the Chinese, who rapidly became the most pampered mineworkers in the world while the fierce light of publicity shone upon them. It was also to prove of great advantage to the Bantu, who not only inherited all the improvements made in the compounds for the Chinese but also became the subjects of

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Dr. E. L. Ferguson

attention. Up to that time no one had worried a great deal about them. They were regarded as a naturally 'tough' race who were rarely ill, who could live on mealie meal and a little meat and who were not accustomed to comforts of any kind (the statistics, had there been any, would have revealed a very different set of facts).

The attention focused on the conditions under which the Chinese lived in the compounds was to be of inestimable benefit to the Bantu once they replaced the imported Labour force and even before the repatriation of the indentured labourers was complete.

The Chamber of Mines had gone out of its way to meet criticism of its Chinese labour policy. An 'inspection committee' of Chinese officials had been invited to Johannesburg to look over the compounds (it was a member of this committee who recommended that, if there were any trouble in the compounds, the men should be assembled and one of their number publicly beheaded as an example to the others). That committee had expressed complete satisfaction with the conditions. Liberal M.P.s were then invited to

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come out to South Africa on the same mission, but the invitation was not accepted. However a party of Conservative M.P.s came and were shown around.

One of their number was Sir Gilbert Parker, who was not only a member of the House of Commons but also a leading novelist, the best-seller of his day. He inspected the compounds and showed keen powers of observation.

In a letter he wrote to the Chamber of Mines on 20 December 1904, after his return to London, he said:

‘ . . . I am glad to bear testimony to the general character and efficiency of the Chinese labourers and the admirable manner in which they are housed and fed. I venture to think, however, that there is some contrast in certain particulars between the accommodation and treatment of the Chinaman and that of the Native. After visiting the Kimberley compounds I cannot but think that there is still room in the Transvaal for improvement in the housing, general care and treatment of the natives. I do not suggest that the natives have not sufficient food and there is not the respectable minimum of care for them. I think, however, that some of the extra solicitude given to the Chinaman, if applied to the Native, would add to his comfort without sensibly increasing the cost to the mine.

‘Upon another point I should wish to make a more explicit observation. I am convinced that the importation of natives from the Zambezi Valley and from Central Africa ought to be stopped, the percentage of deaths amongst the natives on the mines being seriously high chiefly because of the mortality amongst these particular natives. On visiting the compound of the Witwatersrand Native Labour Association I found the natives from the Zoutpansberg district, from Portuguese East Africa and other portions of the sub-continent in good condition, but a limited number of them suffering from colds or pneumonia.

‘It was, however, exactly the opposite with the natives from the Eastern Zambezi Valley. So far as I could judge three-quarters of them were suffering from colds and a large percentage were confined to hospital with pneumonia.

‘ . . . The present mortality is due chiefly, I am sure, to the fact that these natives come from tropical, low-lying regions to the high, and to them, dangerous air of the Transvaal and the Rand. It may also be that sufficient care is not taken in transportation. But it would appear certain that the main cause of the mortality is due to the constitution of the native, born and brought up under purely tropical conditions. . . .’

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It will be observed that he was pretty close to the bull's-eye.

It should be added that Sir Gilbert recommended that clubs and recreation rooms should be provided for the white miners for the encouragement of 'entertainments of a respectable and refining kind'.

'To a great extent each mine is a village in itself and the more it realizes a certain civic and social sense and duty the better will be the character of the labour in this great South African centre of development and progress', he wrote.

Sir Gilbert's remarks were circulated to all the mining companies. One of the letters he received in reply (from an executive director of a mining company) said:

'A year ago I tried to sound a note of warning that we should not go too far in pampering the native who, in his own home, is certainly not accustomed to anything like the comforts which he gets all along the Reef. My own feeling is that, far from being backward, we have if anything done too much already. . . .'

However it would be wrong to suppose that this was the attitude of all the directors of the mining companies. Many of them were very worried by the ill-health of these supposedly 'tough' African mineworkers. They had good reason to be. The mortality was appalling.

Early in 1903 Sir Godfrey Lagden, Commissioner for Native Affairs in the Milner Administration, had called a meeting of representatives of the Chamber of Mines and the medical men who then acted as part-time mine doctors, to discuss the problem. It was decided to appoint a committee of doctors to investigate and report. This committee consisted of Drs. L. G. Irvine, D. Macauley, J. S. Morton, E. Pollak, A. Watt and C. J. Lyons, all of whom were mine doctors (which meant that they combined general practice and/or duties as district surgeons or panel practice with mine medical officers' duties).

Their report, presented to Sir Godfrey in June 1903, showed exactly how serious was the situation. They based their findings on the mortality returns supplied to them for the period November 1902 to April 1903, which were the only figures available.

From these they showed that pneumonia and other respiratory diseases were responsible for 41·7 per cent of all deaths. Deaths from pneumonia in the six-month period they surveyed were 493 out of an average of approximately 50 000 Bantu employed. Scurvy was responsible for 186 deaths, meningitis for 122.

The total of deaths from all causes, including accidents, was 1 541, which gave an annual death-rate of 57·7 per 1 000. The death-rate from sickness

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alone was 54·5 per 1 000.

Deaths from accidents and enteric fever over the six-month period both stood at the same figure—86.

They recorded that ‘. . . curiously enough it appears that the death-rate among the natives employed in the Kimberley compounds is practically identical, namely 57·2 per 1 000 for the year 1902. We do not say that the mortality among the natives of the Rand cannot be reduced. We believe, and will try to show that it can, but it is certainly apparent that the natives on the Rand show a mortality no higher than that obtaining in other mining districts in South Africa. . . .’

They then went on to propose various palliative measures, all of which were excellent in their way, but failed to get to the heart of the trouble.

They recommended the establishment of soup-kitchens at shaft-heads and the issue of two blankets to each man in cold weather, improvements in the sanitary system, impervious floors in compound rooms and more cubic space per head in these rooms.

Their really important recommendation was that there should be a standard diet in all compounds which would include one pound of fresh vegetables per man per week.

How much room for improvement there must have been is illustrated by their chart of an ‘ideal diet’ which provided for mealie meal and treacle, as a full meal, five days a week (with soup and army biscuits as a shaft-head snack for underground workers) and 1 lb of meat with ½ lb of vegetables on Wednesdays and Saturdays.

They recommended that all mines should have compound hospitals to be staffed by Africans who had undergone six months’ training in the care of the sick, or alternatively by retired N.C.O.s and men of the Royal Army Medical Corps of whom there were a number available.

It will be observed that they did not think it necessary to recommend that there should be full-time medical officers. Even such progressive and well-informed men as Drs. Irvine and Watt, who were later to become firm supporters of the scheme for full-time doctors, then could think of mine hospitals only as appendages to compounds, staffed by an ex-R.A.M.C. orderly—one to each hospital—assisted by a couple of illiterate Bantu, as adequate nursing staff.

The committee stated *inter alia* in their report that: ‘The mortality from pneumonia can certainly be reduced but it cannot be altogether eliminated

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for the natives are particularly susceptible to this disease and the conditions of mining work favour its incidence. The same may be said of the allied disease of meningitis and of the 'diarrhoeal diseases', enteric fever, dysentery and diarrhoea.

'We believe, however, that should the recommendations which we shall advance later be adopted, the mortality among mining natives could be reduced to 40 per 1 000 or even lower. . . .'

The caution displayed in this prognosis may have been due to the fact that the majority of the members of the committee were Scotsmen.

In fact there is reason to believe that the mortality rate, particularly among Bantu recruited from the tropical areas, was a good deal higher than the statistics over the six-month period on which this report was based.

In later discussions Dr. Macauley was to quote figures that are almost unbelievable. The shorthand note of this statement, made at a meeting between the Lieutenant-Governor of the Transvaal, Sir Alfred Lawley, and representatives of the Chamber of Mines, reads:

'Dr. Macauley gave figures on Simmer and Jack. On February 26 [1904] 164 boys arrived from Mozambique and since that date 42 others had arrived. The mortality had been very heavy.

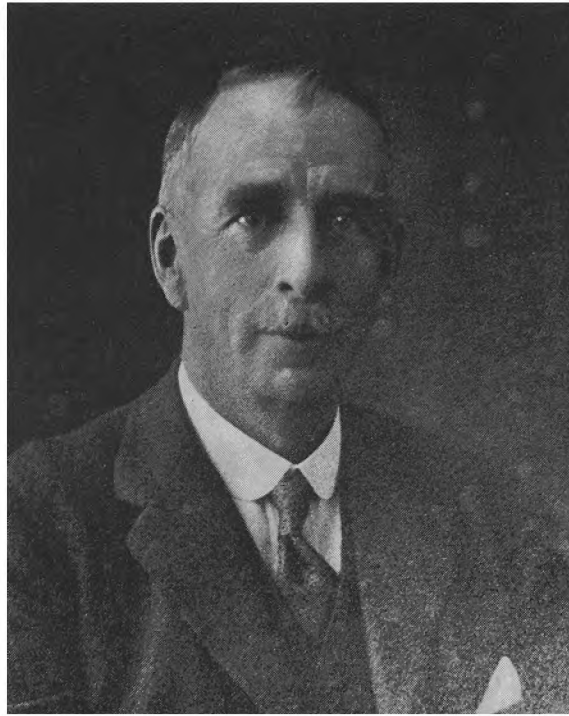
<i>Month</i>	<i>Deaths</i>	<i>Mortality</i>
March	42	360 per 1 000
April	20	120 per 1 000
May	14	250 per 1 000
June	40	339 per 1 000

A communication to the W.N.L.A. from the High Commissioner in September 1905 said:

'I am desired by Lord Selborne to inform you that his attention has recently been called to the high rate of mortality among natives employed on the mines of the Witwatersrand who are recruited from tropical areas north of latitude 22° South.

'For the year ended June 30, 1905, the death-rate among natives from tropical areas was 130·1 per thousand; the death-rate among natives recruited from British Central Africa was 118·3 per thousand. This death-rate is lamentable and as disastrous to the employers as to the employed. As far back as January last the Secretary of State stated in a dispatch that, if the existing rate of mortality continued, the experiment of recruiting labour in British Central Africa must cease.'

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Dr. Andrew Watt, the first medical practitioner to carry out large-scale lung radiography in South Africa.

Even allowing for the fact that the statistics available were unreliable—if anything they probably tended to understate the case—this mortality rate was comparable with that of the Great Plague of London and certainly as bad as the yellow fever rate in the so-called ‘white men’s graves’ in various parts of the world. The modern public health specialist, studying them, would find it hard to believe that they were published in 1904 rather than in 1004.

The outcome of the medical committee’s report was translated into a series of ‘recommendations’ to the Chamber of Mines from the Department of Native Affairs and led to some improvements in the conditions in the compounds. But they were comparatively minor improvements.

There was a prolonged argument between the mining companies and the administration, represented by Dr. George (afterwards Sir George) Turner,

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Medical Officer of Health for the Transvaal, on the cubic space that should be allotted per man in the compound rooms. Dr. George Turner, relying on the regulations that applied to common lodging-houses in England, held out for 300 cubic feet per occupant. The mining companies, alarmed at the prospect of spending some R500 000 on enlarging existing buildings, argued that 200 cubic feet was sufficient on the ground that for the greater part of the week all the occupants of a room were never present at the same time.

There were elaborate experiments to measure the volume of CO₂ in the rooms at given times. At times orders were issued that all vents, or most of them, should be blocked to prevent draughts. These would soon be countermanded as the 'fresh air' experts demanded that there should be free currents of air. The occupants themselves, knowing nothing about the regulations made for their benefit, blocked the ventilators with old clothes or opened them as they felt inclined, which was probably the most sensible way of dealing with the matter.

The measuring of inhabited space in tri-dimensional geometry was the common method in those days. It persists in some laws and regulations even in our day. The modern standard is two-dimensional, i.e. it used to be cubic feet and is now square feet (or square metres).

The arguments based on CO₂ content of the air in the rooms, and 'air purity' judged on this basis, were a relic of the teaching before the 'bacterial era'. Apparently, even in 1904, when bacterial infection was fairly well understood and close contact proved to be favourable to the transmission of many diseases, these ideas had not reached the local physicians.

Among compound managers, and consequently among mine managers, too, it was commonly held that the Bantu mineworkers actually preferred crowded conditions in their sleeping-quarters. This was expressed in these words in a memorandum submitted by the Chamber of Mines after the medical committee's report had been studied: 'The objections we see to this [the provision of 300 cubic feet of space per man] are in the first place the great cost of reconstructing the compounds, and in the second place the well-known fact that the boys prefer a crowded room and, however much space is provided, insist upon huddling together. . . .'

The truth was, of course, that the men huddled together because the rooms were inadequately heated and climatic conditions on the Rand were considerably colder during winter than those to which they were accustomed. Then, as now, there is no overcrowding in huts in tribal areas where a man and his wife and perhaps one or two small children occupy one

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hut while the older members of the family have huts of their own.

Because this erroneous belief was firmly held these early attempts to reduce the incidence of disease overlooked one of the most important causes of all—the ‘huddling’ of men in close contact with others who were infected.

A useful contribution to the discussion was made by the Mine Managers’ Association which, in a bluntly worded statement, said that a very high proportion of the men sent to the mines by the W.N.L.A. arrived in a state of semi-starvation and in such poor health that they were unfit for work until they had been rested and fed. Many of the men, they said, could not be put to work at all but went straight to the compound ‘hospitals’ where some of them died and others had to be repatriated. They advocated a more thorough examination of recruits at the border stations and the provision of a W.N.L.A. ‘receiving station’ on the Rand where the new arrivals would be held for a few days until such time as they were ready to begin work as fit men.

These suggestions were gradually accepted by the W.N.L.A. and were probably the beginning of the efficient system that exists today. There were at the time inspections of the recruits at Ressano Garcia and at various points in British Central Africa but these were often quite perfunctory and did not pretend to be medical examinations, with the result that, if a man had no obvious outward signs of disease or disability, he was ‘passed’, only to become a hospital case on the Rand.

The conditions under which the men travelled, whether on the five-week overland journey or by sea from Mozambique, were pretty rough-and-ready and must certainly have predisposed many of them to attacks of pneumonia.

Sir George Farrar was the first person to point out the very high incidence of respiratory diseases among the so-called ‘tropicals’ in the first weeks of their employment on the mines. He gave chapter and verse in a letter to the Chamber in 1903 which set out the death-rate at the E.R.P.M., of which he was chairman. This statistical analysis showed that deaths were most frequent in the first six weeks of their contracts.

The W.N.L.A. then drew up statistics in which the mortality rate on all the mines was correlated to the length of service before death. This showed that, both among men recruited from Mozambique and in the northern Transvaal, the death-rate was highest among those in their first three months of service.

Of 28 669 east coast men who were brought to the mines in 1903, 490 had

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died in the first month of their contracts and another 270 within two months of starting work. Of 925 men recruited from British Central Africa in 1903, 49 had died within less than three months of starting work.

These startling figures had their effect and, together with the statement of the Mine Managers' Association, led to a more thorough inspection of recruits at the W.N.L.A. depots and the establishment of a special 'detention compound' (with a small hospital attached to it) where new arrivals were held for a short period before being allocated to the mines.

There followed a distinct improvement in the health of the men in the compounds and a reduction of the mortality rate. It could hardly have been otherwise since scurvy, with which the doctors began to get to grips, was estimated to be responsible for 12 per cent of all deaths from disease.

But there was very little reduction of the mortality from pneumonia and other respiratory diseases (these included phthisis which, as distinct from 'miners' phthisis', meant pulmonary tuberculosis). These diseases were responsible for 41·7 per cent of the total mortality from disease. As late as 1912 the mortality from respiratory diseases stood at 24 per thousand per annum, of which diagnosed pneumonia was responsible for approximately 10 per thousand.

At that rate today, the death-rate on the mines would be 9 600 per annum from respiratory diseases and 12 400 from all forms of sickness—figures that no mining company, and certainly no government, could possibly accept. In fact the mortality rate in recent years has been 0·7 per 1 000 for pneumonia and 1·8 for all diseases, so that deaths today are approximately 280 (pneumonia) and 720 (all diseases) out of a total of some 400 000 men.

The medical men of those days were groping their way through a forest of theories about pneumonia and as yet had not grasped the principle of acquired immunity to the disease. We know today that a higher incidence and high mortality from respiratory diseases is to be expected when large numbers of people from widely scattered small communities are brought into intimate contact with a population who have acquired a certain degree of immunity. This was certainly true of Bantu mineworkers who had not been in contact with any such population before. Even today recruits from the so-called 'tropical areas' of Malawi and Tanzania, and from the thinly populated districts of Mozambique, are much more prone to pneumonia than men from the Bantu areas of the Republic and adjacent territories.

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Special cooking facilities were required for the Chinese mineworkers, some 50 000 of whom were brought to South Africa to be employed in the goldmines as indentured labourers between 1903 and 1910. This photograph shows some of the Chinese cooks and supervisors.

In the United States when young men were called up for service in World War I the highest incidence of respiratory diseases was found among those who came from country districts and were indiscriminately mixed with urban dwellers. The physically superior farm lads had a very much higher incidence of pneumonia than the men from the cities. This applied not only to pneumonia but to other infectious diseases such as cerebro-spinal meningitis.

On the Rand the annual labour turnover was more than 100 per cent, which meant that large numbers of non-immunes, arriving in an almost constant stream, were added to a population that had acquired only a partial immunity to respiratory diseases. This aggravated the hazard to the new recruits as well as to some of the previous arrivals. And there can be little doubt that the manner in which the men were conveyed by sea from Mozambique, and the manner in which they were housed and fed in the days before 1912 or thereabouts, made them more susceptible to infection.

The wooden 'shelves' in the compound rooms in which the men slept side by side helped to spread the diseases.

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The last half of the nineteenth century and the first decade of the twentieth was the golden era of vaccination. Vaccination against typhoid fever had achieved dramatic success. It is understandable; therefore, that the leaders of the mining industry, seriously worried by their pneumonia death-roll, should have looked hopefully to attempts to find some form of immunization that might solve their problem. If a practical 'vaccine' could have been discovered they would have been prepared to vaccinate every African recruited for the mines provided the cost was within reason. They had already spent considerable sums of money on improving accommodation in the compounds. They were prepared to spend more.

Thus we find that, as early as 1904, Dr. C. C. Pakes, the government bacteriologist of the day, was at work in the government laboratory on Hospital Hill. He carried out an experiment with a serum called 'Pakes's Anti-Pneumococci Serum' and said that the serum 'had a marked effect in prolonging the life of a rabbit inoculated with the pneumococcus' from which he deduced that it would be effective in human beings. He reported that he found 'the virulence of the South African pneumococcus very great' and proceeded to bump off a large number of rabbits by injecting them with various trial doses of a serum—so much so that at one stage of the experiment he ran out of rabbits altogether and the whole project had to be repeated.

This research was initiated by the Transvaal Medical Society and was under the control of a committee consisting of Drs. Brodie (medical officer to the W.N.L.A.), Irvine, Macauley, Watt, Rogers, Thornton (afterwards Sir Edward Thornton) and Pakes, the bacteriologist.

There appears to be no surviving record of the outcome of these experiments and we are left in doubt as to whether a serum was evolved.

Seven years later, in February 1911, Sir Julius Wernher, chairman of the Central Mining and Investment Corporation in London, received an important visitor—none other than Sir Almroth Wright, M.D., F.R.S. In a letter to Mr. Lionel (afterwards Sir Lionel) Phillips, head of the firm in Johannesburg, Sir Julius explained what it was all about.

'We have had a long conversation with Sir Almroth Wright, one of the leading bacteriologists in Europe who is attached to St. Mary's Hospital', he said. 'Dr. Wright tells us that his vaccine treatment for enteric fever has reduced the mortality in the Indian Army to a very small percentage and he is working now on the problem of pneumonia and, as he tells us, with very

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favourable results.... He threw out the suggestion that it would be worth our while to send two of his men out and study the problem further and very likely to come to results which his preliminary work makes him think would become very successful.

‘... The difficulty here is to find sufficient material even in a large hospital because the patients generally arrive already infected and although the cases which have come under Dr. Wright’s care have, as I said before, given hopeful results they do not lend themselves to a preventive treatment. One of the great objects of his research work is not only to cure but also to prevent and the Witwatersrand with a death-rate from pneumonia of, I believe, over 2 000 would offer a field that could not be found elsewhere. . .’

Wernher went on to suggest that the W.N.L.A. should take up this offer and finance the experiment. He added:

‘There is the question of the attitude of the local doctors but I understand many of them are keen on the problem and, as the gentlemen sent out would in no way interfere with their pockets or prospects, it is to be hoped that professional jealousy would be minimized and that their hearty co-operation would be secured. . . .’

The upshot was that Sir Almroth himself agreed to visit Johannesburg for six months (at a fee of R2 000 a month), bringing with him two assistants and a laboratory attendant. They set to work in the old government laboratory on Hospital Hill to develop a vaccine that would provide immunity from pneumonia or at least reduce the virulence of its attack.

The first prophylactic inoculations were made on 4 October 1911 on ‘tropical’ recruits in the W.N.L.A. compound and simultaneously men were treated in some of the mine compounds. This procedure led to a statistical muddle as some men who had been inoculated in the W.N.L.A. compound were inadvertently reinoculated by mine doctors. In addition to this error some ‘controls’ were inoculated after a period of residence on the Rand and then transferred to the ‘Inoculated’ group, who ought all to have been new arrivals.

As a result this first experiment was inconclusive. However a similar experiment carried out at the Premier Mine, where Dr. S. F. (later Sir Spencer) Lister was then the mine doctor, was reported to have been extremely successful though it was later to be pointed out that there were very few ‘tropicals’ employed on that mine and that all the men lived in a ‘closed’ compound, which meant that they had less contact with sources of

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infection than the men on the Rand. However, the results achieved were to persuade Lister that the pneumococcal vaccine was effective. He was later to be appointed to the staff of the South African Institute of Medical Research and to be put in charge of the mass production of the vaccine. He remained a believer in its efficacy long after most mine medical officers had decided that it was of little use.

For years after this, inoculation of all recruits was practised on all Rand mines. The subject is dealt with more fully on the chapter on pneumonia that follows.

As early as 1913 Dr. G. D. Maynard, statistician and clinician to the Institute for Medical Research, after an exhaustive review of the methods used and the recorded results came to the conclusion that :

‘In these records there is no evidence that prophylactic inoculation has any influence on the case mortality, except possibly for a very short time after the injection.’

This was a conclusion with which most mine medical officers came to agree as time went by. However, the inoculations, if they did no good, did no harm either and they had the important psychological effect of making everyone concerned feel that at last ‘something was being done’, so that on the whole this was a beneficial experiment which helped to focus attention on a set of disturbing statistics. It also had an important political and economic value. It was publicized as an effective prophylactic against the dread pneumonia and the undertaking to continue the use of, and improve as far as possible its efficiency, the vaccine was part of the argument presented to the governors of territories in which recruiting agreements were to be negotiated.

The battle against pneumonia continued in somewhat desultory fashion year after year. Regulations governing the conditions under which Bantu mineworkers were to be housed and fed were promulgated, amended, redrafted and then promulgated again—all without any noticeable reduction of the mortality. It had been established that the men were more likely to succumb to the disease in the first six weeks of their contracts and that the ‘tropicals’ were very much more susceptible to infection than men from the South African reserves. But no one was certain why this should be so.

It was suspected, of course, that the change of climatic conditions was to blame. But the theory was also advanced that the Bantu as a race had a ‘natural’ susceptibility to the disease so that all measures designed to protect

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them were foredoomed to failure. One doctor even argued that, if statistics could be compiled (and, of course they could not), it would be shown that the Bantu probably had a higher mortality rate in their homelands than in the compounds. And thus it might be shown that their health was probably improved by bringing them to the Rand. There was a good deal of arrant nonsense of this description written, while the men continued to die.

In the end it was left to one man, a layman, to propose the practical solution of the problem—and even his proposal was put forward for the wrong reasons. This man was Mr. Samuel Evans, chairman of the newly floated (in 1909) Crown Mines Company (afterwards Dr. Samuel Evans by virtue of an honorary degree conferred upon him by the University of the Witwatersrand).

Evans was a determined reader of all forms of current literature and even more determined letter writer (he seems to have had more spare time than most of the directors of mining companies of those days). In the course of browsing through his weekly batch of periodicals he came across an article that described a lecture by the great Sir William Osler on the work done by the United States Army Medical Corps, and particularly by Colonel William C. Gorgas in the Panama Canal Zone. Osler praised the work done there to protect the army of some 50 000 workers who were building the Canal as the outstanding achievement of preventive medicine of the twentieth century.

Evans then sent for everything available about the health measures adopted in the Panama Isthmus and the more he read the more impressed he became. He found that Ferdinand de Lesseps, the great French canal builder, had been defeated in his efforts to work in this area by the appalling death-rate of the men recruited to do the job, estimated to have been 240 per 1 000. All told the French had lost 22 189 men by death between 1881 and 1889. Of 1 000 Negroes imported from the west coast of Africa to work on the railway all had died within six months.

The French had been obliged to abandon the project and, in 1903, the American Government acquired, by treaty, the right to attempt to build the canal. The work began in 1904 and, with Colonel Gorgas installed as Chief Sanitary Officer, the mortality from all diseases fell from 38·98 per 1 000 in 1906 to 8·68 in 1908 and to 6·37 by 1912.

Evans was particularly impressed by the reduction of the mortality among Negroes which fell from 45·52 per 1 000 in 1906 to 6·94 in 1912. This he found was a great deal better than the mortality rate on Crown Mines. On

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going further into the statistics he found that Gorgas and his team had succeeded, by 1911, in reducing the mortality from pneumonia among Negro workers in the Canal Zone from 18·46 per 1 000 to 2·3. The corresponding rate for Bantu mineworkers in the Transvaal in 1911 was 13·9.

By dint of hard reading Evans soon became South Africa's foremost authority on the building of the Panama Canal and particularly on the health measures adopted there to combat yellow fever, malaria and the ever-present pneumonia. He proceeded to bombard the directors of the Central Mining and Investment Corporation and the President of the Transvaal Chamber of Mines with a series of letters in which the mortality rates in this 'white man's grave' were compared to those of the Rand mines. These statistics were his strongest argument for they showed that the results achieved on the Isthmus were roughly six times better than those on the Rand.

Here it should be explained that Evans had a 'fly phobia'. He was convinced that all forms of infection were spread by the housefly. Thus he convinced himself that pneumonia was caused by the unwholesome activities of flies and that Gorgas's success in reducing the mortality from this disease among the Negroes working on the Canal was due to the destruction of flies and the fly-proofing of the men's huts. In this he was wrong.

Nevertheless he began a one-man campaign to persuade his colleagues that flies were the source of all diseases and in his own domain was able to bring about some useful reforms. In the course of his investigations he found that the Crown Mines company was paying the Johannesburg Municipality R24 000 a year for sanitary services which consisted of removing buckets of night-soil in horse-drawn carts. He then insisted that this most insanitary system should be replaced by water-borne sewerage, with the result that in due course Crown Mines was the first mine to have its own water-borne system installed, a notable improvement. It was, in fact, ahead of most of Johannesburg's suburbs in this respect.

He then decided, without much encouragement from his head office as far as one can see, that he must visit the Canal Zone and find out exactly what Gorgas was doing. So, towards the end of 1912, he set out on what was quite an adventurous journey for those days. He made Panama City his headquarters and spent a month thoroughly investigating the public health set-up.

He met Gorgas, who by this time had become a world celebrity.

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He was then handed over to a young doctor named A. J. Orenstein, a graduate of the Jefferson Medical College, Philadelphia. Orenstein had been on Gorgas's staff since 1905 and was his assistant chief sanitary inspector. Gorgas's own designation was 'Chief Sanitary Officer'. These were titles that fell strangely on English ears.

It was Orenstein's task to show Evans, and the redoubtable Mrs. Evans, everything that was being done and had been done and at the same time gently to disabuse him of his idea that flies were the infective agent in pneumonia.

One has to picture a youthful Orenstein, clad in riding breeches and leggings, carrying out this task. In those days he rode on horseback all round the Isthmus of Panama on his visits of inspection. He had by this time become one of Gorgas's senior administrative officers.

Evans returned to South Africa and Johannesburg deeply impressed by all he had seen. He was not quite certain precisely what it was that had enabled the American medical team to achieve such remarkable results but, whatever it was, he wanted it imitated on the Rand. Like everyone else who ever met the Surgeon-General he had become 'a Gorgas fan'.

In June 1913 he drafted a memorandum for Sir Lionel Phillips, then chairman of Rand Mines, Limited, in which he suggested that the latter should urge the Chamber of Mines to invite Gorgas to visit Johannesburg and advise on how conditions in the mine compounds could be improved. It must be remembered that, in March that year, the British Government had put a ban on the recruitment of men from the Central African territories.

'Something must be done and done soon', said Evans. 'If we let things slide we shall lose the Portuguese natives as well as the tropicals. It is perfectly clear that the things we are doing now, such as attention to clothing, diet, change houses, covered ways, diminution of draughts in the compound rooms etc. have not helped in the least. The death-rate today is, if anything, higher than it was in 1906. . . .

'As far as I can see there is no ground for believing that multiplying doctors, or appointing whole-time doctors, will help so long as we continue on the present lines. It must be remembered that the heaviest death-rate of all is in the W.N.L.A. compound where the medical attention is ample. The mines that already have whole-time doctors are, if anything, worse off judging by the death-rate than many mines where comparatively little attention is paid to the health of native workers.

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‘I think the best course would be for you to call a meeting of the groups and tell them that something has to be done and done without delay. . . .’

The upshot was that a cable that Evans had drafted was sent off to Gorgas by the Chamber. It read: ‘Invite you come here advise sanitation mining district and prevention high mortality coloured miners. Fee £2,000 and all expenses. Also fees and expenses assistants you may require bring with you. . . .’

The invitation was accepted and on 3 December 1913 Colonel Gorgas,* accompanied by Major Robert E. Noble of the Medical Corps of the United States Army (General Inspector, Department of Sanitation Isthmian Canal) and a distinguished pathologist, Dr. Samuel T. Darling, chief of the Board of Health Laboratory in the Canal area, arrived in Johannesburg. They were on the Rand a month later when the second general strike of miners and railway workers was nipped in the bud and nine strike leaders arrested and summarily deported to Great Britain.

In a little less than three months they had completed their investigation and Gorgas presented his report to the Chamber on 25 February.

There was nothing very spectacular or startling in the recommendations that the report made and today most of the proposed ‘reforms’ are routine health procedures. However fifty-seven years ago it is probable that some of Gorgas’s proposals seemed revolutionary and certainly very expensive.

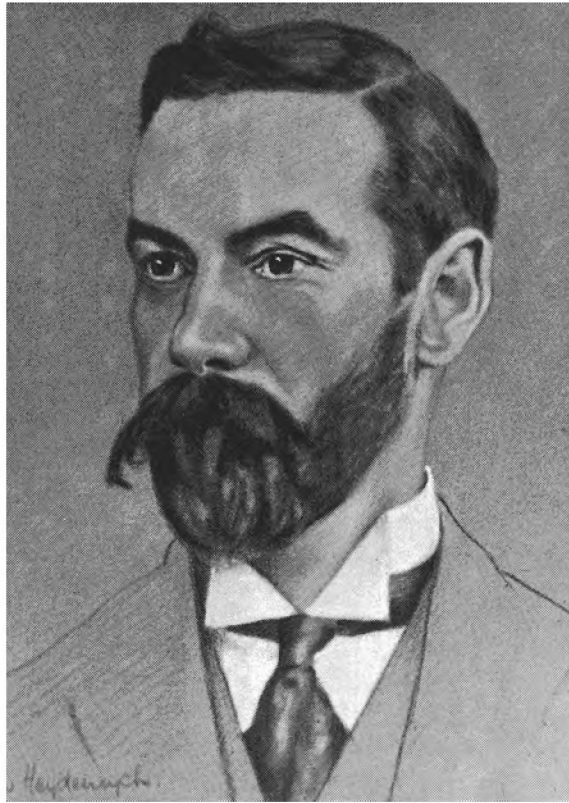
His two main recommendations were that the hospital services provided by the mining companies should be centralized and greatly improved and that much more spacious accommodation should be provided in the compounds as a means of reducing the danger of infection from diseases such as pneumonia, tuberculosis and meningitis.

He called for a minimum of 50 square feet per man in every room, saying bluntly that the compound rooms were much too overcrowded. He said that the French Army had found that overcrowding in barracks was invariably followed by an epidemic of pneumonia.

He attributed his own success in greatly reducing the incidence of pneumonia in the Canal Zone to the fact that a large proportion of the labour force there had been permitted to build and live in their own huts with their families so that there was no close contact with men who might be infected.

* It was while he was in Johannesburg that Gorgas received the news that he had been promoted to the rank of Surgeon-General United States Army.

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Dr. Samuel Evans, LL.D., Chairman of Crown Mines Limited, who visited the Canal Zone on the Isthmus of Panama, and then suggested that General Gorgas should be invited to visit mine hospitals in Johannesburg.

He thought that small huts in which the mineworkers and their wives and families could live together would reduce the incidence of all respiratory diseases. If that were impossible he thought that the next best measure would be smaller rooms with an allocation of much more floor space for each occupant and a separate bed for each man instead of the communal wooden shelf on which they all huddled together under the existing conditions.

The suggestion that there should be family housing could not be adopted for several reasons. The overriding one was, and still is, government policy—there is no room for the families of migrant workers in the cities and there is no suitable area on most mines where a sufficiently large village

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could be built. Then there is the problem of what would become of this uprooted, urbanized family when its head could no longer work for the mine, and also the more complicated problem of what would become of all these families, and of the village itself, when the mine closed down.

A few families, usually those of indunas and clerks were, and are today, provided with housing on mine property.

Gorgas's recommendations on family housing could not be accepted but his remarks on overcrowding did have an effect in the long run. What was known as the 'Rand Mines hut' came to be generally accepted on all mines. This type of hut provided accommodation for no more than twenty men.

When he inspected the compounds Gorgas was told that overcrowding of the living-quarters could not be regarded as a factor in the spread of pneumonia since it had been found that the incidence of the disease was lowest in the old rooms in which were lodged the greatest number of occupants. The point that had been missed, and which Gorgas spotted at once, was that these old huts were the preserve of the old hands, men whose years of service entitled them to say where they wanted to sleep. These men had, of course, acquired a relatively high immunity.

Smaller huts, with fewer inhabitants, made for greater cleanliness. The sheer physical difficulty of cleaning the old huts had made conditions within them deplorable. The lack of cleanliness and the litter in sleeping-quarters drew Gorgas's strong criticism.

He was also critical of the standard food ration given the men in the compounds.

'I have never seen so large a proportion of the ration supplied by one article as is here supplied by mealie meal', he said. 'The two chief components of the daily ration are 2 lb of mealie meal and 6.85 oz of meat. This I think a great deal too large a proportion of the carbohydrates for men doing the hard, manual labour that the natives do.'

'A soldier's ration in the English Army is 16 oz of bread, 12 oz of meat and also an allowance of 3*d.* per day for vegetables and other articles. A miner does very much harder labour than the soldier. I think his diet should be at least as good. . . .'

His recommendations here had some effect and compound diet improved. Scurvy was very prevalent at the time though it was often not diagnosed as such by the mine doctors. Some believed scurvy to be an infectious disease. The role of vitamins was not generally known then. (See p. 142.)

Gorgas tended to favour a system by which labourers were paid a cash allowance and allowed to buy and cook their own food in the way they liked

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best. This had worked well at Panama, largely because the men had their wives and families living with them in their huts and the wives did the cooking. But it would have been completely impracticable on the mines. The system was tried for a time by the Municipality of Johannesburg in the feeding of its labour corps. But it was proved to have disastrous effects on the men, who bought virtually no food but used the money for other purposes.

Another aspect of the hygiene of the compounds that came under heavy criticism was the bucket system of sanitation, then in use not only on the mines but in many parts of Johannesburg.

Gorgas urged that water-borne sewerage should be installed in every compound.

His recommendations included one for a complete reorganization of the hospital facilities for the Bantu on the mines, and perhaps the most far-reaching was his proposal that there should be central control of both curative and preventive services.

‘You have on the Rand now some 54 mines, each entirely independent as to sanitation and the care of the sick’, he wrote. ‘Some 38 physicians are employed by these mines and each is doing the same work as the others. That is each man on his own mine has to do the surgery, the medicine, the pathological work, the sanitary work and the X-ray work. It is impossible for one man to be specially qualified in all these branches.

‘You have 62 hospitals, treating 2 150 patients. None of these hospitals is equipped or manned in a first-class manner. . . . The nursing force is made up of natives who have neither the intelligence nor the training for such work. All is being done, probably, that can be done under the present system of numerous small hospitals.

‘. . . If all the sick could be brought together in one hospital they could be cared for at less cost than in 62 hospitals. You could select the best qualified doctor among your present men and put him in charge of surgery. With such a service as he would have in the course of a few years he would become the peer of any surgeon anywhere and you would be able to give your employees as good surgical attention as the very wealthiest could command. You could afford to equip such a hospital with first-class surgical appliances of every kind at a less cost than the moderate supply at present given to the 62 hospitals now in use. The same could be done on the medical side. . . .’

Gorgas visualized a large, central hospital that would serve all the mines. He wanted all the medical services, curative and hygiene, staffed by full-

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time personnel and centralized under a head directly responsible to the Chamber of Mines and independent of the individual mine managements. He saw this 'head', or chief medical officer, as someone who would be responsible for all matters concerning the health and curative services affecting the Bantu mineworkers.

'If you had had, such a system for the past few years, with a sufficient force constantly devoting its whole time and attention to sanitation, you would have by this time reduced pneumonia to a minimum', he wrote. (In his vocabulary the word 'sanitation' denoted everything pertaining to the health and well-being of a community, in other words 'public health'.)

Another statement in the Gorgas report is worth quoting in full :

'The success of any system of sanitation which is more or less new to any locality will depend greatly upon the choice of the man who has charge of carrying it into execution. If he believes in it, if he has tact, is enthusiastic and persevering it will succeed. If he is discouraged by difficulties and opposition he will fail, even if the system is correct.'

These words are almost an epitome of Gorgas's own professional life.

The Surgeon-General's summing-up of the salient points of his report was as follows:

'Of these recommendations I consider that of increasing the floor space to about 50 square feet [per occupant] the most important and pressing, and by far the best way of doing this to be the village hut system and the introduction of families. If this important method cannot be carried out then to come as near to it as feasible.

'The second in importance I consider improvement in the hospital system and care of the Native sick. This can best be carried out by a central hospital. If a central hospital is not feasible, by such a concentration of hospitals as is possible.

'The third in importance is the establishment of a central Sanitary Bureau or Department under the Chamber of Mines, the head of this department to represent the mines on all sanitary questions.'

For reasons that were not made public the Chamber of Mines did not accept in full the recommendations in this report. One may surmise that most of the companies were not anxious to have officials of the Chamber telling them how to run their compounds and their hospitals. It also seems likely that, having survived one expensive miners' strike and been

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threatened with another six months later, they were in no mood to spend considerable sums on health measures without much prospect of having anything to show for their outlay.

However, the report, even though it was never officially accepted, marked a turning-point in the history of preventive medicine on the mines of the Witwatersrand. Gorgas's wise and practical remarks were circulated to all the mining houses and to some extent all of them acted upon his suggestions.

One group, Central Mining-Rand Mines (the Corner House group of companies), decided to implement his recommendation for a centralized health service, as far as this was possible, by establishing a health department at their head office and by appointing one man as medical superintendent to control all health services on their mines.

Since this was to lead to the appointment of full-time medical officers on thirteen of the group's producing goldmines, and since all the groups were to follow this example in the course of time, General Gorgas may almost be described as the founding father of the Mine Medical Officers' Association, though it was not formed until 1921.

Gorgas's proposal for one large, properly staffed, central hospital for all Bantu mineworkers was completely unacceptable to the Chamber of Mines, the only authority that could have brought it into being. In any case it was not a practical proposal even at that time when the mining areas were less widely spread than they are today.

The principal objections to the scheme were (a) the long haul of patients required even if virtually all of them came from the Central and West Rand mines, (b) the high capital cost of an institution that would have too short a life and was bound to shrink as mines closed down.

However centralization was feasible within each of the groups and was gradually brought about.

Today the best example of what Gorgas meant by centralization is Anglo American Corporation's Ernest Oppenheimer Hospital at Welkom. This serves all the group's mines in that area and structurally, in equipment and staffing is much superior to any mine hospital ever erected on the Witwatersrand. In fact it stands comparison with the best examples of public hospitals in South Africa and abroad. (See description of the hospital by Dr. J. H. G. van Blommestein on page 100.)

The Corner House group, having decided to 'go it alone' in carrying out

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Sir Almroth Wright, the famous British bacteriologist who developed the pneumonia vaccine for the immunization of Bantu mineworkers.

the Gorgas recommendations, needed someone who could take charge of the administration. They wrote to Gorgas, explaining what they hoped to do and asking him whether he could recommend anyone who would fully understand what he was driving at in his report and was capable of setting up and managing a health administration on these lines.

He wrote back warmly recommending a young doctor who had been on his staff for seven years—A. J. Orenstein, the same Orenstein who had acted as Evans's guide during his visit to Panama.

However, Orenstein was no longer on the Isthmus at that time. As a result of having attended an international congress on hygiene and demography in Washington, at which he was the official representative of the Canal Health Department, he had caught the eye of the German Colonial office. In 1913 he was appointed by the German Government to German East Africa (later Tanganyika and today Tanzania) principally to report on methods of malaria

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control in that territory. He was actually in Dar-es-Salaam while Gorgas was in Johannesburg.

The Corner House's invitation to him to come to Johannesburg and take up the position of medical superintendent of its mines reached him there in February 1914.

He had no hesitation about accepting this offer and said so. However, he realized that he would have to get a British qualification in order to work in South Africa and he also realized that the arrival of a young American, who had qualified at the Jefferson Medical School, Pennsylvania, U.S.A., in 1905, to take one of the top medical jobs in the country was going to put a number of noses out of joint. He therefore suggested that, to begin with, 'he should not be called 'medical superintendent' but that instead he should use the title he would have had in a similar job in the United States—Superintendent of Sanitation.

This was agreed. It was also laid down that he should be responsible only to the chairman of Rand Mines, Limited, who at that time was Evelyn (later Sir Evelyn) Wallers. This arrangement made him a sort of 'consulting medical engineer' and somewhat simplified the very difficult job that lay ahead of him.

In these days it seems absurd that a man with Orenstein's qualifications should have had to make a voyage to London to acquire the necessary British qualification. But, despite the fact that Britain, France and Germany were at war when he went to England in July 1915, this was all accomplished without delay, and he was soon back in Johannesburg surveying the field in which he was to labour for the next fifty years.

Someone ought to persuade Dr. Orenstein to write a detailed account of the difficulties he encountered when he first arrived on the Rand. It does not require much imagination to picture the consternation that must have prevailed in the medical profession when some of the leading practitioners on the Rand (who were also 'mine doctors') found that a young American of whom they had never heard was going to take charge of the entire Rand Mines set-up and tell them, his seniors by many years, what they had to do.

He had also to reckon with the mine managers, mandarins in their own right, who brooked no interference with the way they ran their mines. Mine doctors in those days were regarded by the mine managers as members of their administrative staff and subject to their orders, very much as ship's surgeons are subject to the orders of the captain of the ship.

Orenstein planned to alter that system and he also proposed to tell mine

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managers how their compounds were to be 'reformed'. He had a pretty shrewd idea of the ructions he would have to face for the first year or so. But he had not worked for Gorgas for seven years without learning how opposition to public health measures can be overcome. Also he had the great advantage of being responsible only to the chairman of Rand Mines so that he did not have to argue with the lesser fry. Sir Evelyn Wallers trusted him, listened to him and backed him up in everything he did.

But that was not the whole secret of how Orenstein got things done and got them done quickly. Very early in his career as Superintendent of Sanitation for the Corner House group he put the Indian sign on the Department of Mines and Industries. It would be wrong to suggest that he used occult methods or mesmerized the staff of the Government Mining Engineer. Let us say instead that he impressed them with the soundness of his views.

This meant that he could count on the Department's cooperation. So, when he had satisfied himself that a particular measure was necessary for the benefit of the Bantu mineworkers, he would explain what was required to the officials concerned and it would be drafted as a new mining regulation, applicable not only to the Corner House mines but to the whole industry—a very decisive method of getting reforms carried out.

And there was a great deal of room for reforms in those days. The so-called hospitals on most mines were structurally nothing better than the compound type barracks, except that the men in them slept in individual cots of various types instead of on the wooden shelves on which the fit men slept side by side in the compounds.

The nursing in these hospitals, such as it was, was carried out by Bantu orderlies often under the sole supervision of a compound manager. These orderlies were not trained even in the elements of nursing. They picked up what they could usually from the one white man whose job was the care of the sick. He was called the 'Hospital Superintendent'.

Many of these hospital superintendents had very little knowledge of nursing themselves, the best being those who had served as N.C.O.s in the Royal Army Medical Corps or as Sick Bay attendants in the Royal Navy.

There were no proper operating theatres in these compound hospitals, just rooms like any other in the barracks. These rooms had poor lighting, no steam sterilizers, no X-ray apparatus and just a few simple surgical instruments.

Whether the hospital was supervised by the compound staff or by one

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*Sir Spencer Lister, once a mine medical officer
and later Director of the South African
Institute for Medical Research.*

white hospital superintendent there was not a great deal that could be done for the patient under the existing conditions. Medication usually consisted of purgatives, stock cough mixtures and a few miscellaneous pills.

It may be added here that on most mines the room, or building, set aside as a hospital was surrounded by a man-proof fence and a locked gate—not to keep out visitors but to keep in the patients who were inclined to bolt for it if given half a chance.

The mine medical officers of the day were mostly employed on a part-time basis and, when they weren't visiting the mine, were busy general practitioners. In one or two cases the doctor who held the contract for a mine and was too busy in his private practice to do the mine work farmed out this work to young, newly qualified men.

There were times when the visitor got the impression that these 'assistants' were much more interested in the patients in the compounds than were their

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principals. Several of them became fulltime medical officers and rendered excellent services for many years. Some of them were among the founders of the Mine Medical Officers' Association.

It is self-evident that the hospital facilities and the medical and nursing services of those days can have been of little value in aiding the recovery of the patients. The high case mortality in these pseudo-hospitals is therefore not surprising.

The food provided for the patients, however ill they were, was the same as that provided in the compound—mealie-meal porridge, stewed meat and vegetables, bread. The patient either ate this or ate nothing at all.

The reason why milk and milk dishes were not provided for the seriously ill had nothing to do with the cost of milk or the difficulty of supplying them. They were not given to patients because the so-called experts on Bantu tribal laws and customs said that the men would not drink milk or eat milky food because milk is baby food and the adult males believed they would become unmanned if it formed part of their diet.

Despite this 'authoritative' pronouncement a milk diet was later provided for the seriously ill patients. They avidly drank milk and cheerfully ate the milk dishes provided. Milk in its various forms has been in general use in the diets of the mine hospitals ever since, some fifty-five years.

This, misleading opinion, and subsequent analogous advice by the 'native experts' which proved completely wrong, was to shake the faith of the medical profession in such *ex cathedra* statements, which thereafter were carefully tested before they were accepted.

The inadequacy of the medical attendance in the mine hospitals was not really the mine doctors' fault. It had begun as a part-time practice and stayed that way despite the steady rise in the number of Bantu employed. If the figures in the Gorgas report are correct the great mystery lies in the question as to how thirty-eight part-time doctors, getting from point to point in Cape carts, could possibly serve sixty-two hospitals on fifty-four separate mines and attend to their private practices as well.

In one of his first reports to the chairman of Rand Mines, Limited in 1914 Dr. Orenstein, in calling for full-time mine medical officers, said: 'We cannot escape the deduction that the medical officer's private practice is pretty sure to command the best efforts of the part-time medical officer. It is my own opinion that the "full-time" medical officer is entirely to be preferred to the part-time man. . . .'

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He pointed out that a mine medical officer's patients ranged from sufferers from pneumonia, enteric fever, tuberculosis, severe surgical conditions, etc., down to eye complaints, scratches and other minor ailments.

'It is assumed that the medical officer is an expert diagnostician and a good surgeon, a pathologist, eye specialist and sanitarian', he said. 'One might as reasonably assume that the mine manager is an expert mining man, mechanical engineer, architect, accountant, etc. There may be, and probably are, a few many-sided geniuses in the world but we cannot count on anything except an average.'

He then went on to say: 'It can be stated, as being beyond argument, that the average mine hospital is by far the least efficient part of the mine . . .', and went on to explain why in a few blistering sentences:

'The hospital buildings consist of cheerless and, not uncommonly, dilapidated wards either overheated, underheated or overheated in spots near stoves placed here and there. The beds are, in the majority of instances, bunks consisting of several planks nailed together and hinged to the wall. Looking at these beds I could not help thinking of the old saying about "being carried home on a door".'

'The bedding is a piece of felt or one or two cheap blankets—no pillow, no sheets.

'The white attendants are dressed in their street clothes. Their hands and fingers usually look as if they had just come in after doing a strenuous day's work in the garden.

'The black attendants defy description.

'The operating room is, in most instances, devoid of anything approaching adequate equipment. The equipment for doing ward dressings is so slight as not to be worthy of mention.

'It is with such a machine that the mine medical officer is expected to achieve efficiency. And he is expected to look after an average of 100 patients—in one case the number is as high as 352—some of whom require surgical operations, some of whom are suffering from more or less obscure diseases on which modern methods of diagnosis—blood examination, urine examination, examination of stools, bacteriological examinations—should be employed. One or two deaths may occur and the mine medical officer should then perform post-mortem examinations.

'In other words the mine medical officer must be a surgeon, a pathologist and, in addition, an expert on hygiene all rolled into one. And also, in the majority of instances, he must find time to attend to his private practice.

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‘If you or I required a surgical operation would we go to a man devoting most of his time to post-mortem examinations and garbage disposal? And if not, why not? Is it not because our common sense tells us that a man, in the nature of things, cannot be expected to be even reasonably expert in the many branches into which modern medicine is split?’

He urged the mining industry as a whole to modernize its hospital system so that it would no longer ‘have to plead guilty to the charge of providing eighteenth century hospital accommodation in the twentieth century’.

This powerful plea made a great impression on all who read it and Dr. Orenstein was given virtually a free hand to reorganize the entire Rand Mines health set-up. He went to work with a will and, in an amazingly short time, succeeded in changing the whole system as it then existed.

By the end of 1915 he had:

Set up a central sanitation and safety committee within the group and established similar committees on every mine.

Engaged Dr. W. Steuart to carry out all the radiography required and installed the necessary apparatus at Crown Mines Hospital.

Persuaded the board that water-borne sewerage should be installed in the compounds of all mines.

Began the remodelling of the sleeping accommodation in the compound rooms.

He had also established a laboratory, engaged a full-time sanitary inspector, the invaluable Alfred Gordon, and improved the cooking of the food in the compounds.

He had even found time to test the disinfectants that were used so lavishly in the compounds and underground and found that at least half of the R12 000 a year the group was spending on these products was being wasted. He recommended far less use of these antiseptics and far more use of soap and water applied with a mop. A standard for acceptable disinfectants was adopted and is in practice to this day.

All his findings, his statistics and his recommendations were published at the end of 1915 in a well-printed and well-illustrated annual report, which became an immediate ‘best-seller’ among the mining companies of the Rand and today is a valuable piece of Africana, if you can ever lay hands on one.

Photographs in this report showed the method of building and screening the separate bunks he recommended as sleeping accommodation in the

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compound rooms. Beginning at Modder Deep, at Crown Mines and City Deep, bunks of this type gradually replaced the old-fashioned sleeping platforms of wooden boards on which anything up to sixty occupants slept side by side.

This was Orenstein's most important reform in the early days and was to lead to such a striking reduction of the incidence of respiratory diseases that it was not long before all the mines followed his example.

Like Gorgas he had hoped to obtain centralization of all the hospital facilities of the Rand Mines group in a single, well equipped hospital. However, when he found that this was impossible, he settled for a satisfactory compromise by which the groups hospital services were centralized in four geographical areas.

The four main hospitals that emerged from this reorganization were: Crown Mines Central Hospital, City Deep Hospital, E.R.P.M. and Modder B hospitals—each serving not only the mine whose name they bore but also any other Corner House mine in the vicinity.

All these hospitals, as well as one or two mine hospitals of the old type that were still needed, were provided with modern beds and equipment, operating theatres, pressure sterilizers, surgical instruments and X-ray apparatus. Three central hospitals were structurally modernized and new ward blocks and other new buildings, such as the operating theatres at the E.R.P.M., Durban Deep and Crown Mines, were built.

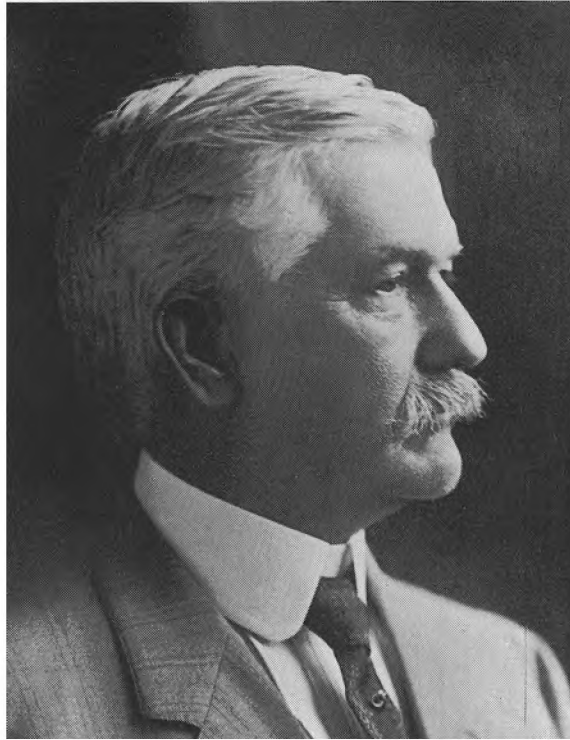
The wind of change that was sweeping through the health administration of Rand Mines became news. Everyone asked 'What will Orenstein do next?' The annual reports of the Rand Mines sanitation department became widely read documents.

By 1916 the group had decided to appoint full-time medical officers on all its mines. In 1917 the training of Bantu female nurses began in the Crown Mines Hospital. By the following year Bantu women and European matrons and sisters were employed in three central hospitals of the Rand Mines group and the training of Bantu nurses has continued ever since. (See page 149.)

There were many prophecies of disaster when Orenstein said 'We must have Bantu nurses—and soon.' But the fact is that this training scheme has been a boon and a blessing to public health not only in the mining industry but throughout the country.

In the middle of all these activities Orenstein joined the army—in 1916. This meant that automatically he forfeited his American citizenship, and he has never regained it.

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Surgeon-General W. C. Gorgas of the United States Army who visited the Rand at the invitation of the Chamber of Mines in 1913 to report on the administration of the mines' health services. He was later awarded the Nobel Prize for his work in improving the health conditions in the Panama Canal workers' camps and combating yellow fever.

In 1917 he was promoted to the rank of lieutenant-colonel. The following year he became a full colonel and was appointed Director of Medical Services. For his services to the Defence Force he was awarded a C.M.G.

One would have supposed that the arduous task of running the medical services of the army would have sufficed to keep anyone busy—but not Orenstein. From his office at Defence Headquarters he sent out a stream of directives to his staff in Johannesburg and his week-end leaves were devoted to visiting the mine hospitals and seeing that all was well.

No difficulty ever daunted him. If there was an obstacle that looked as

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though it might prevent him from getting his way lie either bulldozed it out of the road or went round it. But he always reached his objective—and nearly always got what he wanted.

In reporting to Sir Evelyn Wallers on the progress made during the year 1917 he was able to write :

‘It is very gratifying to note that the mortality from pneumonia is so steadily decreasing. From over 12 per 1 000 for the mines of this group in 1911 it has steadily fallen to 2·65 per 1 000 in the present year. The lowest previous record was 4·1 per 1 000 in 1914. The decline in mortality from all diseases and from accidents has also been steadily progressive and this feature is very encouraging.

‘The total mortality from all diseases for 1917 on the old mines [i.e. the existing mines of the group. The mines of the Neumann group, which had just come under the control of Corner House were the ‘new mines’] was 8·45 per 1 000 which seems nothing short of marvellous when compared with the over 31 per 1 000 of 1910.

‘The decrease in the deaths from accidents is also very gratifying—from 5·2 per 1 000 in 1910 to 2·94 in 1917. It is rather striking to figure these gains in terms of lives saved. With the mortality of 1910 prevailing in 1917 we would have lost approximately 1 907 lives. We actually lost 607 lives in 1917.’

Here it may be remarked that these figures might have been worse had not a typhus epidemic in the Union of South Africa been dealt with very firmly and efficiently.

Louse-borne typhus was probably endemic in the native territories for many years. However it was not regarded as a threat to the mine population until the latter half of 1917.

In that year the smouldering disease took on the form of an epidemic in the Transkei and Ciskei areas, in which extensive recruiting was carried out for employment on the goldmines.

As a protective measure a disinfecting station was established at Sterkstroom at which all recruits from the Cape were deloused and suspected cases retained. A second medical examination, including isolation of suspects and delousing, was instituted at the Witwatersrand Native Labour Association.

How serious the threat was to the mine population in that period is evident from the number of reported typhus cases in the territories, quoted by the Union Health Medical Officer, Dr. E. H. Cluver, at a meeting of the Pan-African Health Conference held in Johannesburg in November 1935. He said that in the period 1919 to 1923 an average of 8 000 cases a year were

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reported, with a peak of 11 000 in 1920. In the period 1923 to 1935, 34 986 cases were reported, with 4 665 deaths. In addition to the Cape outbreak, there were cases reported from Natal, O.F.S. and Transvaal. Dr. Cluver stated that by 1935 typhus was endemic in approximately half the total area of the Union.

During the height of the epidemic there were also about 700 cases with 32 deaths among the white population in the affected regions.

Faced with a population scattered in small groups over an immense area and a totally inadequate staff, all the Union Health Service could do was to attempt to disinfest at least those who were in contact with reported cases. Dr. Cluver's statement to the members of the Pan-African Health Conference that the health service was faced with a 'formidable proposition' was certainly no exaggeration.

It therefore fell to the mines' medical services to protect their population from what might have become a devastating experience, both medically and economically. Fortunately this was accomplished by the medical inspection and delousing station at Sterkstroom, through which all recruits from the Cape Native territories were passed, and by the delousing and disinfesting of the men and their belongings at the Witwatersrand Native Labour Association compound in Johannesburg.

Important also was the periodical disinfestation carried out on the mines.

The effectiveness of these measures was proved by the record that although cases of typhus occasionally found their way into mine compounds, there were but few cases infected by these. This was due to the vigilance of the compound staffs who promptly sent to hospitals all those showing symptoms such as fever.

Also remarkable is the fact that, although some typhus cases were treated in the general wards of mine hospitals, not one case of infection of other patients occurred, as most certainly would have happened had the delousing not been so meticulously carried out.

To praise the pioneer work accomplished by Orenstein is not to disparage the efforts of the medical men who had been grappling with the health problems of the Bantu mineworkers for many years. It must be remembered that Orenstein, fresh on the scene and with all the prestige of the Panama health organization behind him, was given powers such as no other mine medical officer had ever had before. He was backed by the chairman of the biggest and most successful group on the Rand at that time.

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The part-time medical officers of the earlier days had no such support from the companies they served.

There were only a few full-time mine medical officers in the Corner House group before 1915. The rest had to combine private practice with their visits to the compounds.

Part-time medical officers such as Drs. Donald Macauley, Louis Irvine and Andrew Watt had done pioneer work in drawing attention to the evil of silicosis at a time when some influential chairmen and directors of mining companies tended to 'sweep it under the rug'. The W.N.L.A. doctors, W. H. Brodie, George Turner and, later A. I. Girdwood, were all outstanding men.

Andrew Watt was the first man in the world to use mass radiology for the purpose of a large-scale investigation to ascertain the prevalence of silicosis. He X-rayed the lungs of 326 men and demonstrated the hazard of silicosis as far back as 1911. In 1907 Macauley and Irvine had testified before a government commission that silicosis was prevalent and was a very grave problem which the mining industry had to face. They helped to lay the foundation of long-overdue legislation and also started the research work which expanded to become the world's most consistent endeavour in combating silicosis extending over more than half a century—and continuing.

Since those days mine medical officers' chief contribution to the work done on the problem of silicosis has been their day-to-day medical examination of Bantu recruits and periodical examination of Bantu, plus an additional examination at the end of the men's term of employment. This has developed expertise probably unmatched in volume and quality anywhere else.

Until Dr. Orenstein introduced the training of female Bantu nurses under white matrons and sisters at Crown Mines in 1917 it had been considered out of the question to employ women in mine hospitals. However, the shortcomings of the existing system and of the employment of hospital superintendents and Bantu male nurses who were largely untrained were apparent to all.

Early in 1914, the Chamber of Mines Medical Officers' Committee, in an attempt to improve conditions, appointed a sub-committee consisting of Drs. W. Adam, A. Frew, T. M. Frood, S. F. Lister and A. M. Watt to draw up the draft syllabus of a two-year course for superintendents to be followed by examinations to be instituted by the Transvaal Medical Council and conducted by an examining board that would include one or more mine medical officers.

This subcommittee said that it was unable to recommend any training

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scheme for the Bantu hospital attendants, most of whom were illiterate.

After the formation of the Mine Medical Officers' Association the training of the men who are today classified as Bantu hospital orderlies was put under its control as regards the syllabus and examination for certificates of competence. These are issued by the Chamber of Mines on the Association's recommendation. For a description of the mine medical officers' part in training these men see page 61.

The Orenstein plan for the training of Bantu women as nurses ran into heavy opposition, not least of which came from the nursing profession of the day, surprising as that may seem. But this was a subject on which he was not prepared to argue. There had to be female nurses in the mine hospitals and there had to be white sisters to train them—and there were.

The training scheme at Crown Mines, when it was working satisfactorily, was extended to the other mine hospitals. There was no lack of recruits and from that day to this they have flocked to the hospitals in the hope of being accepted for training.

The innovation was so obviously successful that it was adopted by public hospitals as well. Today it is impossible to imagine how the hospital services functioned before the Bantu nurse came upon the scene.

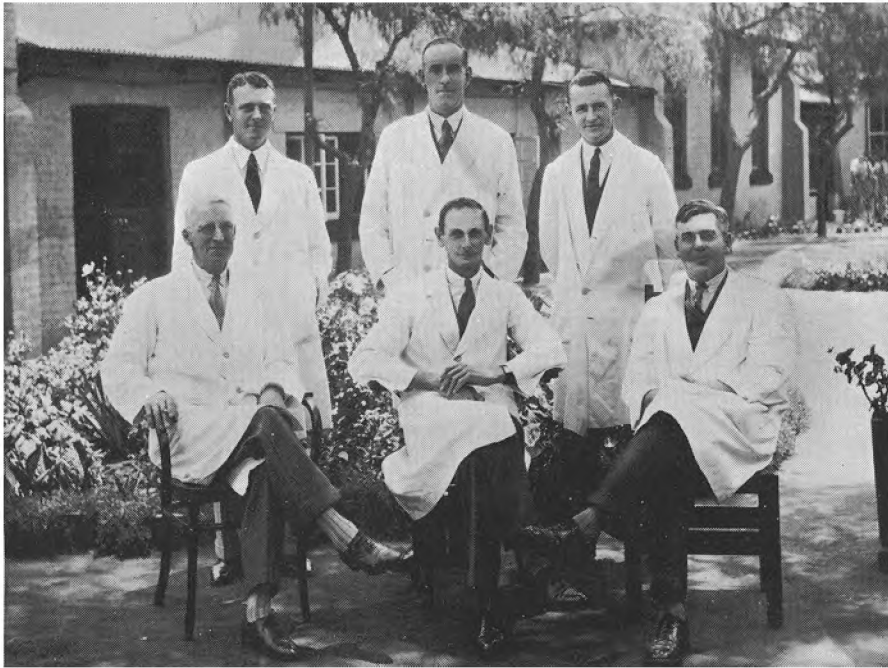
Dr. Orenstein, who had the courage to say 'this must be done', will be remembered as the father of the Bantu nursing services in South Africa. The cheerful and efficient Bantu female nurses probably did as much for the recovery of the patients in the mine hospitals as any of the more prosaic reforms.

When things returned to normal after the end of the First World War (the Armistice was signed in November 1918) there were between fifty and sixty medical men serving as mine medical officers of whom the majority still held part-time appointments. They were represented, as far as they were represented at all, by a Mine Medical Officers' Advisory Committee that appears to have been brought into being by the Chamber of Mines about 1904 when it was called a 'Mine Doctors Committee'.

It is not quite clear whether it was then an appointed body or an elected one and it seems to have met only at irregular intervals.

Some of the full-time medical officers appointed after the war felt that this committee was a somewhat ineffective body. A number of them had served in the Royal Army Medical Corps and as a result probably felt the lack of a centralized organization patterned to some extent on the close-knit structure of the Corps.

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The medical staff of the Witwatersrand Native Labour Association, Johannesburg, in 1932. All these medical officers were subsequently Presidents of the Mine Medical Officers' Association. They were:

Standing: Dr. F. Retief, Dr. H. J. Brady, Dr. J. S. Lawrie.

Sitting: Dr. P. Watkins, Dr. A. I. Girdwood, Chief Medical Officer, Dr. J. F. Young.

They felt the need for co-ordination and a central establishment to which they could refer for advice on matters of which they had no experience, or to which their recommendations could be put to be assessed by members of their own profession rather than by mine managers and engineers.

These views, not in any way revolutionary ones, were admirably set out in a letter that Dr. Harold Thomas Hayward Butt, a Cambridge graduate who at that time was chief medical officer in the Johannesburg Consolidated Investment Company, wrote to Dr. Orenstein in November 1920. He said :

‘I have been thinking over the status of the Medical Officers’ Committee of the Chamber (of which you kindly elected me chairman) and there are several aspects which, I think, need improvement and expansion.

‘I take it that all medical men who undertake native work have a triple function. Firstly to provide the best treatment possible, secondly to maintain the physical standard of labour and thirdly to promote recruiting by estab-

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lishing confidence in the native mind that he will get a square deal when sick or injured during his contract.

‘Such powers make us an important factor in the success of the industry as a whole, a fact that has been forcibly impressed on me during the few months in which I have been endeavouring to establish order out of chaos in medical matters here. . . . And yet the medical administration of the mines as a whole is entirely individual, is uncontrolled and sometimes haphazard and there is no corporate body of appeal or reference except our somewhat ambiguous committee.

‘This is not business; we can discuss anything and recommend anything but we lack vitality simply because those whom we represent are not in touch with us and their wants and worries do not reach us except by chance. I cannot see that we justify our existence by meeting now and then and compiling carefully worded circulars which, except with the small minority of whole-time officers, are soon filed and forgotten. We may mean well but it is a pathetic apology for practical administration of so huge a section of the industry.

‘What is needed all along the Reef is centralization and control of all matters pertaining to the health and life of the mine labourer. What has been done at the Corner House should be expanded and improved so that each mining house can ‘nurse’ its native labour and thereby maintain its success. Without some such scheme it is unavoidable that, here and there, a particular mine or mining house will suffer through inadequate or careless treatment of the native.’

He went on to say that, if they could get some concrete association that would be part and parcel of the Chamber and responsible to it, ‘we could then bury our committee and be able to look to a central administration in all doubts and difficulties in addition to keeping pace with the advances of clinical science. . . . There should be an official medical department with whom the leaders of the industry could discuss the many matters well known to us with which at the moment they cannot be adequately acquainted. . . .’

Orenstein in his reply told him that he was advocating just the sort of organization that General Gorgas had favoured.

‘In fact the original intention in connection with my employment here was that such an organization should be built up’, he wrote. ‘But I understand there was so much opposition from the other groups—stimulated, I am

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informed, by medical men—that before my arrival the plan was abandoned and Rand Mines Limited decided to carry out General Gorgas's recommendation for themselves alone.

‘It may be that conditions are different now and that your idea could be carried to a practical fruition but I am not too hopeful about it. . . .’

The Medical Officers' Committee to which both Orenstein and Butt referred in this correspondence was an advisory body, appointed by the Chamber, which rarely met. At about this time it changed both its character and its name and became the Group Medical Officers' Committee, to which all the groups were invited to nominate representatives who, it was presumed, would be their senior medical officers.

In 1920 the members of this short-lived committee were:

Anglo-French Exploration Company: Dr. G. B. Stoney
Central Mining-Rand Mines: Drs. A. J. Orenstein, A. Frew
Consolidated Mines Selection (forerunner of Anglo American Corporation) : Dr. J. K. Muir
Johannesburg Consolidated Investment Co: Dr. H. T. H. Butt
New Consolidated Gold Fields: Dr. R. L. Kidd
Union Corporation : Dr. A. W. Goldsmith
Witwatersrand Native Labour Association : Dr. A. I. Girdwood

This committee met as such for the first and last time on 9 February 1921. It was referred to later by Dr. Butt as ‘a curious body . . . that met rarely and accomplished nothing’.

In the meantime Drs. Orenstein, Girdwood and Butt had met to discuss informally the possibility of establishing an association that would represent all mine medical officers. The upshot was a meeting, held under the aegis of the Chamber of Mines, of everyone who was interested. This took place on 3 March 1921, and it was then decided to form a body to be known as the Mine Medical Officers' Association. This title was later changed to Transvaal Mine Medical Officers' Association and many years later changed back again to the original title since by that time there were many members at work outside the Transvaal, notably in the Orange Free State.

At the first general meeting of the Association, at the Crown Mines Native Hospital on 12 April 1921, a draft constitution was presented and adopted with some minor amendments. It set out two of the principal objects of the Association thus :

To study and discuss all problems of special interests relating to the work of mine medical officers.

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To promote and foster friendly intercourse and the exchange of views among members of the Association and with other organizations connected with the mining industry.

At this meeting it was agreed that the proceedings of the Association should be printed and made available to all members. The first officers elected were:

President : Dr. H. T. H. Butt

Vice-President : Dr. A. J. Orenstein

Hon. Secretary and Treasurer : Dr. A. I. Girdwood

Members of the Executive Committee in addition to the above :

Drs. S. A. Hawarden, S. Donaldson, A. Frew, A. B. Dodds,
A. Black, F. J. Allen, A. J. Smith, E. L. Ferguson, L. E. Hertslet.

In the year that it was formed there were 50 members. Twenty-five, years later there were 104 members of whom 11 were honorary members. Branches of the Association were later to be established at Witbank and in the Orange Free State.

The annual subscription to be paid by members was R1.05 (the traditional half-guinea). It was obvious that the Association could not exist on the income provided by these subscriptions, particularly since it was estimated that the cost of employing a shorthand writer would be at least R360 a year. It was decided, therefore, to ask the Witwatersrand Native Labour Association and the Native Recruiting Corporation for grants. These two organizations agreed to subscribe R360 a year between them. A few years later they increased this joint subsidy to R500.

The grants have since been considerably increased and, with this assistance, the Association's proceedings have been published without break for fifty years.

They form an invaluable record of observations made, clinical procedures applied and the general treatment of a very large body of men. There is probably nothing quite like this continuous medical record of such a large group of a unique category, migratory mine labour of the age group 18 to 35, anywhere else in the world.

It cannot be said that the Association has ever been an expensive body to run for, apart from the steadily increasing cost of printing and publishing its proceedings, its expenditure has been minimal. It has no headquarters of its own, no permanent officials and no office equipment to write off. Its meetings were held either at mine hospitals or in premises provided by the Chamber of Mines or one or other of the mining companies.

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Today the Association's balance sheet shows income of approximately R4 500 against expenditure of R3 600. Subscriptions now total more than R3 000 and grants from the N.R.C. and W.N.L.A. R 1 000 a year.

The Association's assets, after fifty years, total only some R3 000.

It will be observed that Hayward Butt, who is to be regarded as the founder of the Association, had originally hoped that it might be possible to achieve complete centralization of the medical services for all mines. However those who were in close touch with the Chamber thought that it would be pointless to make such a recommendation. It was decided that the practical course would be to form an association which would be recognized by the Chamber as the authoritative voice of the mine medical officers as regards the policy of hygiene and medical services.

'As is often the case, Butt, and those who wanted a centrally controlled, co-ordinated medical service had to accept a compromise', says Dr. Orenstein, who is the sole surviving member of the original executive committee.

'The clause in the Association's constitution which reads . . . "to co-operate in solving administrative and other problems confronting members . . ." is a fairly clear indication of what the founders hoped to retain from the original proposal of a coordinated service', he adds. 'Looking back I think that the compromise has worked fairly well.'

The Association has certainly served one of the primary purposes for which it was founded—to act as a clearing-house of information gathered in the course of practice among Bantu mineworkers. It has never been what might be described as a 'talking shop', but at the same time there is no subject that affects the health of these men that has not been thoroughly discussed at one time or another.

As far back as 1924, three years after its formation, the *South African Medical Record*, which at that time was a privately owned journal that had no connection with the official body, paid the Association this tribute:

'We know of no medical society with so small a membership that has done such sound and, in some cases, brilliant work and which, apart from the strictly scientific side, has effected so much for the people with whom its members are principally concerned : the Natives. It might, indeed, almost as well be called 'Association for the Study of Medicine and Surgery in the Native Population' and therein lies its main *raison d'être*.

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*Scene in a ward in an early hospital for White miners on the Witwatersrand.
Note the gas jet above every bed.*

‘The vast field of interest afforded by our teeming Native people was, prior to the formation of this Association, practically untouched. Now a commendable beginning has been made with the work of tilling this field and the results, if the work is continued, may be of incalculable value.’

There was more to it even than that. The mine medical officers, the orderlies they had trained and the Bantu women who took up nursing, did a wonderful job in teaching the mineworkers that they had nothing to fear from submitting themselves to treatment by white doctors in mine hospitals. This was important because many of these men went back to their villages to spread the word that the white man’s medicine was good.

It must be remembered that the witchdoctors, and their incantations to the spirits of departed ancestors, were a powerful influence in these people’s lives. Treatment for any ailment by these medicine men was accompanied by loud noises, stamping of feet and other ceremonies calculated to terrify the patient so that a ‘visit to the doctor’ in the tribal areas was a very trying business. Beyond occasionally muttering words beneath their breath and

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*A doctor of the old school mounted for his rounds in a Reef town, circa 1905.
In those days there were doctors who combined private practice and work as district
surgeons with part-time appointments as mine doctors in charge of Bantu patients.*

wearing a white robe mine medical officers were comparatively formal in their behaviour. They did not dance round their patients and spit in the dust. What was even more impressive was that there was no charge for their services—though this did suggest to some that their ‘muti’ could not be much good since it was free!

It has already been pointed out that, in the early days of gold-mining on the Rand, it was necessary to build high fences round all compound hospitals to keep the patients *in*. It took years of patience and sympathetic treatment to put an end to that state of affairs.

Today the fact that there are tens of thousands of men in the wilds of Africa who have some idea of what proper hospital treatment means is proving a boon and a blessing to the medical services of the continent. Nevertheless the witchdoctors are still in practice and applications of hippopotamus fat are still failing to mend ruptured appendices.

Among the many subjects discussed at the Association’s earliest meetings

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was the real problem of what to do when permission to operate was refused in cases where lives were at stake. The legal position being what it was there was no answer to this question and even a regulation gazetted in 1943 that empowered native commissioners to give such permission where an operation was considered vital was of little help in an emergency.

Thus mine medical officers often found themselves in the dilemma that is fully described in a report in the Proceedings in May 1921. Dr. S. A. Hawarden was asked at a meeting what had happened to him.

The Chairman: You had rather a painful experience, didn't you?

Dr. Hawarden : Yes. I operated with the consent of the patient but without the consent of his relatives.

The Chairman: Will you tell us about it or would you rather not?

Dr. Hawarden said that, on a Monday, a very bad abdomen case came into hospital. The position was explained to the patient who, through an interpreter, said: 'Do what you think best.' Help was obtained and the operation took place in the afternoon. The condition of the patient was very bad and the next day the compound manager came in and said there was a row in the compound because of the operation. The compound manager added that he hoped to Heaven that he (the Native) would not die.

He (Dr. Hawarden) said he was afraid he would, whereupon the compound manager said: 'Oh, Lord! Then there is trouble coming' (laughter).

Two days later the patient unfortunately died and then the trouble really began. The compatriots of the men refused to go to work or to bury the body. They would do nothing. Dr. Hawarden was asked to go to the compound and talk to them. He argued with them for about half an hour and then left.

Here let Dr. A. J. Orenstein take up the story.

'I was telephoned late that night by Mr. H. M. Taberer, Native Labour Adviser to the Chamber of Mines, who asked me to come out immediately to Modder B mine.

'There I found the Bantu mineworkers in a sort of natural amphitheatre with the mine manager, the compound manager and Taberer facing them. Taberer then introduced me as the 'Big Boss'.

I asked the men's spokesman what we could do that would satisfy them. The spokesman then made quite a speech to the meeting. He then

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announced that what they said was that their law demanded that the man who had been responsible for the death of the sick man should take over the widow or widows of the dead man and all his children.

‘This would have been an awkward predicament for poor Hawarden who had, as far as I can remember, a family of nine children of his own at the time.

‘However something had to be done to pacify the men and at that moment I had a brainwave. I asked Taberer to suggest to the men that we agreed with the wisdom of their law but that *our* law was that a white man could not marry a Bantu Woman. We therefore proposed that they accept a cash payment for the widow—a sort of “lobola”. They said that this was just and they would accept the proposal. I think the amount agreed upon was R70. And then we all went home at 2 a.m.’

Dr. Orenstein was subsequently to introduce Mr. Taberer, at a meeting of the Association, as ‘the man who saved you from marrying your patients’ widows’.

Nothing better illustrates how rapidly the Association got down to business in the year of its birth than the list of the matters that were discussed at the monthly meetings held under Butt’s chairmanship in 1921. To deal with some of these subjects specialists were asked to lecture. On others members of the Association read papers which were later discussed, sometimes quite heatedly.

The first paper of all, an important one, was on the treatment of scurvy and was read by Dr. Orenstein. After this came, as we have seen, a discussion on the vexed question of obtaining permission for surgical operations. Other subjects that followed in quick succession were: the treatment of cerebro-spinal meningitis (following a paper read by Lister), degrees of disability caused by injuries at work, sepsis, the diagnosis of silicosis and tuberculosis (paper by Dr. W. Watkins Pitchford, chairman of the Miners’ Phthisis Bureau, and Drs. L. C. Irvine and J. M. Smuts of the Bureau staff), intravenous infusion of vitamin C in cases of scurvy, early treatment of injuries, first aid training, and plague prevention.

These were the main subjects. There were many others, as well as a number of interesting cases discussed at clinical meetings. Clearly the Association got off to a flying start.

Those were the days before the appearances of the sulpha compounds and antibiotics. Sepsis was a great hazard and its prevention a perpetual preoccupation of mine hospitals. A symposium on this subject was held at

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one of the earliest meetings (May 1921). This was opened by Dr. A. Frew and led to a discussion in which a large number of members took part.

From these and subsequent discussions came a series of recommendations that were forwarded to the Chamber of Mines as representing the considered opinion of the majority of mine medical officers. Very largely these recommendations are now standard practice on all mines.

The most important of these was the proposal that boss boys and police boys on all mines should receive training in first aid and be paid a monthly bonus once they were qualified. Broadly the scheme suggested was one then already in force on the Modder East Mine, by which boss boys and police boys, trained in first aid, were each made responsible for seeing that all injuries in the groups of some 200 men under their care were properly treated and recorded.

It was also recommended that suitable first aid dressings should be carried by all white miners and all boss boys and that mine medical officers should be made responsible for all first aid arrangements. Further, it was proposed that a simple but satisfactory routine for the treatment of *all* minor injuries should be introduced and the formation of first aid classes encouraged.

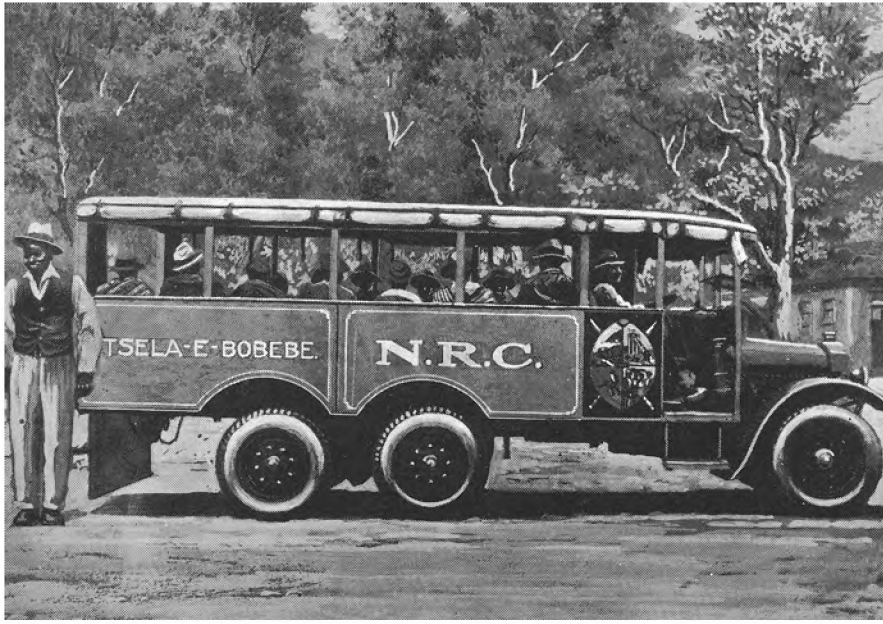
All this arose because the men often neglected minor injuries until they became septic, and septic wounds of various descriptions were a very serious cause of lost time and, let it be added, of pain and suffering.

Prompt treatment of all injuries continued to occupy the minds of members of the Association for a very long time. It required the co-operation of mine managers and underground officials and this was an administrative Rome that could not be built in a day.

Forty-seven years ago, in June 1923, the Association arranged a symposium on this subject. It was attended by every available mine medical officer, by senior mine officials, by the Chamber of Mines' official First Aid Organizer, Mr. A. M. Anderson, and the managing secretary of the Rand Mutual Assurance Company.

The symposium was opened by Dr. L. E. Hertslet, who reviewed the history of first aid and early treatment organization and proposed several measures aimed at improving this service. Mr. Anderson, who was among the speakers, said that when he had begun his work as a first aid trainer in 1912, there had been a great deal of opposition to the proposal that Bantu mineworkers should be taught first aid and that opposition had persisted right up to 1920.

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A very early motor conveyance used for carrying Bantu recruits for the mines to the railhead.

It was resolved at the end of the discussion to record, and report to the Chamber of Mines—

‘That the Association fully realizes the value of training native mineworkers in First Aid and recommends the full development of the scheme and the formation of a joint committee representative of the organizations concerned in this matter.

‘That any recommendations made by the joint committee be brought to the attention of the Prevention of Accidents Committee, the Association of Mine Managers, company managers and the Hospital Superintendents and Attendants Association.’

It should be added that at the Association’s annual meeting in 1923 the President reported, with much appreciation, that all the recommendations made by the Association to the Chamber of Mines, to the Witwatersrand Native Labour Association and to the Native Recruiting Corporation had been favourably received and acted upon.

The meetings in the months of September, October and November that first year were largely devoted to a discussion of the very difficult problem of diagnosing correctly tuberculosis and silicosis, and the exact significance of lung crepitations.

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Tuberculosis, even at that early date, had begun to worry mine medical officers. Having diagnosed the disease in a mineworker was it right that they should send him back to his kraal to spread the disease? (See chapter on Tuberculosis, page 125.)

Much time was taken up at all meetings in discussing reported advances in diagnosis and treatment. A number of these are recorded in the chapters dealing with specific diseases.

As far back as December 1923, Dr. A. J. Orenstein reported the use of oral prophylactic vaccine against typhoid, as developed by Besredka at the Institute Pasteur. It had been used on several mines and appeared to have some value. But in the end it proved to be inferior to the orthodox vaccination by injection.

In that same month, at the meeting on 21 December, Dr. S. Donaldson gave what was surely an historic demonstration. He demonstrated the technique of treating scurvy by the intravenous administration of sterile orange juice.

This most successful treatment was originated about that time by a pediatrician in New York. In these days when scurvy is almost a forgotten disease, and synthetic vitamin C is readily available, it is no longer of importance. But for anyone who may want to study the technique of the preparation and administration of orange juice it is fully described in the December 1921 number of the Proceedings.

At the same meeting the diagnosis of early lesions of tuberculosis was discussed in papers presented by Drs. A. I. Girdwood and J. F. Young, both of the W.N.L.A. Dr. Boigelot, a visitor from the Congo, participated in the discussion.

One other important action by the mine medical officers in 1921 was their approval of a letter drafted by their Executive in which was urged the establishment of a central board at the Witwatersrand Native Labour Association's hospital to which could be referred all cases of compensation for accidental injuries that presented difficulties in ascertaining the degree of disability. The letter was then sent to the Chamber of Mines, which promptly took the necessary steps to set up such a board.

The first attempt to organize training of male Bantu hospital orderlies appears to have originated with the Association of Hospital Superintendents and Assistants. They submitted a scheme of training to the Chamber of Mines in August 1918. The Chamber, acting on the advice of the 'Medical Officers Committee', recommended the scheme to mine managements in a letter dated 14 August 1918.

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The principal recommendations were :

Three years of hospital work, during which instruction was to be given by the white nursing personnel and the mine medical officers.

At the end of the training there was to be an examination by mine medical officers. Those who satisfied the examiners would be granted a certificate of competence on the authority of the 'Medical Officers Committee'. The scheme failed for want of suitable trainees.

In July 1922 Dr. H. Butt presented a memorandum to the Mine Medical Officers' Association in which, *inter alia*, he wrote that most of the men employed as hospital orderlies were 'drifters' who stayed only a few months and . . . 'I have been deeply impressed by the fact that there is no machinery whereby the hospital orderly may acquire even the simplest training'. Dr. Butt went on to say that nevertheless there were even then serving in mine hospitals a few men who could probably be trained. He therefore proposed that men sufficiently literate and intelligent should be selected for training. He thought that the theoretical part should be given by mine medical officers, and practical nursing by qualified nursing staff members. A detailed syllabus of training should be devised by the Mine Medical Officers' Association, covering a period of three years of training. Those who completed satisfactorily the training and passed an examination conducted by authority of the Mine Medical Officers' Association should be granted a certificate of competence, and a badge to be worn on duty.

Based on Dr. Butt's proposal, the Executive of the Mine Medical Officers' Association submitted, in August 1922, a detailed scheme of training to the Chamber of Mines, which was approved in October 1922. In November the Executive of the Association appointed a subcommittee to implement the scheme: Drs. H. Butt, C. B. Stoney and A. J. Orenstein (Chairman). Training was to commence in January 1923. *Handbook for Native Nursing Orderlies* by Dr. Butt was published in June 1924 as the official manual for this training course.

Unfortunately no suitable trainees were found, and training limped along very badly.

Through the following years many changes were attempted in the scheme of training. For example, in 1927 the Mine Medical Officers' Association proposed a scheme, the salient points of which were that formal classes should be abandoned; that hospital orderlies who completed a minimum of one year of service, and whose aptitude, literacy and character were

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vouched for by the mine medical officer concerned, should be eligible to sit for an examination prescribed and conducted by the Association, the successful trainees to receive a certificate and badge.

In 1936 a further downward revised curriculum was recommended. This also failed to attract suitable trainees.

In January 1947 a revised edition of Dr. Butt's *Handbook* was published. This subsequently became somewhat outdated, and in 1952 it was decided that a widely used nursing manual—*Nursing*, by Miss Ruth A. Bagot—supplemented by *Nursing Manual for Native Orderlies*, written by mine medical officers E. T. Clifton and L. E. Miller, assisted by the matron of the Crown Mines Native Hospital, Miss Davies, were to become the approved texts.

In 1954 Dr. L. S. Williams suggested that an attempt should be made to train suitably qualified orderlies for registration as 'Male Nurses' by the South African Nursing Council. This was discussed, and in the event left to the discretion of individual mine medical officers, inasmuch as it was only possible to offer such training in hospitals specifically approved for this purpose by the Nursing Council.

Training of nursing orderlies was finally stabilized in two categories, respectively A & B. To be accepted for training in category A, it was necessary for the candidate to have passed at least school Standard VIII or its equivalent. For category B the minimum requirement was Standard VI which was later amended to 'ability to read and write one of the official languages'. Trainees who have satisfactorily completed the prescribed courses are examined by examiners appointed by the Mine Medical Officers' Association. Those successful receive the appropriate certificate.

Subject to compliance with the prescribed conditions, orderlies in possession of the appropriate mine certificate are eligible to sit the Nursing Council's examination for State Registration as Enrolled Auxiliaries.

At the date of writing 1 554 have obtained B certificates and 130 A certificates.

One of the big events of 1924 was a conference, arranged by the Association, on the precautions to be taken to prevent the threatened introduction of plague on the Witwatersrand. It was a subject of particular interest to mine medical officers because their responsibilities included keeping a watchful eye on very large areas of open land, inhabited by rodents that could very easily become plague carriers.

Among those who attended this conference were: Dr. Haydon, of the

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Union Health Department and the following Medical Officers of Health: Drs. Milne (Johannesburg), Moller (Germiston), Morton (Boksburg), McNeil (Benoni), Coats (Springs), and Drs. Wallace and Pijper.

The chairman, Dr. S. Donaldson, referred to a round-table discussion of the menace of plague, held earlier by the medical services of the Rand Mines group, at which anti-rodent measures were decided upon and were being carried out on the mines of group. Trapping, poison baits, the gassing of burrows in the veld and rat-proofing of buildings had been instituted.

Dr. Butt reported on similar measures on the Johannesburg Consolidated Investment properties at Randfontein.

Dr. Haydon described the anti-rodent work carried out in the veld by the Union Department of Health and exhibited specimens of the various rodents found to be carriers of plague. All the other participants took part in the discussions and reported on what was being done within their areas.

The conference helped towards an intensification of the anti-rodent campaign. That the measures taken were effective is proved by the fact that, though infected rodents were found and are still found from time to time, no outbreak of plague has occurred on the Witwatersrand in the last forty-five years.

However that there was need for such measures was shown by the statistics produced by the mine medical officer of a mine within 5 miles of the centre of Johannesburg. He said that his rodent-exterminating team (which consisted of one white phthisis sufferer and four Bantu mineworkers) had accounted for:

- 16 432 rats
- 36 dogs
- 69 meercats
- 2 swarms of bees.

The bees, it appeared, were not suspected of carrying plague but were found guilty of having stung the anti-rodent officer.

Up to 1934 the growth of the Association was slow. In that year, at 31 March, the membership consisted of 34 medical officers on goldmines, 6 members on the staff of the W.N.L.A. hospital, 5 members of the Witbank branch (collieries), 5 associated members, 6 honorary members and 11 not included in any of the above categories—67 in all. From then on, as new mines were opened up on the Far West Rand, in the Klerksdorp district and eventually in the Orange Free State, and in the Bethal district, there was to be a great increase in mining activity with a corresponding increase in the

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These men are recruits for work on the goldmines at one of the out-stations of the Native Recruiting Corporation.

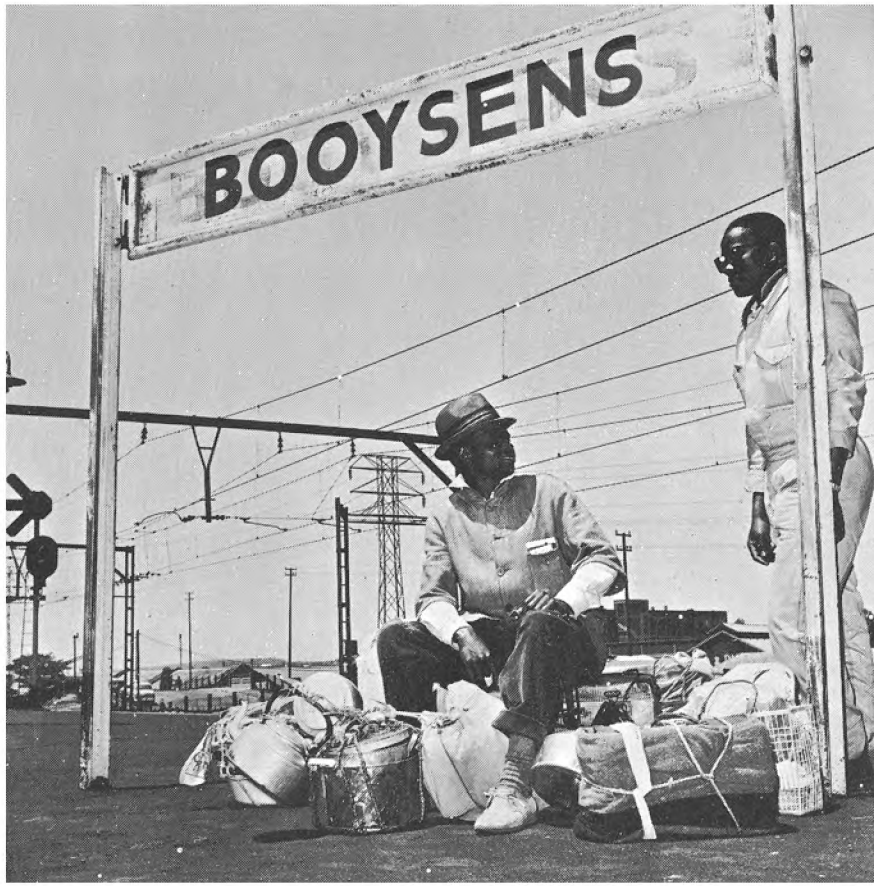
number of hospitals built and of mine medical officers appointed.

However, more important than numbers was the growth in prestige. The Association had started life as an organization that was virtually unknown outside the mining companies. The excellent work its members were doing, not only in the mine hospitals but also in their teaching of first aid, had begun to build it a reputation.

‘Our Association is still in its infancy and the majority of its members have passed through difficult times’, said Dr. J. H. G. van Blommestein in his valedictory address at the end of his presidential year in June 1938. ‘This Association has still to outlive the stigma applied to its members viz.: “He’s only a Kaffir Doctor”—though very little was accomplished in the days of the part-time medical officer, whose duties as far as one can ascertain were principally to sign death certificates. . . .

‘Our medical organization today consists of whole-time medical men who intend to make this subject their life work and I feel confident that the “Kaffir doctor” will outlive the stigma that was placed upon him in the past and emerge triumphant to find a place in the realm of scientific medicine.’

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Homeward bound after nine months' work on the Rand.

There was keen resentment of this phrase 'Kaffir doctor' among members. One member of the Association described it as 'our unevolved colleagues sticking their tongues out at us and calling us Kaffir doctors . . .'. However, by 1938 this disrespectful description had passed from the vocabulary of even the most ancient surviving practitioner on the Reef and the short title, 'M.M.O.', was in general use.

In replying to a speech by Dr. A. O. Dreosti of City Deep, at the annual banquet in April 1940, Mr. P. M. Anderson, chairman of Union Corporation Limited and President of the Chamber of Mines that year, paid the Association the highest compliment it had received to that date. Dreosti had said, rather wistfully, that he hoped some day the medical service of the goldmines might attain the same recognition as some of the other depart-

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ments of the gold-mining industry occupied in the mining world. Mr. Anderson said:

‘You, Mr. Chairman, have expressed the hope that some day the medical services of the goldmines may attain the same high position of efficiency in the medical world as some of the other departments of the gold-mining industry occupy in the mining world.

‘May I say that in my view you have arrived. To use a racing phrase: You have caught the judge’s eye and are no longer among the “also rans”.’

During the presidency of Dr. A. W. Goldsmith in 1937 the Association very successfully organized a course in industrial medicine which ran from March to September that year and comprised no less than forty lectures at sessions of from two to five hours.

A very wide range of subjects was covered, ranging from an ‘Outline of technique of Mining and Recovery of Gold’, by S. N. Hoffenberg, and ‘Ethnology and Customs of Native Races’, by Rev. H. P. Junod, to ‘Hospital Organisation’, by Dr. Orenstein, and ‘Anaesthesia : Methods Applicable in Mine Native Hospitals’, by Dr. B. Weinbren.

Certificates were awarded to mine medical officers who attended an agreed minimum of the lectures. One of them, Dr. A. W. Daubenton who acted as the Association’s official observer, attended all forty!

The development of the sulpha drugs and their dramatic success in the treatment of pneumonia and meningitis (fully described in the chapter on Pneumonia, page 122) was, of course, a milestone in the history of the Association. The story of how the first large-scale test of M & B 693 (2-sulphanilyl-amino pyridine) came to be carried out on the Witwatersrand is well worth recording.

The drug was discovered in the laboratories of May & Baker Limited early in 1938. Experiments on mice carried out by Dr. L. E. H. Whitby showed a significant reduction of mortality, and after his results were published in the *Lancet* tests were carried out on pneumonia patients in Bart’s and the Dudley Road Hospital, Birmingham.

On 1 June 1938 Dr. T. B. Maxwell, a director of May & Baker, wrote to Dr. Orenstein at Rand Mines Limited suggesting that he might care to give M & B 693 a trial.

Dr. Orenstein immediately agreed to arrange a test involving 200 unvaccinated cases of pneumonia and a further 200 as a control. The

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prospect of carrying out a test on such a large scale in a short time which would have been impossible in any one hospital, or probably anywhere but in the mine hospitals of the Rand, naturally delighted the manufacturers of the drug and aroused the widest interest in the medical profession in other parts of the world.

May & Baker sent Dr. Orenstein 20 000 M & B 693 tablets. Dr. Marguerite Kettle, renowned assistant editor of the *Lancet*, wrote 'to put in an early claim for first refusal of the account of the results of these tests'.

The drug was tested at the City Deep Hospital, the W.N.L.A. Hospital, Randfontein Estates Hospital and also the Johannesburg General Hospital, some 550 cases being involved, of whom approximately half were controls. The joint paper by Drs. A. L. Agranat (of the Johannesburg General Hospital), A. O. Dreosti (of the City Deep Hospital) and D. Ordman (of the South African Institute for Medical Research) was published in the *Lancet* in three instalments on 4, 11 and 18 February 1939.

The Mine Medical Officers' Association held its own symposium on 16 November 1939 on the treatment of various diseases with the sulphanamide preparations.

Commenting on the papers presented Dr. A. Miller said that it was instructive to note that, within twelve months of the introduction of sulphapyridine members of the Association were able to report on its effects in over 5 000 cases of lobar pneumonia, 250 cases of meningococcal meningitis and more than 50 cases of pneumococcus meningitis.

Dr. J. S. Lawrie's comment was: 'Osler's Captain of the Men of Death has been reduced to the ranks. The brilliance of this newcomer to the army therapeutic, his successes in the field—and an extraordinarily wide field it has been—have resulted in an unforeseen, almost unhoped for, peace. What of that peace? Despite this dashing chemical Prince Rupert we must strengthen our defences and, in inoculation, I feel we have the Maginot Line of Modern medicine.'

But in spite of this splendid mixed bag of military metaphors Prince Rupert turned out to be all that was required.

Dr. S. Donaldson, first of the full-time mine-medical officers (he joined the Rand Mines group in 1912) and probably the oldest living member of the Association at that time, died in retirement in April 1939.

The outbreak of World War II in 1939 coincided with a marked increase in mining activity on the Far West Rand.

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Venterspost, Libanon, Blyvooruitzicht and Western Reefs were all in sight of production at that time (Venterspost actually began crushing in October 1939). The entire industry was expanding with a consequent rise in the number of men employed. Between 1934 and 1941 the total of Bantu employed rose by more than 100 000.

By law mine managements had to provide one full-time medical officer for every 5 000 men employed and major fraction thereof. This meant that the majority of mine medical officers, to their great disappointment, were tied to their jobs 'for the duration'. It proved very difficult, if not impossible, to find replacements for those who retired or resigned at that time, so that a number of the younger men who wanted to see active service found themselves classified as 'key men'. Gold production was regarded as a vital part of the Allied war effort.

As the acting President of the Association remarked in his address in 1941 (the President, Dr. A. O. Dreosti, having joined the South African Medical Corps) : 'Our only consolation must be that, as custodians of the health of nearly half a million natives, the Government regards us as being engaged on national service, of the first importance.'

Nevertheless of an active membership of 90 to 100, not more than 70 of whom could be regarded as fit for active service, the Association had 20 members serving with the forces in 1941, 27 in 1943 and 24 in 1944.

Of those who had to stay behind a considerable number joined the Mines Engineering Brigade and, after being put through a strenuous training course at the S.A.M.C. training camp at Sonderwater, served in a part-time capacity, combining their duties in mine hospitals with work in military hospitals.

The proceedings in October 1942 contain an amusing account of the hardships endured by twelve mine medical officers in the course of their training at Sonderwater.

'Bathed, shaved and moderately alert we attended physical training parade', said the author (Dr. L. S. Williams). 'Gone forever apparently are those unending physical jerks we knew so well in the last war. In these days one prances about with a medicine ball, or one leaps over a stick to the tune of "A-tisket, A-tasket, I've lost my little basket". . . .

'And what a sweet spirit of give and take there was between us and instructor. "Let us now, gentlemen, play, Boat Races", said the instructor. "No", would chorus the gentlemen. "It's too strenuous. Let us rather play

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Progressive Arch Ball.” “So be it”, said the instructor, and methought I could detect, a glint in his eye. . . .’

Dr. A. J. Orenstein was routed out of his office at The Corner House by none other than General Smuts and once again he became Colonel Orenstein. Smuts appointed him Director-General of Medical Services of the Armed Forces. He was soon to become Director of all medical services, British and South African, in the Kenya—Somaliland—Abyssinia campaign and to earn promotion to the rank of brigadier.

In his official dispatches at the end of the campaign General Sir Alan Cunningham was to pay Dr. Orenstein this tribute: ‘I wish to bring to notice the high standard of work and unfailing devotion to duty of all the medical staff and personnel of the force and I feel that the very satisfactory situation owed much to the experience of Brigadier A. J. Orenstein, C.M.G., LL.D., M.D., M.R.C.P., The Director of Medical Services of East Africa Force.’

The death-rate from all diseases in this campaign, per thousand, per annum, was whites 1·8, non-whites 3·8. Deaths from malaria were only 0·28 and 0·26 per thousand.

The corresponding figure for the East African campaign during the First World War for deaths from malaria was 42 per thousand per annum.

Dr. Orenstein’s honours for his work in this campaign and in the Middle East included the C.B. and C.B.E. and won him the warm friendship of General Cunningham. The latter wrote to him at the end of the campaign to say: ‘. . . I had hoped to see you personally before you left—to tell you how much I appreciated your great share in this campaign, one of the most remarkable features of which has been the health of the troops. But apart from that I feel I am losing a wise counsellor and, I hope I may say, a friend. I hope sincerely our paths may cross again if not in war then, and preferably so, in peace. All good luck go with you.’

Another member of the Association who distinguished himself was Dr. J. H. G. van Blommestein of Anglo American Corporation, who was Officer Commanding, 7th Casualty Clearing Station, S.A.M.C. in Egypt. He was awarded the Distinguished Service Order for bravery and coolness under fire and promoted to the rank of lieutenant-colonel.

Dr. van Blommestein, after service as mine medical officer at Brakpan Mines, had been appointed medical consultant to Anglo American Corporation in 1939. He was to be largely responsible for the design of the Ernest Oppenheimer Hospital that was to be built at Welkom and opened by

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Sir Ernest Oppenheimer in 1952. (See his article on the subject on page 100.)

Dr. Fraser Eagle, mine medical officer at Daggafontein Mine, was captured in the Middle East and later awarded the O.B.E. (military division) for his work in prisoner-of-war camps. Dr. H. T. Croudace was killed in active service in the Western Desert.

It should be recorded that those members of the Association who had to stay behind worked very hard indeed to keep things going. Though they all had extra duties of one sort or another there was no falling-off in either the number or the quality of the papers presented during the war years, and though the sequence of clinical meetings was interrupted from time to time, these continued, too. The publication of the Proceedings was only once allowed to lapse and that was briefly in 1942 when there was no editor available. On top of all this members of the Association managed to subscribe an average of R200 a month to war charities for a period of approximately four years.

Of those who joined the forces it may be said that, wherever they served—and quite a number were scattered in various theatres of war in the R.A.M.C., the R.A.F. and the Royal Navy and the South African Naval Forces—they earned a high reputation for their versatility.

To some extent their work as mine medical officers had prepared them for the sudden emergencies and the wide variety of wounds and fractures that they were to encounter. This was due to the experience in traumatic surgery they had acquired in their work. The importance of this experience is underlined by the record of Lieut.-Col. van Blommestein's unit, the 7th Casualty Clearing Station, S.A.M.C. This unit functioned uninterruptedly for nine months under desert conditions in Egypt. During that period approximately 9 000 patients received treatment and 1 400 major operations were performed.

Traumatic surgery calls upon much of the time and skill of mine medical officers. Although more than half the cases dealt with are minor injuries there is a great deal of major surgery performed which in ordinary hospitals would almost invariably be done by specialists. Some mine medical officers have indeed acquired quite exceptional skill in this type of surgery. This is shown by the low mortality and high rate of restoration of function.

The total amount of traumatic injuries and the variety dealt with are probably unequalled anywhere else. This is due to the concentration of some 400 000 unskilled and semi-skilled workmen in an occupation in which there is a high hazard of injury. It would be wearisome to burden this

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*In training at the South African Medical Corps Camp at Cullinan, October 1940.
Future medical officers of the Mines Engineer Brigade.*

Seated: Dr. L. S. Williams, a Sergeant-Instructor, Colonel W. H. du Plessis, Officer Commanding S.A.M.C. Training Camp, Members of U.D.F. Camp Staff and (*extreme right*) Dr. F. Retief.

Standing: Dr. E. T. H. Mason, Dr. K. Sartorius, Dr. E. T. Clifton, Dr. N. A. McColl, Dr. G. Chouler, Dr. V. C. Smith, Dr. L. E. Miller, Dr. C. Berman.

account with detailed statistics, but a few examples, and Dr. McDavid's description of the day's work of the mine medical officer (page 91), should help in forming an image of what is done as routine day after day.

The Transactions of the Association record a mass of the more important and difficult surgical cases dealt with by mine medical officers. Among these have been :

732 cases of knee injuries reported by one hospital and 150 by another.

A piece of knife removed from the eye.

Two cases of perforated enteric fever ulcers.

A successful reconstruction of a nose.

Fractured trachea.

A 'Jumper' impaling the abdomen.

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Visit of members of the Mine Medical Officers' Association to the Ernest Oppenheimer Hospital, Welkom, at the invitation of Anglo American Corporation on 21 March, 1957.

Left to right: S. E. Phillips, J. C. de W. Becker, A. Miller, . . . , J. Counihan, H. H. Wright, C. Berman, R. A. Caldwell, President of the Association, W. J. C. Tomlinson, Secretary, N. J. Weinberg, S. Levy, R. Richards, L. L. Peringuey, . . . , J van Blommestein, L. R. B. Birt, W. M. McFarlan, . . . , R. C. T. Pearson, V. H. Turnbull.

Avulsion of arm (two cases).

Multiple fractures of the pelvis.

Several cases of tubular skin grafts.

Stab wounds involving spleen and liver.

Several severe spinal injuries dealt with by operation or traction.

Axillary artery end-to-end suture, with complete restoration of flow.

Three cases of flail chest.

Gastrectomies.

Mine medical officers can, and do, refer some cases for treatment by specialists. However the cases mentioned above were all dealt with exclusively by mine medical officers without any reference to specialists. These are but a few examples of many similar cases dealt with over the half century.

'Practice makes perfect.' Mine medical officers have much and varied practice in traumatic and emergency surgery.

The mine medical officers who had been on active service returned to find

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a revitalized mining industry spreading its activities to Klerksdorp and across the Vaal River. Within the space of the next eight years eighteen new goldmines were to be developed and, though not all of these survived, by 1953 the membership of the Association stood at 153.

In co-operation with Drs. E. A. Nicoll, C.B.E., M.D., F.R.C.I., an eminent orthopaedic surgeon, and with a grant of R2 500 from the Chamber of Mines, the Mine Medical Officers' Association undertook a research into the treatment of fractures of the tibia. This investigation was carried out by mine medical officers who had been Chamber of Mines Travelling Fellows. Thirteen mine hospitals and Wenela Hospital participated in this research, co-ordinated by a committee of which Dr. K. Sartorius was Chairman.

The research continued over a period of about four years, covering 705 fractures of the tibia, of which 460 were treated in the mine hospitals and 245 in Britain. It was directed principally to the assessment of the value of conservative and other methods of treatment.

The procedure adopted and the findings were published in the August 1964 number of the *Journal of Bone and Joint Surgery*.

The following two abstracts from the published summary are of particular practical importance.

1. Continuous traction does not delay union.
2. No case has yet been made out for internal fixation as the method of choice in the treatment of this fracture.

Everybody had war memories, but there was nothing quite to equal the adventures and the hardships of Dr. Eagle as related by him in a talk he gave members of the Association entitled 'Experiences as a Prisoner-of-War'. Dr. Eagle was captured at Tobruk and thereafter was in prisoner-of-war camps in the Middle East, Italy, Germany and Poland. His matter-of-fact description of the evacuation of the prisoners from Poland as the Russians made their thrust towards the German frontier in January 1945 is still hair-raising reading. The wounded prisoners in his care had either to take part in forced marches through deep, midwinter snow or die where they lay.

Dr. R. C. T. Pearson, who, as a former regular officer, had been recalled to the Royal Navy at the beginning of the war, described his experiences as Principal Medical Officer in a cruiser in another interesting post-war talk. His story of how, at his request, every ship in the Eastern Fleet was asked: 'Have you a silver catheter in your sick bay?' is a classic naval signal.

In January 1946 almost the entire membership of the Association attended a farewell presentation to Dr. A. I. Girdwood on his retirement from his

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position as Chief Medical Officer of the Witwatersrand Native Labour Association. Dr. Girdwood had been associated with the mining industry for close on forty years and had earned the affection and respect of his colleagues. He was one of the founders of the Mine Medical Officers' Association.

Two of the other 'founding fathers' were present on this occasion in the persons of Dr. A. J. Orenstein and Dr. A. Smith. During the next twenty years they were to say farewell to many more of their former colleagues. Their longevity became proverbial. Dr. Orenstein is still hale and hearty. Drs. Smith and Girdwood have both died recently.

One of the phenomena of the fifties was the nonchalance with which the world accepted the miracles worked by the new drugs of that era and the efficiency of the antibiotics. The new generation of medical practitioners took these new aids in their stride. Some of the older men occasionally paused to look back.

Thus Dr. A. O. Dreosti called his valedictory address, delivered at the end of his presidential year in May 1956, 'Yesterday and Today', and described the amazing progress that medicine had made in his lifetime.

He recalled that in 1936, just prior to the advent of the sulphanamides, there had been 465 cases of pneumonia at the City Deep Hospital and 65 deaths. In 1955 there had been a total of 790 pneumonia cases and 2 deaths.

'The advances that I have described have been truly phenomenal and the results dazzling', he said in concluding his address. 'The clinical pictures that I have tried to describe to you simply do not exist today and our younger members must have considerable difficulty in trying to visualize these from books.'

Earlier than this Dr. L. R. B. Birt read a paper on 'The Campaign Against Malaria in the Copperbelt of Northern Rhodesia', in which he described how Anglo American's anti-malarial department had searched and sprayed the staggering total of 409 510 huts in a belt of territory round the Nchanga Mine.

Effective as previous anti-malarial measures had been, it was D.D.T., and later B.H.C., that had won the final victory. He gave figures to illustrate this. They recorded the incidence of malaria among the mine population at Nchanga, as follows :

1944	..	117.2 per 1000 of population		
1947	..	23.33	”	”
1950	..	5.65	”	”

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The use of D.D.T. began with the arrival of the first consignment in Northern Rhodesia in November 1945. Dr. Birt showed that anopheline mosquito catches at Rhokana in 1942 averaged 15.92 per 1000 huts. By 1950 a count at Nchanga showed 0.16 per 1 000 huts.

‘A controversy arose which had never occurred before’, said Dr. Birt. ‘Owing to the effectiveness of the campaign the African was not renewing his tolerance nor were his children acquiring theirs, as they were not being subjected to repeated minor infections. It was thought by some people that, if they returned to their unprotected villages, morbidity and even mortality might be very high and consequently it was argued that the campaign should be relaxed. The true answer really was that it should be extended throughout the country. . . .’

Dr. R. C. T. Pearson, who was later to succeed Dr. Frank Retief as Chief Medical Officer of the Witwatersrand Native Labour Association, attended the world congress of the International Society for the Welfare of Cripples at Stockholm in 1951, and the following year read a paper on the subject and particularly on the great strides made by physical medicine and occupational therapy.

His conclusion was: ‘Occupational therapy and vocational therapy must take their part in our Centre soon, but what I feel will be the greatest success in our venture will be to see a substantial number of our patients placed in jobs—not only those with minor injuries but amputees, spinal cases and the major disabilities.

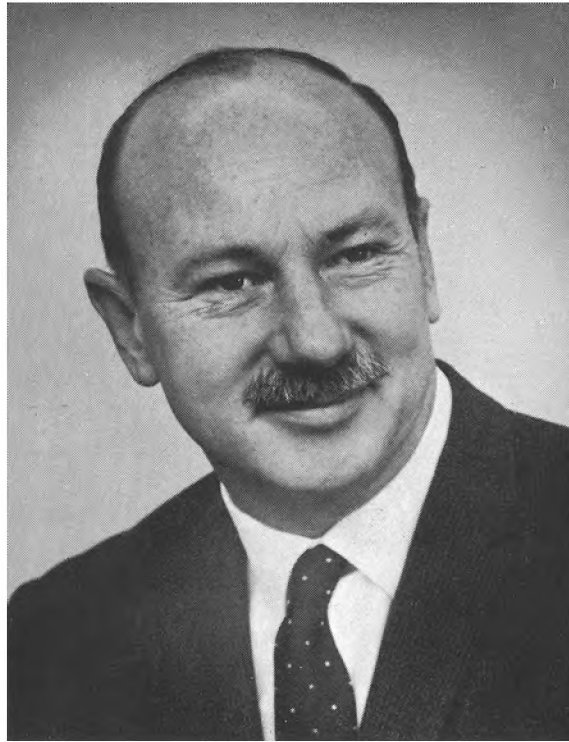
‘Let them earn their living and not just be given useless work to keep them quiet’, he said. ‘Those injured who have been re-employed have shown their ability on the goldmines.

‘Hire the handicapped. It’s good business!’

By way of showing the progress that has been made since Dr. Pearson delivered that address it is worth quoting the statistics that Mr. Alfred Rothberg, Superintendent Physiotherapist at the Rehabilitation Centre, W.N.L.A. Hospital, gave in a review of his work ten years later.

Mr. Rothberg said that in that year (1962) it was twenty years since the inception of physiotherapy and just fifteen years since the treatment of paraplegics had begun. In that time 10 000 patients had been treated. There was an attendance at the centre of more than 90 patients a day and treatments had risen to a peak of 2 245 in one month. That meant that the amount of treatment given had doubled since 1952.

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*Dr. J. G. D. Laing, President of the Association,
1970-1.*

Over the years members of the Association have used such opportunities and spare time as they have to conduct research. Following are some examples of the original work they have done.

RESUSCITATION

Dr. W. A. Burnett, at the meeting of the Association held on 20 July 1939, discussed briefly the manual methods of artificial respiration in common use, such as the Schafer and Howard, and described the 'mouth-to-mouth' method. The latter he believed to be superior, primarily because it is more positive than the indirect manipulations of the other procedures, because it can be used in cases of even severe injuries, chest injuries, and also because the air insufflated by the rescuer, containing CO₂, stimulates the respiratory centre.

A quarter of a century passed before this method came into general use—and a very much longer time since it was mentioned—in the Old Testament

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The subcommittee responsible for organizing the Association's 50th anniversary celebrations.

Left to right: Dr. R. C. Dickson, Dr. J. B. Rossiter, Dr. A. T. Holliday, Dr. D. Mirman, Dr. J. G. D. Laing and Dr. A. M. Coetzee. Inset: Dr. R. E. Barry.

(II Kings 4.34). It was also used by a Dr. William Tossoch to resuscitate a miner as far back as 1743.

HEARING DAMAGE

Dr. R. C. Dickson, at the meeting of the Association on 16 November 1961, presented his finding of a survey, covering two years, of 2 600 Bantu underground workers. In this survey he investigated the noise levels in various working areas and the state of the hearing apparatus of those exposed to the various degrees of noise, as well as of the hearing acuity of recruits.

He found that

50·3 per cent of recruits had some form of ear pathology.

1·5 per cent of the total examined developed ear pathology during the period of work.

Otitic barotrauma incidence varied from 3·4 per cent in the deepest mine to 0 in the shallowest.

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Noise levels and narrow band analysis of the noise spectrum measured in known noisy occupations—especially rock-drilling—ranged from 90 to 136 db. Bantu employed in these occupations showed marked hearing loss in the high frequencies and moderate loss in the middle and low frequencies.

At the 15 June 1967 meeting Dr. Dickson presented a paper on his study of the normal hearing of Bantu, Tonga and Bushmen.

To establish a threshold, 257 recruits from various tribes, who were all from native reserves and had previously been only herd-boys, were examined on the first day of arrival on the mine. All were in good health, aged 18 to 20, with no history of any illness and normal ear-drums.

Forty-two Bantu of both sexes, ages 10 to 80, were then tested for hearing changes due to age. It was found that in this group the changes were less than those reported in whites of the same age groups.

Ninety-eight Bushmen of both sexes and of approximate ages between 10 and 60 or more were also tested. In this group the onset of presbycusis was less than in the tested Bantu of approximately the same age groups.

TUBERCULOSIS

Investigation by Drs. A. M. Coetzee and J. Berjac of the effect of B.C.G. on the incidence of pulmonary tuberculosis among Bantu mineworkers is referred to in the chapter on tuberculosis, as is also the investigation initiated by Dr. P. Smit on the administration of neotizide as a prophylactic against this disease.

CANCER

Dr. Charles Berman's interest in malignant diseases of the Bantu dated back to the early thirties. In June 1935 he presented to the Association a paper outlining the epidemiology of carcinoma and sarcoma as recorded in various publications, and his own findings among the Bantu mineworkers. The striking phenomenon was that carcinoma in this relatively young population occurs more frequently than sarcoma, and that primary cancer of liver was apparently dominant, accounting for about one-third of all carcinoma cases observed. He continued this investigation, and embodied his research in a thesis for the M.D. degree.

In the period 1965 to 1969 Dr. E. W. Geddes investigated 189 primary carcinomas of the liver in Bantu mineworkers concentrated from several mines in the City Deep Mine Hospital. The principal purpose of this study was to evaluate several forms of therapy of this invariably rapidly fatal disease. In every case the diagnosis was established histologically.

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The effect of therapy was measured by the length of survival. The therapeutic agents employed were radiotherapy, alone and with various drugs, singly and in combination.

A control group of 27 were given vitamin C, as a placebo. Another group of 35 did not receive any treatment. Patients were assigned to the various groups at random, by drawing a card in a sealed envelope.

Dr. Geddes suggests that, in spite of the disappointing results in this relatively small series, studies on therapy should be continued.

A detailed account of this study was presented as a thesis for the M.D. awarded to Dr. Geddes by the University of the Witwatersrand.

The author summarized the result of this study thus:

‘No single form of therapy used in this study resulted in prolongation of life beyond 2½ years (in a patient who received radiation therapy only), but it is realized that this is one of the most fulminating and malignant of cancers.’

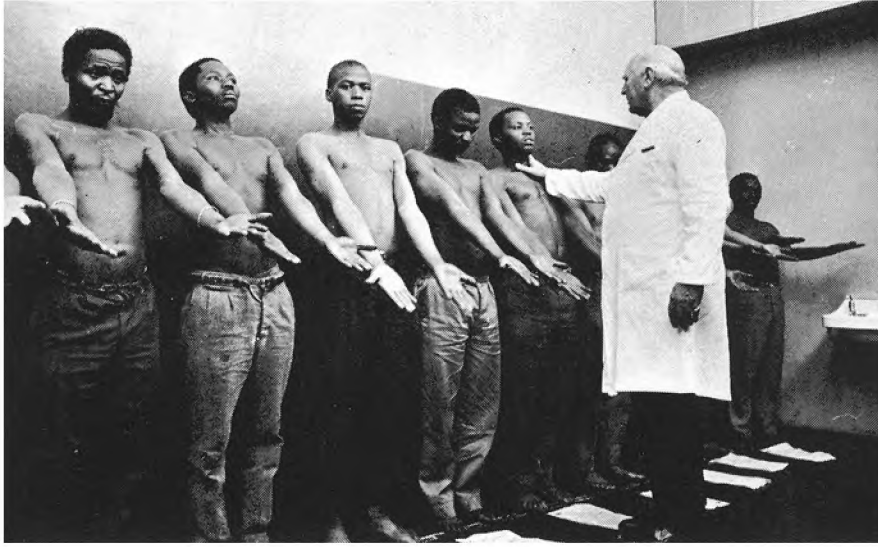
In the fifty years that have elapsed since the Association was founded the average number of non-white employees of the goldmines and the coalmines—the mine medical officers’ patients—has increased from approximately 170 000 to 396 000. Over the same period the membership of the Association has increased from 50 to approximately 170 (a figure that includes some honorary and associate members).

All told there are today probably some 150 medical practitioners actively engaged in caring for this great army of men.

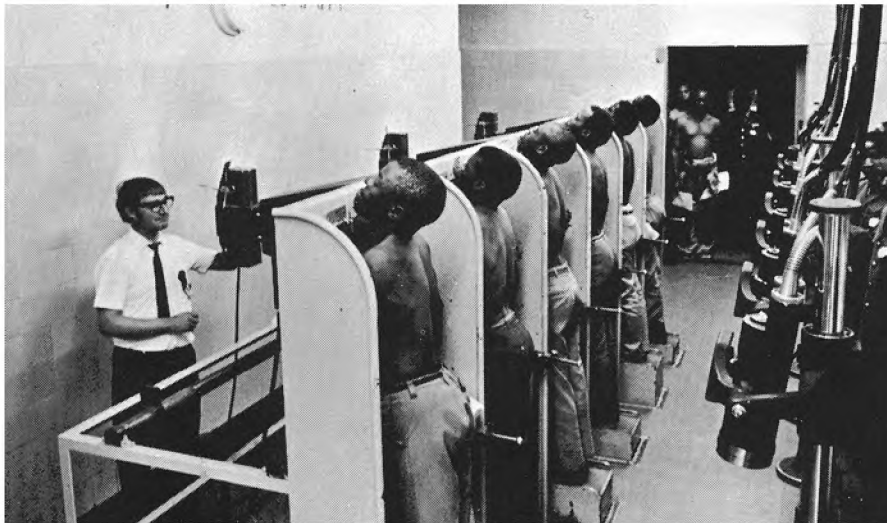
It is, of course, quite impossible in a comparatively brief history of a body such as this to describe in detail all that it has accomplished. It must suffice to say that, despite the ever-present hazards where some 400 000 men—having a turn-over of 100 per cent—are closely congregated there has never been a serious outbreak of any form of communicable disease on the mines, and the old enemies of health have been steadily beaten back on this wide front.

The mine medical officer is more than simply a physician or a surgeon in his job. In a sense he is a medical missionary, too, for in treating his patients he teaches them some of the first lessons of civilization. More than this, every year he sends back to the tribal territories 40 000 men who have had some training in first aid. For that alone the people of Africa have reason to be grateful to him.

400 000 Men in their Care



Recruits for the mines undergo physical inspection at the Witwatersrand Native Labour Association's Hospital, Johannesburg, before being accepted. This is followed by a stethoscopic examination of heart and lungs.



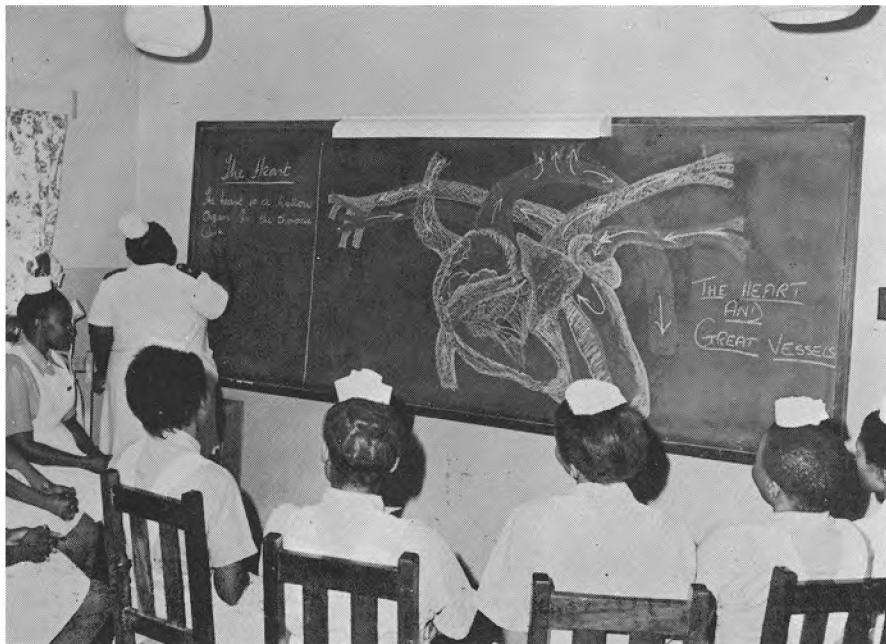
After their preliminary physical examination at the Witwatersrand Native Labour Association's Hospital recruits for the mines undergo radiographic examination of the lungs.



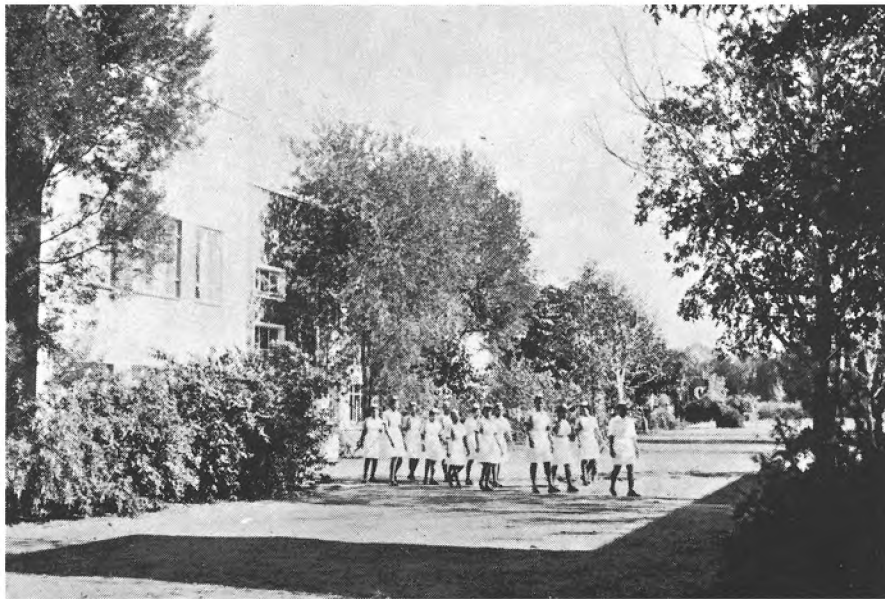
A patient in a mine hospital being cared for by a Bantu nurse.



A typical ward in a mine hospital. This hospital, which is on Harmony mine in the Orange Free State, has 234 beds. The nursing staff consists of white matron and Bantu nurses.



Bantu student nurses attending classes to prepare for the examinations they must sit. The training of Bantu nurses for mine hospitals began in 1916.



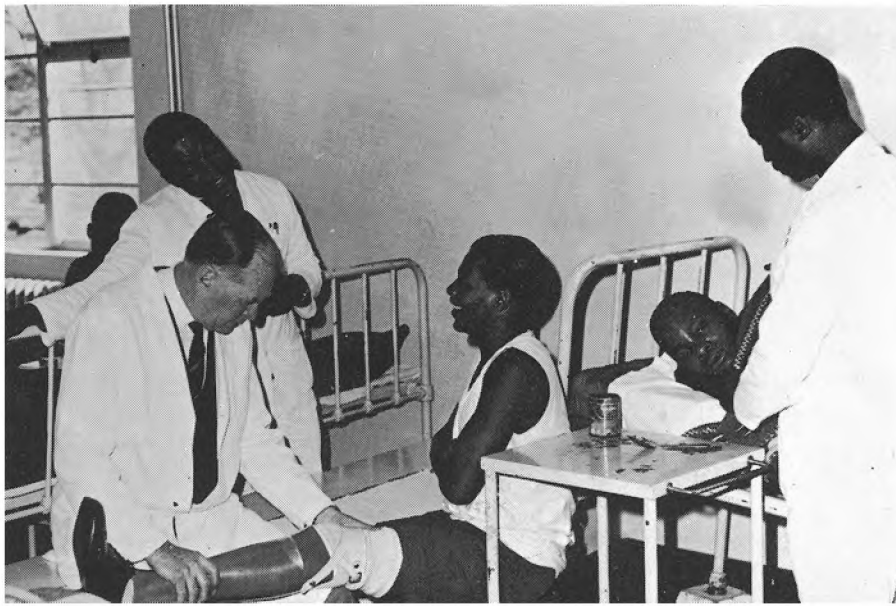
Nurses outside their hostel at the Harmony mine hospital.



An underground first aid team of Bantu mineworkers competing in the annual inter-mine competitions, arranged and judged by mine medical officers. These competitions arouse the widest interest and are watched by large crowds, each team having its supporters who loudly applaud its skill.



Handbooks on first aid and rescue work in mines, and for the training of hospital orderlies, one of which was written by the late Dr. H. T. H. Butt, one of the founders of the Mine Medical Officers' Association, and another by the late Dr. L. G. Irvine, a mine medical officer. When these handbooks were first published there was no suitable literature on the subject for South African mineworkers and nothing in the various Bantu languages. Tens of thousands of these early handbooks have been printed.



A mine medical officer fits an artificial leg to a cheerful patient in a mine hospital.



A photograph taken in the physio-therapy department of the Ernest Oppenheimer Hospital at Welkom in the Orange Free State. This hospital serves five of the mines of the Anglo American Corporation Group. It has a total of 900 beds available and is the largest industrial hospital in Southern Africa.



A patient at the Ernest Oppenheimer hospital is lowered into the Hubbard tank for hydrotherapy. The temperature of the water is thermostatically controlled. The tank enables patients to exercise weakened muscles and stiffened joints more easily.

PART II

**MINE MEDICAL OFFICERS
AT WORK**

THIS IS THE M.M.O.'s DAILY ROUND . . .

HIS COMMON TASK

BY DR. W. G. McDAVID

No one wants to work at 8 o'clock on Monday morning. This applies equally to the mineworker and the medical officer so that Monday's sick parade is not only longer but the medical officer's patience is shorter.

However it is essential to sort out the genuinely ill and admit them to hospital. The others are either sent back to work or kept under observation for the day. And it helps to keep a sense of proportion to remember that we have only seen a hundred or so out of 16 000 on the mine.

We now get on with the purely routine task of examining the new recruits and the veterans who are going home at the end of their contracts, heavier, healthier and more sophisticated after a year or eighteen months of mining experience.

The recruits have had their chests X-rayed at Wenela, but the homegoers have been X-rayed on the mine and these films have to be read along with the six-monthly routine films which are taken of every mineworker.

Some two hundred films later we probably find that we have sorted out half a dozen or so for further investigation and a small percentage will ultimately, after much paper work by the medical officer, be found by the Miners' Medical Bureau to have compensatory lung disease.

And so to the wards, where the numbers of in-patients have inevitably been swollen by the cracked heads and stab wounds of those who have celebrated the week-end unwisely. An examination of every patient in hospital with the minor medical and surgical procedures—aspiration of chests, opening of abscesses, stitching of wounds and so on—goes to make up a busy morning.

The routine of ward rounds goes on in the afternoon. The detainees from the morning sick parade are either admitted or discharged. A few European patients report for examinations and minor treatment, a Bantu first aid class has to be examined, but by 5 o'clock the day is over except for a last quick hospital visit by the duty doctor before he goes to bed.

THE MINE MEDICAL OFFICER AT WORK

Tuesday is one of the days when the 'cold' surgery is done and today we have a fractured femur to be nailed and a hernia to be repaired. These cases involve three doctors—surgeon, assistant and anaesthetist—so routine work is kept to a minimum and we are lucky enough to be spared an emergency.

Wednesday is not so fortunate. There is the ominous rumble of an earth tremor. Everyone looks at his watch.

It is 9.30 a.m. and a bad time with everyone in his underground working place. Within an hour a message arrives to say that there has been a pressure burst at 68 level, that a number of minor injured are coming to the surface but that the full extent of the damage is as yet unknown.

A medical officer goes to the shaft-head prepared to go underground, but trained ambulance officers are already at the scene of the accident and there is little that doctors can do which they cannot, so he examines and classifies the injured, as they come up, into urgent hospital cases and those who can be treated on the spot at the station.

The hospital, to an onlooker, is a scene of confusion. There are some fifty patients, nearly all with wounds caused by the knife-sharp rocks, and most of which have to be stitched. But the confusion is deceptive; a staff which has dealt with this type of emergency for years soon produces order, and by three o'clock the last of the walking cases has been dealt with. In the meantime the doctors have been busy with two badly shocked patients. They both have injuries requiring major surgery under a general anaesthetic, but both require resuscitation before operation can be undertaken, and the basis of the resuscitation is blood for transfusion.

Eight pints are kept in the hospital refrigerator, but it is obvious that more will be needed and a call is put through to the blood transfusion service of the South African Institute for Medical Research. In less than an hour the blood has been delivered. This is a service of which the Institute and we can be justly proud.

By two o'clock the first patient is on the operating table and his ruptured bladder is repaired. He leaves the table with a good blood pressure and causes no further anxiety.

The other patient is a problem. He has multiple injuries which require operation and he does not respond well to shock treatment. At 4 p.m. we decide that we have reached the stage where we must operate even if his shock has not been completely overcome. To delay may mean deterioration

THE DAILY ROUND. THE DAILY TASK

and the chance of success may be lost. He too leaves the table in fair condition but requires hours of careful attention and it is 8 p.m. before the doctors feel that they can safely leave him.

Two Bantu are still buried, so after dinner the doctor goes to the shaft. Rescue operations are in full swing and behind the laconic reports from underground he can glimpse something of the conditions which the rescuers are facing. There is in fact little which he can do but he justifies his presence by the thought that may be 'good for morale' to have a doctor present. The drama of the occasion impresses even after many years and many, many similar scenes.

The machine boy is dead. His body has been partly exposed and it is almost certain that the spanner boy is dead too but there is no let-up in the pace of the rescue. And incredibly, at 1 a.m., the spanner boy is heard talking and even more incredibly is brought out almost uninjured but dispatched to hospital for observation.

Apart from the ordinary routine of Thursday there is a more careful examination of all the accident admissions, and X-rays of bruised limbs and ribs show a few fractures—minor ones fortunately—which were missed the day before. Both the operation cases are improving and are going to recover.

Mine medical officers' meetings on Thursday afternoons are usually popular, but it is with reluctance today that one of the doctors agrees to go to Johannesburg. A warm room, no lights and slides of graphs and statistics and his head tends to nod, but he is cheered on his return by the news that his colleagues spent the afternoon stitching tendons, a meticulous and rather tedious job.

By Friday there are more cold cases to be done, including a very specialized operation by an orthopaedic surgeon. This has been specially arranged for Friday afternoon to let the surgeon in question play nine holes of golf on the mine course before dark with, of course, the anaesthetist and assistant.

In the meantime, however, the senior medical officer is engaged with the Rand Mutual Company's medical officials in assessing disabilities of patients, who may either be repatriated for injuries or go back to work.

Apart from the documents required by the Pneumoconiosis Act, the reporting and recording of accidents represents most of the paper work required of the mine medical officer, and, even if not very popular, is essential in the patient's interests.

THE MINE MEDICAL OFFICER AT WORK

Fortunately the cases for assessment today are not too numerous and by 4 p.m. the three-ball on the first tee has become a four-ball.

Mine work starts early on Saturday and ends early so the doctors hope to get away by midday. The golf-course and tennis courts are close to the hospital so it is easy to get in touch if necessary—only too easy we often feel, and that the duty officer is lucky if he has a full Saturday afternoon free. In any case he does a hospital round in the late afternoon or evening.

One of the trials of the medical officer is the Sunday morning first aid competition. It often involves considerable travelling and he never feels more of a martyr to duty than at 6.30 a.m. But first aid training, lectures, examining and judging are very much part of the doctor's life on the mines.

The evening yields its crop of stabbing and broken heads which fortunately is finished by about 9 p.m., and the medical officer breathes a silent prayer that that is the end and that he can have an undisturbed night. . .

No one wants to work at 1 a.m. on Monday morning!

TRAINING THE BANTU IN THE ELEMENTS OF FIRST AID

On 26 June 1960 a boss boy named David Motjalemi, employed at the Durban Roodepoort Deep Mine, stepped forward to receive the South African Red Cross Society's certificate of proficiency in first aid and the badge that went with it. This ceremony represented an important milestone in the history of the Association for Motjalemi's certificate was the millionth of its kind awarded to Bantu mineworkers. Behind it lay some fifty years of patient work by mine medical officers in fostering knowledge of first aid among miners, black and white, and acting as adjudicators in the competitions that are held on the mines.

Since that day the number of first aid certificates awarded to Bantu mineworkers has grown to 1 750 000. Perhaps it should be explained that this does not necessarily mean that all these men are learning the principles of first aid for the first time. Some of them may have been awarded a second certificate after a refresher course. Nevertheless the figure is an impressive one, representing as it does what is probably the biggest training scheme among illiterates anywhere in the world. The thought that there are some thousands of men with knowledge of first aid in regions where there are no medical services must be a source of satisfaction to medical men.

There have been some outstanding examples of what this training means in far-off corners of the continent. First aid has been given by former mineworkers after tree-felling accidents; in emergencies after attacks by wild animals such as crocodiles, leopards, lions and hyenas; for injuries caused by horses and attacks by bulls. Prompt treatment has been rendered in car and rail accidents; for burns; for hunting injuries; for asphyxiation by smoke and fumes and in a number of cases of attempted suicide.

First aid treatment has even extended to domestic animals. In a survey in which mineworkers were asked to say what use they had made of their knowledge of first aid at home one man described how his 'best fowl' had broken her leg and how he bound the leg with strips of cloth and used twigs

THE MINE MEDICAL OFFICER AT WORK

as splints so that the hen eventually recovered the use of her leg.

The survey produced 360 separate reports of apparently efficient use of first aid in emergencies in the Bantu territories. In a number of cases fractures were dealt with and children revived after immersion in dams and lakes, all this without any help whatever from doctors or nurses.

One most remarkable incident was described by Gavumende Calishe, a Mchopi from Portuguese East Africa, who said that while he was hunting near his home a man with a shotgun who was one of the party accidentally shot another African. On finding out what he had done this man pulled out a knife and cut his own throat, after which he collapsed.

‘I immediately took off a triangular scarf and lightly bandaged round the man’s throat’, said Gavumende. ‘I then brought his head forward in order to close the wound as much as possible. I had him carried to his hut. There I bandaged him again, using clean sheets which I received from his wife. I also strapped his head well forward so that nothing could move and covered him with a few blankets.’

They then loaded the man into an ox-cart and set off on a two-day journey to the doctor, with Gavumende constantly attending to his patient.

When they got to the doctor the man’s wound was stitched and he recovered.

‘The doctor was very surprised’, said Gavumende. ‘He asked who had bandaged the man and where on earth I had learned to do so. I told him I had learned first aid on the mines at Dunnottar. The doctor said I had definitely saved the man’s life with my knowledge and prompt bandaging.’

Nimrod Xongo from Lusikisiki saved his brother who had collapsed while taking mealies from a silo. Nimrod recognized the symptoms and knew that his brother had been overcome by fumes. He applied artificial respiration and ‘got his brother’s health back’.

A very serious case was described by Euzebio Mathosse, a Shangaan who was called to help a man attacked by a crocodile. This man was fishing when he was seized and dragged under the water by the crocodile. His companions then beat the water with sticks and shouted until the crocodile became alarmed and let go.

The man had severe injuries, including deep lacerations of the thigh. Euzebio promptly applied a tourniquet and then bandaged the wounds with shirts. The man was not only terribly wounded, but was also partially

FIRST AID TRAINING

drowned and suffering from severe shock. Euzebio applied artificial respiration and succeeded in reviving him. In due course his patient made a complete recovery.

The competitions, in which first aid teams from various sections of each mine compete against one another and the winning team goes forward to compete against other mine teams, arouse great interest, even excitement, among the men. When a team sets off to another area to compete on a regional basis it may take a large band of 'supporters' with it just as football teams do.

The most recent statistics of these first aid competitions show that 3 970 teams, each of five men, from the goldmines—19 850 men in all—took part. There were also 701 two-men teams (1402 men) from the collieries. Thus in this one year 21 251 trained Bantu mineworkers were involved in the competitions. There was, of course, also a competition for teams composed of white miners. For both sets of teams the Mine Medical Officers' Association had arranged the training classes, written the textbooks and judged the competitions.

First aid training of a kind has probably been practised in the mines of the Transvaal since 1903 or thereabouts. There were a few men who had picked up some elementary knowledge of the treatment of injuries while serving in the British Army in the South African War.

The Red Cross Society really began its career in South Africa in 1896 when, after the Jameson Raid, four doctors started an ambulance corps in the South African Republic with President Kruger's approval. In July that year the Volksraad passed a law instituting 'Het Transvaalsche Roode Kruis', to which it voted R1 000. Later similar societies were formed in the Cape Colony and the Orange Free State.

However, after the Treaty of Vereeniging had been signed, the citizens of the colonies apparently saw no further need for the Red Cross societies and they ceased to exist. They were not re-established until 1913 and, in the case of the Transvaal, it is amusing to read in the report of the honorary secretary in August 1913 that 'owing to the Strike the work of the Society has been brought practically to a standstill'. If ever there was a time when first aid was needed it was during the battles in the streets that year.

One of the first acts of the Society when its activities were resumed was to invite Dr. Louis G. Irvine to write 'a special mining first aid textbook'. Irvine's *First-Aid in Mining* was published that year, under the auspices of the South African Red Cross Society and was to be reprinted again and again.

THE MINE MEDICAL OFFICER AT WORK

In 1911 new mining regulations, approved by the first South African Parliament, laid down that all mine officials must hold a certificate of competence in first aid 'with special reference to mining accidents'. This regulation applied to all mines employing more than 500 men and also imposed upon mine managements the duty of providing an ambulance for the conveyance of injured men.

There was at the time no machinery for training the Bantu in the practice of first aid. They were regarded as incapable of learning even the simple techniques involved. Indeed the first reference to the advisability of instituting lectures on first aid for 'Natives' in the proceedings of the Red Cross Society comes only in 1916 when the principle of holding such classes was accepted.

In the meantime some of the mining companies were taking an active interest in the teaching of first aid and had begun carrying it considerably beyond the statutory training of officials required by the Act. The Prevention of Accidents Committee of the Chamber of Mines was formed in 1912-13 and began taking a very active interest in the propagation of a knowledge of first aid.

This committee paid for the printing and publication of a new book by Dr. Louis Irvine, entitled *First Aid and Rescue Work in Mining*, for which the renowned Professor J. S. Haldane of Oxford University wrote a prefatory note in which he said: 'I heartily recommend the book to all English-speaking mining communities and I trust that it may have the wide circulation that it deserves.'

The organization of first aid competitions on the Witwatersrand owes much to the extremely detailed and efficient schemes drawn up by the Bureau of Mines, then under the Department of the Interior, of the United States. As far back as 1910 the Bureau had organized first aid classes and demonstrations of the proper use of breathing apparatus in the mines of Pennsylvania, West Virginia and Kentucky. From these arose the competitions, and a set of rules governing them, which very largely are the rules governing the contests in South Africa today.

It was from an illustrated booklet, *First Aid Instruction for Miners*, published by the U.S. Bureau of Mines in 1913, that a simple, illustrated instruction book was eventually evolved as the best method of training Bantu mineworkers. The book, which is really a picture book with captions in three Bantu languages, was first written by a mine medical officer, Dr. H. T. H. Butt (first president of the Association). It has been revised many times since it was first published and is still in use. As *Ikusiza Aba Limele* it

FIRST AID TRAINING

is the Bantu first aider's 'bible'.

When the first aid competitions for teams of white miners began on the Witwatersrand they were at first held in underground workings which provided a realistic setting. But, while this was an advantage, it was outweighed by the fact that there could be no spectators. Since the propaganda value of competitions held in full view of some thousands of men is of the greatest importance, the competitions were soon brought to the surface and have been held there ever since.

One of the early competitions held underground came very close to providing real accident cases. There was a fall of hanging close to the spot where the teams were at work. One of the judges, a distinguished President of the Association in his day, found himself sliding down a winze on the seat of his trousers and needed first aid—in the form of a stimulant—when he recovered his breath.

The great value of first aid exhibitions on mines is not only that they make the men 'accident-conscious' and therefore help to prevent accidents, but that they are also of great instructional value to the spectators who, though they may not take a first aid course, can learn what they ought to do simply from watching the trained men at work.

The President of the Mine Medical Officers' Association is always co-opted to serve on the Council of the Southern Transvaal Region of the South African Red Cross Society and a number of them have in their time also been elected to serve as presidents of the national body. Dr. A. J. Orenstein succeeded Sir Evelyn Wallers as president in 1926. He served again from 1928 to 1939. Dr. P. A. Peall was president from 1946 to 1948 and more recently Dr. L. R. B. Birt, then senior medical consultant to the Anglo American Corporation, was elected in 1964 and served to the end of 1969.

All told, members of the Association have held the office of President of the Society for twenty-four years of the past fifty.

THE ERNEST OPPENHEIMER HOSPITAL

By DR. J. H. G. VAN BLOMMESTEIN, D.S.O.

When the goldmines on the Witwatersrand began employing large numbers of Bantu in the last decade of the nineteenth and the first decade of the twentieth century, it was soon found that the existing hospital facilities were seriously inadequate structurally, in equipment and in personnel and that with the disease and injuries of those people more and better medical and nursing services and hospital facilities had to be provided, and the mine managements had to do this. The 'hospitals' provided in the early days were usually merely rooms in the compounds.

An Act passed by the Union Assembly in 1911, and Regulations promulgated in terms of this Act, provided, *inter alia*, conditions of hospital provisions. Among these it was stipulated that hospital beds should be provided in the ratio of 2½ per cent of the number of Bantu employed.

As this meant additional construction it led to some improvements in hospital structures and facilities. However, beds were still made of planks, sometimes on trestles and sometimes hinged to the wall. Bedding was one or two blankets. The operating theatres were small replicas of the wards, which in turn differed little from compound rooms.

There were no facilities for sterilizing anything. There were no X-ray machines. Gradually improvement was brought about. But there were many defects to be found which still existed on some mines at the time the Mine Medical Officers' Association was founded.

There is no intention to place the responsibility for these deplorable conditions on anyone, for this was an era in which there still survived an *idée fixe* in some people that workers were just hands, especially when they were primitive blacks, furthermore that expenditure not directly relevant to profit must be kept at a minimum.

However, the winds of change blew. Chairmen and directors and managers began to realize that every day lost by a sick or injured man adds to the cost of production and that it is sound management to keep down hospital admissions and length of stay in hospital.

THE FOUNDING OF THE ERNEST OPPENHEIMER HOSPITAL

In the course of many years of study of hospital design and planning it became more and more evident to me that, if ever the opportunity arose of planning a new hospital for Bantu mineworkers, the existing concept of such a hospital would have to undergo radical changes.

The opening of the mines of the Orange Free State at the end of the Second World War provided a wonderful opportunity for putting new ideas into practice. This was particularly true of the four new mines that Anglo American Corporation hoped to establish in a comparatively small area round what is today the flourishing town of Welkom, where hospital facilities were obviously going to be necessary for the very large number of Bantu who would be employed there.

It was at this point that I suggested to the late Sir Ernest Oppenheimer, Chairman of the Corporation, that there should be one central hospital to serve all the mines in the Welkom area.

When Sir Ernest asked me why I wanted a central hospital I explained that, as all the mines would be within approximately 4 to 5 miles of Welkom, there would be great savings in manpower, ancillary services and building costs if the hospital services could all be concentrated under one roof. The money saved by not duplicating buildings could then be made available to provide first-class buildings and equipment in the central hospital, plus the services of specialists, physicians and surgeons and such other services as are necessary in the field of occupation medicine.

For example, pneumoconiosis could be treated in a special centralized section in such a hospital, staffed by a special team having expert knowledge of the disease.

We discussed the matter further, and Sir Ernest gave his approval to my proposal.

The planning of this hospital began immediately. At the outset, Sir Ernest agreed that the latest information on hospital planning in other parts of the world should first be obtained. It was arranged that I should make a comprehensive tour of modern hospitals overseas, particularly those in Sweden.

One of the most important features of the planning was the decision to standardize all building materials and equipment throughout the hospital. As a result, costs were kept to a minimum and waste of space was avoided.

Medical and technical visitors from overseas have since said that they

THE MINE MEDICAL OFFICER AT WORK

could not build a hospital to compare with the Ernest Oppenheimer Hospital at less than three to four times the amount expended. Yet the total cost per bed came to R2 260, without skimping on a single item.

As this hospital was to be a central hospital, it was planned accordingly and provision was made for the following services: major surgery, orthopaedic surgery, internal medicine, communicable diseases, teaching, physiotherapy, radiography, occupational therapy and other departments necessary in a 1 000-bed hospital.

In planning this hospital the special needs of the Bantu workers had to be kept in mind. For instance, there are many ethnic groups and sub-groups among Bantu mine labourers, and past experience had shown that Bantu patients prefer being nursed in large wards where there is always a possibility of having others of their tribe with them. It was therefore decided to standardize on large wards.

Past experience had shown that forty-four patients were the maximum number that could be dealt with adequately in a ward. In each nursing unit there are, in addition, private wards which are set aside for very ill patients and for Bantu employed in the higher work categories.

As approximately 60 per cent of patients hospitalized are ambulatory, it was considered more expedient to have dining-rooms on each floor. This innovation was not only appreciated by the patients but had the additional advantage of considerably reducing the pressure of work in the wards.

It is amusing in this connection to recall the comments made to remind me of the rule about the avoidance of waste space. Many were the sly digs and teasing remarks that were passed concerning the extremely wide corridors in this hospital. In fact at one time it was a current story that the Corporation planned to use our corridors for landing and housing its aircraft.

However, experience had taught me that, perversely, demand for beds can occur just at a time when all, or nearly all, beds are occupied. It was at such times that the wide corridors were a boom. These corridors could be transformed into wards at very short notice, without disturbing the other patients or disrupting hospital routine. For instance, the corridors fully proved their worth and justified our forethought during an outbreak of smallpox, and again during an epidemic of influenza.

In building the hospital two great objectives were achieved—the first, the best possible services and medical equipment were provided and, secondly,

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these were provided economically. When the building programme was completed the hospital had 16 general wards, and nearly 70 private wards for the more serious cases. About 100 beds were provided for women, children and maternity cases.

It was generally agreed that the only satisfactory means of administering the hospital would be through the medium of a board. It was felt that, in order to ensure the smooth running of a hospital of this size, the composition of the management board was an all-important factor. The board was therefore constituted as follows :

Medical consultant (chairman), consulting engineer, three mine managers and the chairman of the O.F.S. Mines, or his deputy.

It became clear after the first few meetings that, from merely being a board concerned with routine administration and finance of a large hospital, it was transforming itself into an occupational health team. Mine managers found themselves bringing up a variety of industrial health problems which they were encountering in their mines. Through this lively interest of the mine managements the industrial medical research team received every encouragement to conduct their investigations in the mines themselves. As a result many most interesting problems, which in the past had been regarded as insoluble, were brought to a successful solution.

South African mining and allied industries have special problems, not only in the conditions encountered, such as exposure to the hazard of high underground temperatures in mines of the Free State, but also in relation to the many races of Africans and Europeans employed, and many other matters. Such being the case, it was felt that the training offered overseas did not altogether meet the needs of mine medical officers in this country. To meet these problems it was decided to institute courses on industrial hygiene based on this hospital.*

After some persuasion, the Royal Colleges of Physicians and Surgeons agreed to hold on a trial basis the first examination for the Diploma of Industrial Health ever held in South Africa. They were not at all sure that our training would come up to their extremely exacting requirements.

Professor J. Schilling and Dr. Guymer, two household names in occupational health, were sent out to conduct the examinations.

* An industrial hygiene diploma course was offered by the University of the Witwatersrand in 1959. No mine medical officers enrolled in this course—*Editor*.

THE MINE MEDICAL OFFICER AT WORK

Sixteen entrants took part and fourteen passed. It was agreed by the examiners that they were more than satisfied with the standard achieved, and that in many cases knowledge had been displayed that far exceeded that required for the diploma.

In addition to the work medical officers perform in the hospital a medical officer is appointed to each of the mines. Besides routine medical duties, he is expected to consult with the manager, hold daily sick parades at the dressing stations attached to each hostel on the mine and, in company with the public health officer, inspect hostels, kitchens, foodstuffs and underground mining conditions. He is also expected to pay regular visits to the clinics in the married workers' villages.

It may also be of interest to recall how the problem of nursing staff was overcome. It was clearly realized that to recruit nurses to live and work under the difficult conditions then pertaining in this undeveloped part of the country would be virtually impossible. Social life, shops and all the amenities of a community were non-existent. The blinding dust-storms of the Free State are too well known to warrant description. Small wonder then that the problem of nursing staff caused great anxiety.

But Fate works in mysterious ways and, just at this time, a member of the Society of Catholic Medical Missionaries Incorporated, which has its headquarters in the United States but operates throughout the world, visited me to find out whether there might be any possibility of its Sisters working in mine hospitals. The outcome was that the first batch of nurses arrived from Holland before the hospital was even half built. They did a sterling job of work even to the extent of turning a completed wing of the hospital into a temporary hospital for white patients until the mining industry built three hospitals as a gift to the Province, one of these in Welkom.

The hospital was designed with an eye to the future. Thus when new aseptic techniques were developed overseas, it was possible to adopt them at the Ernest Oppenheimer Hospital with very little structural alterations and cost. This was also the case when the physiotherapy and occupational therapy block had to be enlarged.

The needs of paraplegics are met by provision of physical and occupational therapy. The latter is directed toward teaching skill within the capacity of each patient, which would enable him to become self-supporting. Mental as well as physical rehabilitation is the goal aimed at.

Accommodation is provided within the grounds of the hospital for the

THE FOUNDING OF THE ERNEST OPPENHEIMER HOSPITAL

families to visit their menfolk so that they do not become isolated from all they hold dear.

One meets with many amusing situations. Two of such come to mind.

After the completion of the Ernest Oppenheimer Hospital at a time when South Africa was not in particularly good odour with the rest of the world, an effort was being made to promote trade relations with overseas countries, and publicize the many advantages we had to offer. As a result a constant stream of important people and representatives of various institutions were being invited to come and see for themselves.

By this time, the Hospital had become a showpiece of the Southern Hemisphere, not only in its design and size but because it was devoted solely to the health and welfare of the Bantu mineworkers and the families of such Bantu as hold higher positions on the mines. During a visit of representatives of the world press imagine my feelings when I heard one of our well-known engineers airily remarking in the mortuary: 'One of our operating theatres.'

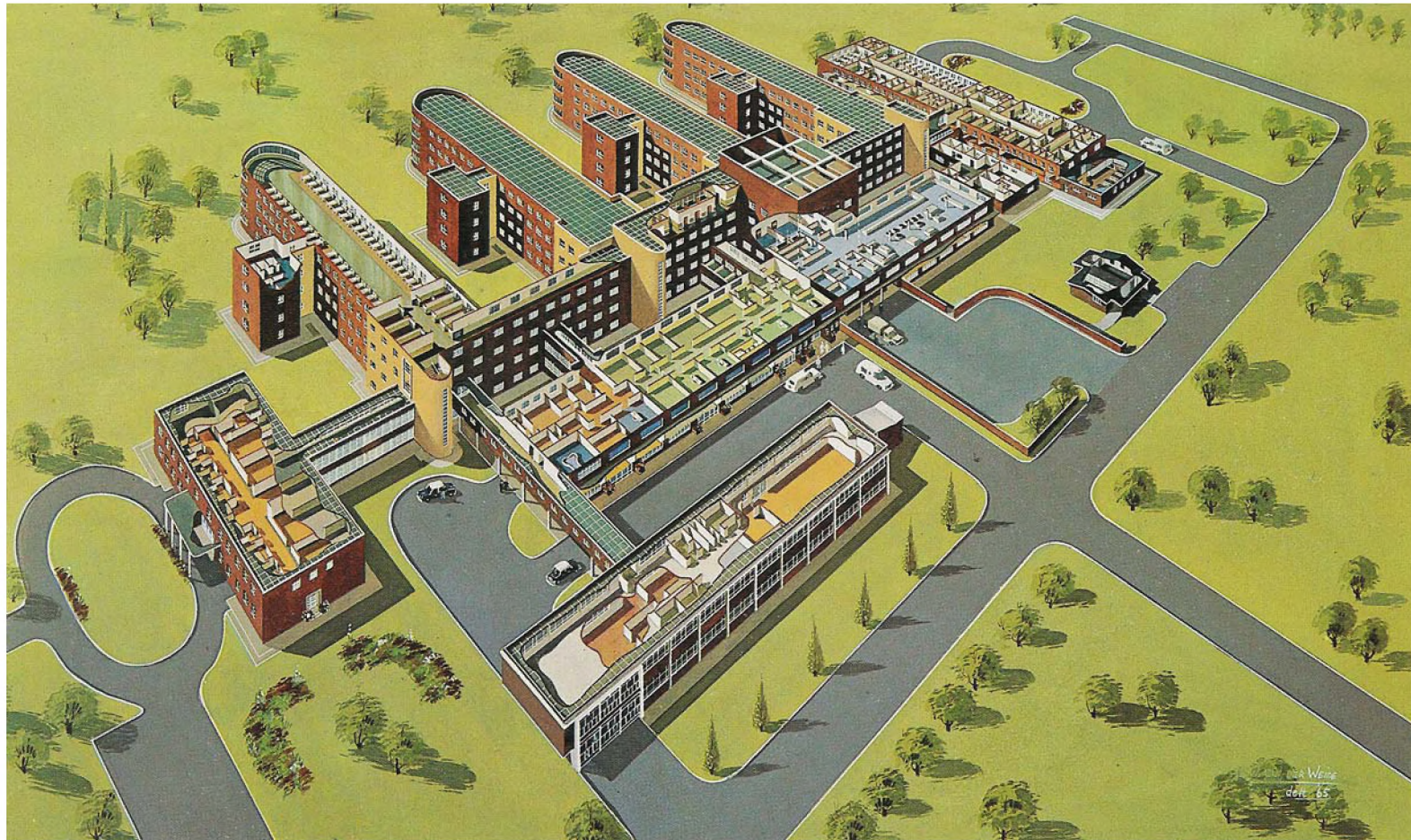
The other situation arose through a misconception of mining terms. It was customary in my annual report to list in the order of importance the main causes of accidents in our group. As always, falls of hanging (or 'roof' as it would be known to the initiated) are the cause of serious injuries. These are usually listed as 'hanging'. It was our custom, to send, at their request, a copy of the Annual Report to the International Labour Organization at Geneva to enable them to obtain, as far as possible, a complete picture of mining conditions in different parts of the world. Imagine our consternation when a letter was received from them requesting elucidation of the term 'hanging'. They felt it could not possibly mean 'suicide' but would like to be reassured on this point.

The Ernest Oppenheimer Hospital is now a recognized teaching institution. The South African Medical Council has approved the Hospital's departments of medicine, surgery and orthopaedics as meeting its criteria for specialist training. It is the only hospital in the South African mining industry that has been approved for such training.

It can truly be said that it is not often in a man's career that he is afforded such an opportunity, as I was, to see his dreams become reality. Experience in designing and revamping twenty-three hospitals for the mines of the group had laid the foundation for the creation of a hospital that it is hoped will serve worthily the African men who have played a vital role in the winning from the stubborn earth its golden treasure, and when this is

THE MINE MEDICAL OFFICER AT WORK

exhausted this hospital may yet come to serve the people of the city of Welkom—newly risen in the highveld—and now one of the largest cities in the land.



ERNEST OPPENHEIMER HOSPITAL

A perspective painting of the Earnest Oppenheimer Hospital at Welkom. It is the largest industrial hospital in Southern Africa. It was established in 1952 to serve the Bantu employees of the five goldmines under the control of Angle American Corporation in the district. The hospital now has 900 beds.



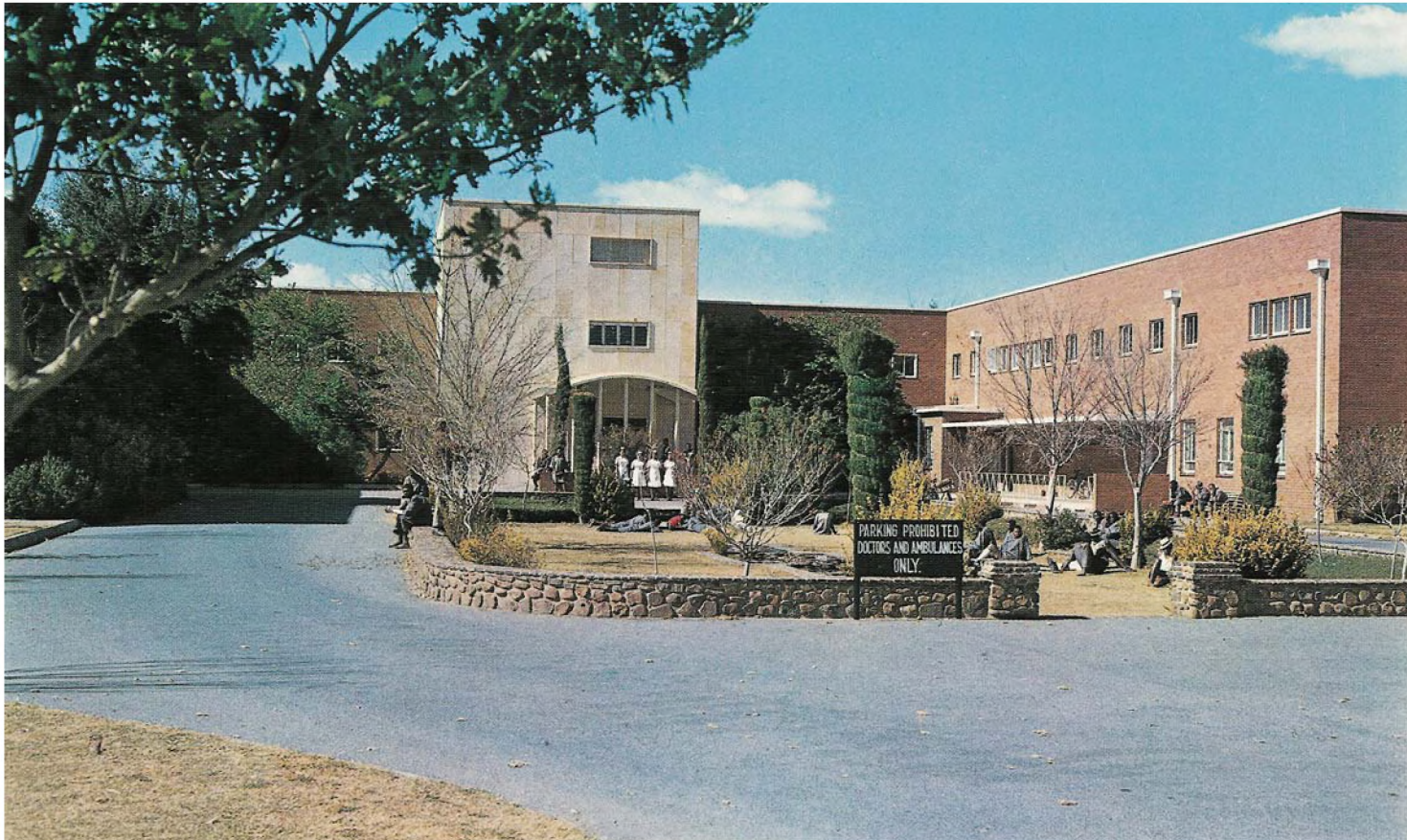
LESLIE WILLIAMS MEMORIAL HOSPITAL

Commemorates Dr. Leslie Williams, for many years a medical officer in the service of the Gold Fields Group, and latterly the Group Chief Medical Officer. Planned for 600 beds, at the time of writing only 328 beds were equipped. However all main ancillary services were built and equipped for the full planned complement, and additional wards are now being built. Notable features are an admission ward and resuscitation facilities. A dental suite is also provided. The hospital serves all the mines of the Gold Fields Group in the Far West Area. It is an approved training school for African male nurses.



WINKELHAAK HOSPITAL

This 234-bed hospital serves four mines of the Union Corporation group in the Evander area. The main building is in the shape of the letter T. The vertical limb houses services common to all floors, while the horizontal limbs house principally wards and their ancillary services, as well as some special facilities. Thus, on the ground floor there are, in addition to wards, the patient receiving facility, administration offices, the kitchen and the laundry. On the first floor are surgical wards, the operating theatres, the central sterilization and the radiological departments, and the recovery room. The second floor houses medical wards, the occupational therapy room and stores. All ward rooms are subdivided into bays.



HARMONY HOSPITAL

There are 234 beds at this hospital, some are segregated for women and children. In addition to operating theatres there is a delivery theatre. The casualty and out patient department provides consultation and treatment facilities for both sexes and children. There is also a well equipped physio-therapy department with a qualified physiotherapist in charge. The radiological department is equipped with standard and 70 mm apparatus. Because of the frequent dust storms in this area, the whole hospital is air-conditioned. The nursing staff consists of a white matron and African nurses.

PART III

**PROPHYLAXIS AND
THERAPY: THE RECORD
OVER 50 YEARS**

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The story of pneumonia—and under this name are included various acute inflammatory diseases of the lungs other than tuberculosis—is recapitulated in the introductory chapter. What follows covers the period of 1921 to date and describes the role played by the Mine Medical Officers' Association and individual members in the diagnosis, treatment and prevention of this group of acute diseases of the lungs.

The problem is one of the most formidable facing medical science and though much progress has been made, it has by no means been solved anywhere in the world as regards prevention. Wherever and whenever large numbers of men are brought together, respiratory diseases break out. Even the Roman legions experienced this.

In September 1922, about eighteen months after its inauguration, the Mine Medical Officers' Association held a round-table conference on the subject of mine hygiene in which mine and compound managers, as well as other mine officials, participated.

The conference was opened by Dr. A. J. Orenstein with an address in which he drew attention to this phenomenon and to the lack of exact knowledge of its operation and, consequently, of how to combat it. He referred to the experience of the Manaos—Marmorey railway construction, the mobilization of men for military service in the U.S.A. in 1917, and to the Panama Canal construction period. For the latter he quoted figures which illustrated the correlation between influx of new arrivals and incidence of pneumonia:

<i>Year</i>	<i>New Arrivals</i>	<i>Pneumonia %</i>
1905	12 000	5·8
1906	10 000	15·5
1907	13 000	8·4
1908	4 000	2·1
Thereafter to 1913 (few arrivals)		1·4

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He spoke of the importance of reducing the number of persons occupying a room, of sufficient floor area and of built-in prevention of contact during sleep, as well as of cleanliness, and the germicidal power of sunlight. The role of food and of general sanitation was also stressed, particularly with regard to other diseases, such as typhoid and scurvy.

Several mine and compound managers as well as mine medical officers participated in the discussion.

Discussion of vaccine in prophylaxis of pneumonia occupied the January, February and March 1924 meetings of the Association. The principal paper, which also dealt with the therapeutic use of vaccine, was presented by Sir Spencer Lister. He reviewed Sir Almroth Wright's work, and the work done by himself and others. The discovery that there were several strains of pneumococci was important, as it affected the preparation and efficiency of the vaccine.

The discussion was participated in by, among others, Dr. Pratt-Johnson, a pathologist in private practice. He sharply criticized the method of preparation and the alleged efficiency of the vaccine, but, as Lister remarked in his reply, the criticism was not as sharp as it had been a few years earlier (Pratt-Johnson put on the market his own vaccine for which therapeutic value was claimed).

By this time the prophylactic value of vaccination had become controversial. Lister replied at length, defending the prophylactic value of vaccination. A resolution was adopted to the effect that, if vaccination is used, there should be two inoculations at an interval of six to twelve days.

Pneumonia continued to be an important concern of the Association. Thus, at the September 1926 meeting, most of the time was devoted to pneumonia. Dr. A. S. Strachan, of the South African Institute for Medical Research, presented a paper in which he described the principal pathological lesions found at autopsies. He mentioned an important finding: that in recent years typical lobar pneumonia was not found as frequently as in the past; broncho-pneumonia was much more prevalent.

Dr. R. L. Girdwood, a consultant physician, reviewed the records of 363 pneumonia patients treated in the General Hospital during the period 1924 to 1926. Of these 173 were treated with Lister's vaccine and 174 in other ways. (14 died on day of admission and are not included in the two figures given above.)

His own experience, having reviewed all the factors that might have influenced the results, was inconclusive. He said, 'even the keenest

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advocates of the use of vaccine for the treatment of pneumonia stress the point that it is of most use when used early in the disease, while others hold it is of little or no value after the third day; some say after the second day'.

Dr. L. E. Miller reported the use of sodium nucleate in the treatment of pneumonia. Again the result was inconclusive, though the temperature seemed to fall to normal by crisis within forty-eight hours.

At the February 1926 meeting Dr. L. E. Miller reported on the treatment of pneumonia by diathermy and sodium nucleate. He concluded that diathermy relieved pain, tended to induce sleep and prevent severe exhaustion.

At this meeting Dr. H. Q. F. Thompson reported on treatment with Optochin, a drug reported to have a lethal action on pneumococci in blood as well as in cultures. It proved of no value, as well as being difficult to prepare and administer intravenously to delirious and restless patients.

In the same meeting Dr. A. I. Girdwood reported on the complications of pneumonia observed in the Witwatersrand Native Labour Association Hospital and, particularly, that in the treatment of late unresolved lung lesions, all forms of therapy appeared to have little value.

Discussion of the papers presented at the previous meetings was continued at the October meeting.

Dr. P. A. Peall said that the number of lobar pneumonia cases had diminished on the mine in his care, and then increased again in the past three years. In his experience vaccine given early in the onset of pneumonia was of considerable value.

In reply to a question by Dr. A. I. Girdwood, Dr. Strachan said that anti-pneumococcal serum had been found of no value in the treatment of pneumonia, except perhaps in just one type of this disease.

Dr. A. Frew submitted statistics from the East Rand Proprietary Mine on cases of lobar pneumonia for the years 1925-6. From these he drew the inference that the Bantu were 'building up an immunity'.

In September 1927 the Executive of the Association issued a questionnaire on pneumonia to all goldmines and coalmines. Thirty gold mines and five collieries completed the questionnaire.

A subcommittee of the Association, Drs. Butt, Frew and Scholtz (later the surname was changed to Scott) and A. J. Orenstein (convener), analysed the data in the replies and produced a detailed report for submission to the Chamber of Mines in April 1928.

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This report had been circulated to members prior to the meeting held in April 1928 and was discussed by members, who were by then fully cognizant of the contents. Sir Spencer Lister and Drs. Frew, Goudie and Daubenton took part in the discussion. Daubenton's contribution was the most noteworthy.

He said that they seemed to have agreed that they were not satisfied with the prophylactic value of the present vaccine. The logical decision must be to discontinue vaccination, and wait for a better one to be produced. He had stopped vaccination in October 1927. He submitted a tabulation showing—although the numbers were not large enough for drawing definite conclusions—that, although vaccination had stopped, there was a decrease of incidence of pneumonia, despite heavy recruiting. He stressed the importance of hygiene and of separate bunks.

Dr. Goudie surmised that vaccination lowered the power of resistance to infection for some time immediately following inoculation. (He referred presumably to the theory of a 'negative phase'—held by some authorities.) Too much vaccination, he thought, might account for the current high death-rate.

Dr. Frew said that, in view of the great divergence of views regarding vaccination, he would propose: That the report be forwarded to the Gold Producers Committee as an interim document, and that the incoming Executive should be asked to appoint a subcommittee with instructions to investigate the practicability of differentiating the various types of pneumonia, including a study of autopsies bearing on the above subject. The subcommittee should also be instructed to study vaccination with reference to (1) abolishing it, or (2) vaccinating on some mines and keeping others as controls, and to consider methods of treatment. This proposal was unanimously adopted.

In June 1929 Mellanby and Green published a paper in the *British Medical Journal* on the anti-infection properties of vitamin A. They used this vitamin in the treatment of puerperal sepsis with notably good results. During a visit of Professor Mellanby to the Crown Mines Hospital he suggested that this substance be tried in treating pneumonia.

Drs. Donaldson and Tasker reported the result of this trial at the February 1930 meeting of the Association. 399 consecutive cases diagnosed as lobar or broncho-pneumonia were divided into three groups, A of 100, B of 99 and C of 100 patients, assigned in the order of their arrival in hospital, without any selection. Group A was treated in the routine manner used in this hospital.

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Group B received half a pound of lightly steamed ox liver daily, Group C was treated with highly potent vitamin A preparations.

The progress of these cases was recorded under:

1. Number of days of elevated temperature, taken to be an index of toxæmia.
2. Number of days during which the physical signs of lung inflammation persisted.
3. Apparent delay of resolution.
4. Number of days in hospital.

The patients treated with vitamin C (Radiostoleum and Preparation Y) had shorter hospital stay, shorter period of elevated temperature, shorter period of abnormal physical signs, and a lower mortality rate.

This was another of many attempts to find an efficient treatment for this prevalent and mortal disease. However no treatment ever proved very effective until the advent of the sulphas and antibiotics. Both these drastically reduced the case mortality, as will appear later in this chapter.

Dr. David Ordman of the South African Institute for Medical Research, who had done most of the work on the identification of the bacterial flora in pneumonia, presented a comprehensive paper at the March 1931 meeting. The summary stated that there had been a fall in mortality from 1907 to 1927 and a slight rise since then. All the available evidence showed that the classical form of pneumonia had been modified, and so had the bacterial flora. There was evidence that the flora of the winter season pneumonia differed from that of the spring season. There was consequently need for seasonal changes of the bacterial constituents of the vaccine.

As there seemed to be also a difference in the bacterial flora in different parts of the Witwatersrand, 'community autogenous vaccine' should be prepared for each of the relevant geographical areas.

The discussion disclosed that while Dr. Peall claimed a high degree of success following vaccination, other mine medical officers reported the contrary. Thus Drs. Donaldson and Daubenton reported an actual decrease in mortality since vaccination had been stopped. Dr. Orenstein recapitulated the statistics of the Rand Mines group, and again disagreed with the contention that the vaccination had a valid effect. If a certain procedure produced a valid effect it should be demonstrable by relatively simple mathematics. This was not possible in the case of prophylactic inoculation

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against pneumonia as practised here for nearly fifteen years.

Discussion of this subject was taken up again at the May 1931 meeting. Dr. A. Smith, of Government Areas, New State and Van Ryn Deep Mines, reported the experience of Government Areas, where inoculation had been stopped on 28 March 1928. At New State Areas and Van Ryn Deep inoculation was discontinued in March 1929. Supporting his opinion by statistics, demonstrated on graphs exhibited, he said that, despite unusually large numbers of new recruits, no ill effect had followed the dropping of vaccination.

At this meeting Dr. Daubenton referred to the difference of views regarding vaccination. He said that on the one hand there were about thirty mine medical officers who, on the basis of their statistics, saw no value in the procedure, and on the other hand the South African Institute for Medical Research and the Union Health Department urged continuing vaccination. Was it perhaps due to differences in the criteria on which the diagnosis of pneumonia is made? He thought that such might be the case. This might account for the great difference in the case mortality of American Negroes and Bantu—respectively 30-40 per cent and less than 20 per cent. The inclusion in statistics under the head of pneumonia of cases which were not due to pneumococcus was likely to bias opinion against vaccination.

Dr. Peall presented statistics separating respiratory diseases into three categories: pneumonia, broncho-pneumonia and 'other respiratory diseases'. He concluded that various environmental factors influenced the incidence of respiratory diseases. The incidence of 'other respiratory diseases' was much higher than in both of the first two categories, whereas the case mortality was much higher in 'pneumonia'. He had instituted inoculation with the 'community' vaccine in July 1930, and the mortality rate had shown a marked decrease, though he did not wish to imply that the decrease was due solely to the vaccination. He suggested, however, that there was enough evidence to justify a thorough and extended test of 'community autogenous' vaccine.

Dr. Coleman reported on the effect of intravenous infusion of sodium salicylate in the treatment of pneumonia, based on a paper in the *Journal of the American Medical Association*, 5 October 1929. Forty-eight consecutively admitted cases had been so treated. The results had been disappointing.

Dr. H. Q. F. Thompson reported treatment with intramuscular injection of quinine, stated as having been 'the method of choice' on the basis of 300

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cases reported by Professor von Bergmann and others in Germany. He found no apparent advantage in this therapy.

A prolonged discussion followed remarks by Sir Spencer Lister in which he referred to the paper he presented previously. He concluded by suggesting that to obtain reliable results in any future investigation all preconceived views should be 'kept under discipline . . . and nothing but strict and accurate methods of investigation employed'.

A point brought out in the discussion was that acute respiratory diseases attacked recruits from areas where there has been little contact with strangers, and that most of the cases occurred in the first three months after arrival on the mines.

Dr. A. Frew spoke with wit, humour and tolerance on the pneumonia problem. He believed that the suggestion that the controversial views held on the value of vaccination were due to the method having been 'applied loosely'—as allegedly stated by Sir Spencer—was a grave injustice. He did not think any experiment of this nature had had a larger, fairer or more prolonged trial.

Although there was on the Rand what was probably the largest field in the world for research, no progress had been made in the past thirty years towards lowering the death-rate from pneumonia. Many treatments were promising in the beginning 'only to fall like a damp rocket in the end'.

Drs. van Blommestein and Scholtz spoke of the difficulties of differential diagnosis of acute lung inflammation, particularly as between lobar pneumonia and broncho-pneumonia, some of possibly influenza origin.

Dr. A. J. Orenstein replied to certain criticism by Sir Spencer of the statistics of the Rand Mines group. He prefaced his remarks by stating that he had the greatest admiration for Sir Spencer's pioneer work in the typing of pneumococci.

The discussion continued at length, participated in by those who had spoken before and by Drs. Tucker and Goudie.

Rand Mines' Annual Report for 1937 contained a statistical analysis by Professor J. N. Dalton of the group's experience with the 'community autogenous vaccine' and a review covering the period 1915-36. Professor Dalton stated that the result could be summarized as 'unproven', in the Scottish verdict term, as regards vaccination for the control of pneumonia. Drs. Frew and Goudie analysed 1591 charts of pneumonia cases submitted by nine mines. The results confirmed those of previous analyses. These

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were: Men from 'east coast' were more susceptible than those from the Union of South Africa and adjacent territories. There were more cases in the first and second months of service than in any of the following four months. The incidence rates of pneumonia in this series was approximately 2.5 to 1 among underground workers compared with surface workers.

There was no difference in the effect of the various treatments used in this series.

Dr. Daubenton submitted an elaborate analysis and discussion of the influence of environmental factors on the incidence of respiratory diseases on the mines. Because of the wide ground covered by this paper, discussion was deferred.

Dr. C. Justin Scholtz presented a paper discussing the possible importance of diet in relation to respiratory diseases, especially that of vitamin A. Dr. Orenstein reported that Dr. Fox of the South African Institute for Medical Research had been engaged for some time in investigating the vitamin A content of the mine labourers' diet. Lister said that he held strongly the view that resistance to pneumonia was not chiefly a matter of diet but of active immunization by means of a suitable vaccine.

It was decided that the Executive Committee should consider the appointment of a committee to collate all the papers presented, to serve as a basis for framing a final report to the Chamber of Mines.

Later reports by Dr. Fox on analyses of vitamin A content of the livers of mine labourers accidentally killed showed no deficiency of vitamin A. This finding was later supported by an investigation of a night vision carried out by Dr. L. Staz of randomly selected mine Bantu. As agreed at the previous meeting, Daubenton and Orenstein collated the data of Daubenton's paper on a single graph. This graph demonstrated that :

1. The greater the ratio on a goldmine of voluntary to recruited labour the lower the incidence of respiratory diseases.
2. The greater the ratio on a given mine of 'east coast' men the greater the incidence of respiratory diseases.
3. That deeper mines have an average higher incidence of respiratory diseases than the shallower mines.
4. There is a positive correlation of the incidence of 'other diseases' with that of respiratory diseases. This points to there being no tendency to record respiratory diseases under 'other diseases'.

At the May 1932 meeting Dr. Daubenton presented another well-prepared

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paper as a continuation of the one presented eight months earlier. His review covered the period 1930—of all mines members of the Chamber. These data confirm the principal findings reported in September 1931 and also demonstrate that there is a wide variation between mines in the reported ratio of lobar pneumonia to other acute respiratory diseases. As was stated on previous occasions, under the prevailing circumstances the differential diagnosis is very uncertain, a matter of personal judgement of the relative value of clinical signs and symptoms and also probably conditioned by the fact that precise diagnosis would not influence the kind of therapy prescribed.

At the June 1934 meeting Dr. P. A. Peall presented a paper on the experience with 'community autogenous vaccine' for the past 3½ years at the Randfontein Estates mines. The statistics submitted, the author stipulated, covered under the designation 'Pneumonia' lobar, broncho- and influenzal pneumonites. Examination of specimens from the lungs disclosed that the bacterial flora of the pneumonias had completely changed. None of the species found previously were at this time present. A new vaccine incorporating the flora now found was prepared. This vaccine was used both prophylactically and in therapy commencing on 1 July 1930. In 1929 the incidence of pneumonia was 54·02 per 1000, and in 1930—45·59, as against 30·56 and 37·72 for all goldmines, excluding Randfontein Estates. This dropped to 26·43, 12·96 and 9·85 at Randfontein in the subsequent three years, while in the corresponding years the incidence on *all* goldmines, excluding Randfontein, was 31·48, 23·90 and 21·37 per cent. The mortality rates per 1 000 were even more dramatically reduced from 8·3 in 1929 to 3·8, 1·6, 1·2 and 1·1 in the four subsequent years, while these rates for all other goldmines were respectively 4·88, 4·37, 3·25 and 2·60. Various factors that could possibly have had an influence on the incidence and mortality were discussed, and the conclusion Dr. Peall arrived at was that the new vaccine was the major factor in the reduction achieved.

Dr. Daubenton, while fully recognizing the value of the work done and the manner in which it was presented, justified the criticism he would make on the score that it would court certain setback if a procedure were generally adopted as 'the result of over-keen enthusiasm'. He presented several detailed tables which, in his view, contradicted some of Dr. Peall's deductions. Much of Dr. Daubenton's criticism related to the inclusion by Dr. Peall of all types of pneumonias under one head.

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Drs. Frew and Goudie also submitted some criticisms of Dr. Peall's statistics, and expressed a guarded view of the true value of the new vaccine and on the advisability of its general adoption. Dr. E. L. Ferguson said that he attributed the fall in mortality at the Simmer and Jack mines—which he believed to be a much more reliable yardstick than incidence in the case of respiratory diseases—to the following factors: change of the tribal composition of the labour complement; vaccination with the new vaccine, and on as yet unknown factors. Dr. van Blommestein reported that the new vaccine had been used at the Brakpan mines from the middle of 1929 to June 1931 when vaccination was stopped. The incidence was: 1928—28·5; 1929—27·9; 1930—30·6; 1931—21·6; 1932—15·6; 1933—16·6. The drop had been gradual and the best years were the years after vaccination had been stopped.

Dr. L. E. Miller of Durban Roodepoort Deep, quoted statistics from that mine. The experiment coincided in time with that at Brakpan. Vaccination was stopped at the beginning of 1931, yet the incidence of both pneumonia and 'total diseases' steadily declined—as also did the mortality—to approximately the same extent as at Randfontein.

Dr. Ordman (South African Institute for Medical Research), who was mainly responsible for the preparation of the vaccine at that time, and Sir Spencer Lister queried the statistical methods used and the conclusions reached. It is true that the various tabulations were open to valid criticisms. But differential diagnosis, and correct segregation by even the main types of pneumonia, or 'pneumonitis', the better modern nomenclature, is difficult under the best hospital conditions, as Ferguson commented in his contribution, 'Medicine is more of an art than an exact science'. In the hurry of mine medical practice it could hardly be expected for the diagnosis to be always meticulously correct, hence Dr. Peall's lumping all acute 'pneumonitis' under one head was probably the best method in the circumstances.

At the invitation of the Chairman, who reminded members that Dr. Peall's paper dealt with data from an experiment still in progress, Dr. Orenstein concluded the discussion. He added his appreciation to those already expressed by members of Dr. Peall's initiative and thoroughness in organizing the investigation, and the manner of compilation and presentation of the findings. He said that, while it was true that statisticians might cavil at his method, it had to be remembered that Dr. Peall had not set out to make a mathematical statistical analysis, but to record what he

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had observed. He was fully entitled to draw conclusions there-from. Sir Spencer had rightly remarked that mine medical officers could be grouped as either pro- or anti-vaccination. Dr. Orenstein said that many might consider him a member of the latter group. Actually he was but a sceptic and a seeker of the truth. He was sceptical because of the records of failure of vaccination against pneumonia not only locally but also elsewhere. At the risk of being accused of dogmatism, he would recapitulate his view in a few brief sentences :

1. The true aetiological factors of the respiratory diseases named pneumonia, broncho-pneumonia and influenza were not yet clearly demonstrated.
2. Attacks of these diseases, natural in man but artificially induced in animals, produced no marked immunity, except in certain experimental animals after inoculation with *living* cultures of pneumococci.
3. Inoculation of these animals with *dead* pneumococci had produced only questionable immunity.
4. Inoculation with dead cultures against diseases, an attack of which does not induce immunity, does not appear to generate either marked or lasting immunity.
5. Immunization by a mixture of varieties of organisms appeared to him to indicate lack of exact knowledge. The only warrant for such a procedure would be unquestionable success.

He suggested that an experiment should be conducted, with any vaccine the South African Institute for Medical Research might produce, at the City Deep and Geldenhuis mines, the one deep and the other of medium depth, by using every second recruit selected at random to be vaccinated. The experiment should be under any type of supervision the South African Institute for Medical Research might desire, and it should be conducted over several years, and recorded in any form the South African Institute for Medical Research might direct.

He closed by restating his appreciation of Dr. Peall's contribution and by thanking the Chairman for the invitation to address the meeting.

In a later comprehensive paper Dr. Peall dealt with a number of the queries raised by contributors to the symposium. In particular he stated that he agreed with those who considered that all acute respiratory diseases should be shown under one head, and not divided into 'influenza' and 'bronchitis'. He defended the conclusion he had derived from the experience

at Randfontein Estates that the community autogenous vaccine played a decisive role in the reduction of mortality from pneumonia, and dealt with the various objections raised. He referred to the Simmer and Jack experiment as supporting the claims in favour of this vaccine.

Sir Spencer Lister raised several objections to the conditions attached to the offer to conduct an experiment on two mines of the Rand Mines group—viz. City Deep and Geldenhuis. He suggested that these should be considered before any plan was decided upon. If those points were adjusted, there should be no obstacles to mounting an experiment. Sir Spencer's principal objection was that the proposal of vaccinating alternate persons would create a bias against vaccination by altering the herd immunity. Consequently the matter was dropped.

Dr. F. J. Allen, a shrewd and experienced general practitioner who had a large private practice in Witbank and also served as mine medical officer to the Witbank and a number of other collieries in the district, presented at the January 1935 meeting a paper entitled 'Perplexities of a General Practitioner Regarding the Aethiology of Infective Diseases in General and Pneumonia in Particular'.

Here are some of his aphorisms:

'... Vaccine therapy in lobar pneumonia has not even a scientific basis for its use, as an antigen requires about ten days to produce antibodies, by which time the disease has about reached its end. I raised this point recently with a bacteriologist who suggested it might act as a form of protein shock, a form of treatment in acute disease which reminds one of the old way of starting a recalcitrant motor-bike. When applied knowledge fails, give it a good shaking and a kick and it sometimes started; again, you sometimes bust it.'

'... Pneumonia, after losing eight heads has, hydra-like, grown eighty new ones and is now to have these blown off by the new vaccine. The first shot has been fired at Randfontein.'

'... If the lay public are fooled by some of the panaceas of patent medicines still more so are the general practitioners, exploited by enterprising salesmen of various vaccines, sera, vitamin preparations and a growing host of hormones skilfully advertised in scientific phraseology with quotations from the scientist who has made the "new discovery".'

'... A Press censor is badly required for this class of literature. I shall conclude with a quotation from H. G. Wells:

' "The most beautifully reasoned deductions in the world, the most elaborate mathematical demonstrations, collapse and must be made over

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again before the absolute veto of a single contradictory fact, however small that fact may be.” ’

Allen was held in the highest esteem by everyone in his town and by those who worked with him. In a farewell letter to him on his retirement in 1955 Dr. Orenstein wrote: ‘ . . . I have always had, and still have, the deepest regard for your professional acumen and your enormously upright character.’

At the May 1937 meeting Dr. Frew reported on an outbreak of pneumonia during the period May to September 1936. Except that it occurred in the cold months, he could find no other possible cause. Dr. Ordman of the South African Institute for Medical Research found that the prevalent bacteria were pneumococci—types I and II.

Rand Mines Health Department Report for 1937 recorded the finding that pneumonia incidence increases in months of low temperature, low rainfall and high wind velocity. This was based on records supplied by the meteorological service for the years 1926 to 1935.

In this report was also published Professor Dalton’s statistical analysis of the effect of the ‘community autogenous vaccine’ on the City Deep and Geldenhuis mines. (This is not to be confused with the proposed experiment at these mines mentioned above, and which had never taken place.)

Only the following summary is relevant to the present purpose. The complete text was published in the Rand Mines Health Department Report for 1937.

The population of the two mines at the commencement of the investigation was about 8 000 and 6 600 respectively. This rose to a peak at the City Deep of 9 400 in February 1937, and had receded to 8 400 by the end of the investigation. Geldenhuis Deep remained at about the original figure, until it dropped to 4 000 about the middle of 1936.

Both mines in the preceding years, from 1924 onwards, had a higher incidence of pneumonia (both lobar and broncho were included under this head) than the group average.

This investigation covered the period 1 October 1934 to 31 September 1937.

The vaccine used was the ‘community autogenous’ supplied by the South African Institute for Medical Research.

During the period 1928 to 1930, when inoculation with the then supplied vaccine was in vogue, the incidence trend was in most cases upwards. In the period 1930-4, when no inoculation was used, the trend was definitely downwards.

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From October 1934 onwards every recruit was inoculated at the Geldenhuis and every alternate recruit at the City Deep.

Professor Dalton's conclusion from the statistical analysis of the data recorded at the two mines was that 'it was not possible to attribute the results obtained to the introduction of vaccination. The manifestation showed a secular trend due to a yet unknown cause.'

The October and November 1939 meetings were devoted to a symposium on the effect of treatment of pneumonia with 'M & B 693'—sulphapyridine. This happened to be the first extensive trial of the sulpha family of drugs in treating pneumonia. The results were dramatically favourable. But this particular variety of the drug had the objectionable side effect of nausea and sometimes vomiting. Later various changes in the composition of this medicament eliminated the side effect, and also increased its effectiveness. Until the advent of antibiotics the sulphas were the sheet-anchor in the therapy of pneumonia.

At this symposium Dr. A. O. Dreosti presented the main paper. This paper dealt with the results of treatment of pneumonia with sulphapyridine, and one hundred concurrent cases treated routinely as heretofore were the control.

The results confirmed the findings of clinicians overseas that this drug shortened the duration of illness and ameliorated distress. The effect on mortality was not definitely ascertainable, as the number of cases treated was too small for statistical analysis. However, there were no deaths among those treated, but four deaths in the control group.

Similar results were reported by Dr. Peall, who also gave the comparative case mortality rates for the years July 1931 to July 1938 as 5.5 per cent, before the sulpha was used, and October 1938 to October 1939 when the drug was in use, as 0.83 per cent.

Dr. Ordman presented an analysis of the statistics of all the West Rand goldmines for the year ended 31 September 1939. This shows that the use of the sulphapyridine resulted in a marked reduction of deaths from lobar pneumonia, less so from broncho-pneumonia, and that there had been no effect in influenzal pneumonia. In the almost invariably fatal pneumococcal meningitis there was a number of recoveries with the use of the drug. It appeared to be also effective in reducing the mortality of the more common meningococcal meningitis.

At the January 1940 meeting Dr. A. Miller opened the discussion on the papers presented at the November 1939 meeting. He confirmed the efficacy of sulphapyridine in pneumonia and pneumococcal meningitis from his own

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experience, and expressed the hope that an equally effective drug might be found for the other scourge of the Bantu, namely tuberculosis.

Considerable progress towards the realization of this hope was made in later years.

Drs. Lawrie, Clifton, A. Smith, Tucker, Goldsmith, Eagle, Williams and Ordman participated in the symposium and all reported favourably on the use of the drug.

At the September 1949 meeting Dr. W. F. Scott reported on his intensive study of fifty-two pneumonia cases at the City Deep hospital. The criteria for the diagnosis of pneumonia were definite signs of consolidation of a lobe or a portion of a lobe, crepitant râles at some stage of the disease; and crisis, pseudo-crisis or rapid lysis—except where some complication was present. A detailed record was kept of each case, comprising the clinical picture, laboratory findings and physical and radiological signs. Results of treatment with sulphapyridine and penicillin were recorded; penicillin was found to be more effective. A number of mine medical officers took part in the discussion of this very painstaking and well-documented study.

At the January 1959 meeting Dr. P. Smit reviewed the history of pneumonia as it affected Bantu mineworkers. He recapitulated the bearing of the tribal composition, the working environment and the medical service on the occurrence of pneumonitis, and of influenza, on the development of local epidemics. He advocated an intensive study, clinical, pathological and epidemiological, as the most promising way towards effective preventive measures.

He was supported in this view by the Director of the Institute for Medical Research, Dr. J. H. S. Gear, who said that the Institute would be glad to collaborate in such a study.

Dr. E. W. Geddes at the October 1959 meeting reviewed the present methods of therapy and the complications which occur in acute respiratory diseases. These diseases are still a major problem, he concluded.

In 1957 the Association suggested that there should be instituted an investigation into the aetiology of acute respiratory diseases among the mine labourers. In 1959 the Chamber of Mines Research Advisory Committee approved the project. One finding in this investigation by mine medical officers, which occupied eighteen months, was that about 20 per cent of shifts lost was due to respiratory diseases.

Professor C. H. Stewart-Harris of Sheffield University, whose special field is acute respiratory diseases and chronic bronchitis, was invited by the

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Chamber of Mines to visit the mines and advise on further research. He addressed a meeting of the Association on 7 July 1966.

His address dealt with the known respiratory viruses. They were spread by sputum droplets, and their seasonal prevalence was characteristic, but had not yet been explained. The epidemiology of respiratory diseases caused by a virus differed in a closed community, such as schools and barracks, from that in a general population. Epidemics of certain of these infections persist as long as new arrivals keep coming. In such a population as the mine Bantu it might be possible to control the incidence of influenza by the right kind of a virus vaccine. But the efficiency of the vaccine must be proved beforehand. Interferon is not effective in virus infections.

And this is how the matter stands today!

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Pulmonary and other forms of tuberculosis have been a scourge of many people of Africa for as far back as there are any records, certainly many years before recruiting for mine work was instituted.

The problem facing the mines is, therefore, a dual one—to keep out infected and therefore most probably infective men, and to detect new infections at as early a stage as possible.

To these ends diagnostic procedures are constantly evaluated and refined. Many mine medical officers have played an important role in the evaluation of existing methods and the significance of certain findings such as, for example, those of certain lung râles.

The improvements made in the last few decades in the technique of radiography, particularly in the use of small films in mass radiography, enable the use of this most important diagnostic aid in quantity, as well as quality, probably unequalled anywhere else. Mine medical officers read many thousands of lung radiographs every year.

The Chamber of Mines sponsored financially several investigations into the prevalence of tuberculosis in the territories in South Africa. The most comprehensive of these was that carried out under the general direction of the late S. Lyle Cummins.

The prophylactic value of BCG vaccination, and the curative and prophylactic values of newly developed drugs were, and continue to be, investigated.

Because of the importance of tuberculosis both as an industrial health problem and as a national one, the role of mine medical officers in dealing with this matter will be given in some detail.

Only five months after the formation of the Association, the August 1921 meeting was devoted to the discussion of the diagnosis of pulmonary tuberculosis. The first paper was by J. F. Young, medical officer of the Native Recruiting Corporation. He described the procedure of examination of recruits from South African territories at the Witwatersrand depot. There was a preliminary examination at the recruiting centres. The examination at

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the depot relied entirely on the physical examination, particularly auscultation.

Dr. A. I. Girdwood, Medical Officer of the Witwatersrand Native Labour Association, dealt with the examination of the recruits from Mozambique. There was a preliminary examination at the Ressano Garcia depot. The examination at the W.N.L.A. depot also relied principally on auscultation. He said: 'There is no doubt that a number of incipient cases of tuberculosis and silicosis escape detection at the initial examination, but the number is comparatively small.'

Recruits were also examined by mine medical officers on arrival at the mines to which they were assigned.

Both Drs. Young and Girdwood stated that they were not very happy about the thoroughness of the procedure adopted, but described it as the best that could be done in the prevailing circumstances. It is to be noted that there was no radiological examination.

The diagnosis of tuberculosis and of silicosis was further discussed at subsequent meetings at which the leading paper was presented by Drs. L. G. Irvine and J. M. Smith. It dealt with the procedure adopted at the Miners Phthisis Medical Bureau. Radiology was used in all cases.

Dr. A. B. Dodds, who had many years' experience in mine work, presented at the October meeting a paper in which he stressed the importance of the general constitution of the recruit, such as ratio of weight to height, respiratory movement and normal lung signs. He said that he rejected all recruits who had crepitations in a lung apex. He favoured the practice of repatriating all who had frequently recurring attacks of bronchitis because these were most apt to acquire tuberculosis. The monthly weighing system, it was agreed, had much merit as a means of screening suspect lung pathology.

At that time the recruits from 'British South Africa' (now the Republic of South Africa) and adjacent territories were concentrated and examined in a depot near Germiston and the 'east coast' natives at the depot in Johannesburg. It was suggested that all recruits should be dealt with at one depot and that an adequate staff be provided there to ensure as efficient an examination as possible. It was agreed to discuss this proposal at a subsequent meeting. Consequently, at the November meeting, Dr. S. Donaldson moved a resolution to that effect. He said that the existing system was not that of examination but of inspection. He quoted a number

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of statistical data in support of the proposal. No decision was taken.

This matter came up again a year later, triggered by a paper presented by Dr. Hertslet in which he quoted statistics indicating the serious prevalence of tuberculosis. Donaldson reminded the meeting of his motion and asked that it be dealt with. A decision was postponed pending a report from a subcommittee appointed to consider the broad aspects of the problem. The members of this subcommittee were Drs. Donaldson, Dodds, Girdwood, Irvine and Orenstein. They presented their report at the November 1922 meeting. The report, after acknowledging the assistance of Dr. Peter Allen, the Union Department of Health Tuberculosis Officer, stated :

‘The available data are insufficient to permit a definite conclusion as to the prevalence of tuberculosis in the Native territories, nor whether it is increasing or decreasing. But it is safe to say that tuberculosis is widely prevalent.’

The opinion was expressed that tuberculosis was on the increase among native mineworkers.

It was recommended that a memorandum be issued to medical examiners of recruits setting out a detailed procedure. A draft of this was given as an annexure.

Mine medical officers were to be asked to follow this procedure.

The establishment of a central examining board was not justified by the available information, and was not recommended.

The report made recommendations on the disposal of those who had tuberculosis. In brief these were: Local treatment was impracticable, nor was it feasible for the industry to establish treatment facilities elsewhere.

The report was discussed at the next meeting and, with a few minor amendments, and with the addition of the statistical data at the disposal of the subcommittee, was adopted for transmission to the Chamber of Mines.

The concern of mine medical officers with the problem posed by tuberculosis continued to occupy much of the time of the Association's meetings in the following years.

The two subjects which received most consideration were the search for criteria indicating the earliest signs of tuberculosis detectable by physical examination, and the disposal of those found to have the disease.

As regards the latter the Association recommended that, as prolonged treatment locally was impracticable because there were no facilities, and also because once the diagnosis was established the men were entitled to be

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repatriated, and insisted on exercising this right, it was important that there should be little delay in arranging repatriation. To this end the Mine Medical Officers' Association recommended that all such cases should be dealt with by a central board at the W.N.L.A. hospital. It was recognized that, from the wider point of view, repatriation of infected cases to their home kraals was undesirable. But at that time it seemed the only possible course open.

This dilemma persisted until recent times, when curative drugs became available and the Bantu, having lost much of their dislike of hospitals, are in many cases willing to stay on for treatment now provided at mine and Wenela hospitals.

At the May 1926 meeting Dr. Butt reported on the proceedings of a committee appointed by the Chamber of Mines in June 1925. The members were: Drs. W. Watkins Pitchford, F. S. Lister, A. Mavrogordato, J. H. H. Pirie of the S.A.I.M.R., A. Pringle of the Miners' Phthisis Sanatorium; and A. Bloom, A. Frew, A. I. Girdwood, A. J. Orenstein and H. T. H. Butt of the Mine Medical Officers' Association.

One action taken was the installation of radiographic facilities at the W.N.L.A.

Both radioscopy and radiography were used, the work being done by an 'expert'. (Radioscopy was proved unreliable as a diagnostic tool.) Further research was to be done on radiography.

The recommendations made included :

Long-service Bantu to be radiographed annually.

Standard weighing machines to be used and the weighing to be well supervised.

A monthly report on tuberculosis to be submitted to the Chamber of Mines by mine medical officers.

In June 1926 the Chamber of Mines directed that :

Mine medical officers should carry out a pre-employment examination, and not rely on the findings of the examination at W.N.L.A. Mining and compound officials should report to the mine medical officer any cases of chronic cough, debility or any signs of possible tuberculosis and that the mine medical officers should examine all such cases.

All Bantu with more than six years' cumulative service should be radiologically examined at least once a year. *Pro forma* record and report forms were to be supplied for use by the mine medical officers.

At the meeting in June 1927 Dr. Mavrogordato reported the result of an investigation carried out by the Chamber of Mines Tuberculosis Committee

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appointed in 1925. It covered a population of 160 000 observed for nine months. The results were characterized by Mavrogordato as completely unreliable and even absurd.

An important landmark in the various attempts at dealing with the problem of tuberculosis was the expansion of the Chamber of Mines sponsored 'The Medical Committee on Tuberculosis' into 'The Tuberculosis Research Committee' in 1926. This Committee was financed jointly by the Chamber of Mines, the Government and the Deferred Pay Fund. The membership was enlarged by the addition of nominees by the Government. These were: Drs. Alexander Mitchell, J. T. Denniston, W. A. Murray and Major M. S. Cooke, Director of Native Labour.

The S.A.I.M.R. was represented by Dr. W. Watkins Pitchford, Sir Spencer Lister, Drs. G. Mavrogordato, J. H. Harvey Pirie and G. Buchanan. The Mine Medical Officers' Association was represented by Drs. A. J. Orenstein, H. T. H. Butt, A. I. Girdwood, A. Frew, A. Bloom, A. W. Pringle, and Mr. H. M. Taberer, Labour Adviser to the Chamber of Mines. Mr. B. Orpen, consulting engineer to Gold Fields, was co-opted as representing the Mine Managers' Association. Professor S. Lyle Cummins, Professor of Tuberculosis, Welsh National School of Medicine, was appointed as adviser and consultant and Dr. Peter Allan, Superintendent of Nelspoort Sanatorium, was seconded by Government as Field Research Officer. Dr. W. Watkins Pitchford was chairman. On his resignation because of ill health he was succeeded by Sir Spencer Lister.

The comprehensive report of the Committee's activities and its recommendations was published in March 1932, but was available to mine medical officers and others concerned in 1930. (Publication XXX, vol. V, S.A.I.M.R.)

This report gives a mass of valuable data concerning the clinical and pathological findings, and the incidence of tuberculosis among mine Bantu, as well as among the native population in southern Africa. It records the result of the largest number of tuberculin tests ever carried out in a similar community. All told 93 979 mine natives were thus tested; 65 per cent of these reacted positively.

In 'kraals' the positive rate for males over 20 years of age ranged from 69 to 88 per cent and among female adults from 35 to 83 per cent. This was taken as at least in some part accounting for the decrease of the acute tuberculosis cases and an increase of the type of that usually seen among Europeans. Nevertheless Dr. Allan found that about one-half of repatriated

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mine Bantu tubercular cases died within two years.

Professor Lyle Cummins addressed the September 1927 meeting of the Association. After pointing out the importance of tuberculosis to the native peoples of Africa, of which he had had considerable experience in the Sudan, he referred to the manifestation of the infection among European adults and among their infants: slow progress and many recoveries in adults, and in infants rapid progress and high fatality rate. He said it was the latter form which in the past was prevalent among the Bantu, and which still occurred, but much less frequently than it had a few decades earlier. He stressed the importance of establishing the mechanism of transmission of the disease. In this he was supported by the speakers in the discussion that followed.

The help given by mine medical officers in the course of the investigations by the Committee was praised by Lyle Cummins and by other speakers, particularly by Sir Spencer Lister, who said that a heavy burden had been put upon mine medical officers in collecting statistics and that the work had been done not only well but also cheerfully.

The following are a few of the more important recommendations made by the Committee:

1. The value of BCG vaccination in the prevention of tuberculosis was not confirmed, and should be further investigated.
2. More stringent pre-employment medical examination.
3. Periodical examination of long-service mineworkers.
4. Reduction of the number of men occupying compound rooms and physical separation of sleepers where this had not yet been done.
5. Acclimatization to mine work by a graduated increase of the rate of work.

All these were introduced over the following years.

A symposium on tuberculosis was held on 15 February 1940. Three papers were presented and were followed by a discussion. Dr. F. Retief's paper was on the clinical aspect; Dr. E. Grasset of the S.A.I.M.R. spoke about treatment by an endotoxoid vaccine and Dr. A. S. Strachan of the same Institute described the pathology.

Dr. Grasset's paper is particularly noteworthy as it revived a concept which gave hope of vaccine treatment of tuberculosis.

When Koch discovered the tuberculosis bacillus he produced a vaccine. This failed, and was the source of deep disappointment and distress to Koch.

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History repeated itself. In Koch's case there were initially a few successes, then failure. And the same cycle was the fate of Grasset's vaccine.

Tuberculosis continued to claim a great deal of the mine medical officer's time and attention. Mass radiography of all recruits and periodical examination plus a further examination prior to discharge, including radiography, were introduced. This was made practicable by the invention of apparatus which can produce a satisfactory lung radiograph on film as small as 35 mm. The procedure used at W.N.L.A. was described by Dr. F. Retief in a paper presented at the April 1945 meeting of the Association. He pointed out, however, that when even a small abnormality was seen on a miniature film, a radiograph on a standard-size film should be made to verify the diagnosis.

The President's report for 1942 is remarkable. It records that despite the fact that 27 of a total of 57 mine medical officers were serving in the armed forces, a number of valuable papers had been presented at eleven meetings held in the twelve months.

An extensive review of tuberculosis in South Africa was presented at a meeting of the Association on 18 November 1943 by Drs. B. A. Dormer, J. Friedlander and T. J. Wiles, of the Union Health Department. As published it is virtually a monograph of more than 40 pages, and is a valuable source of the history of the disease and of various efforts of control and treatment, made from the time of Koch's discovery of the tuberculosis bacillus up to the time of writing this paper. It is published as no. 257, vol. XXIII, of the Proceedings.

The first specific curative drug for treatment of tuberculosis was streptomycin. It is still used in conjunction with PAS and INH. The availability of those medicaments turned thoughts toward treating tuberculosis cases locally. The Association, however, considered that these patients should *not* be treated in the mine hospitals and advised accordingly.

In 1954 the Department of Public Health wrote to the Chamber of Mines suggesting that tuberculosis among the Bantu mineworkers should be dealt with as is done with other diseases.

An *ad hoc* subcommittee was appointed by the Chamber to advise on this matter.

Various consultations which were held culminated in a conference convened by the Secretary for Public Health, held from 2 to 4 May 1954, in which the Chamber of Mines was invited to participate. The Chamber's representatives were Drs. Pringle and Retief and the Chamber's legal adviser.

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This was the prelude to the acceptance by the Chamber of the principle of providing treatment for mine Bantu cases, the Government agreeing to pay hospital costs as from the date of certification by the Medical Bureau.

After a six-month trial of the procedure, it was reported that it had operated satisfactorily.

In 1962 the scheme was modified by offering surface work to selected non-infective men after a period of intensive treatment for several months. These men would remain under special surveillance by mine medical officers while so employed. This scheme was suggested by Dr. A. M. Coetzee, Director of Medical Services, Rand Mines Ltd., who pointed out that repatriation after a relatively short period of treatment resulted in a breakdown of a considerable number of cases.

In recent years mine medical officers, individually and as an Association have undertaken some particularly important investigations. Thus, Dr. P. Smit, Chief Medical Officer, Gold Fields, started in August 1962, an investigation of the prophylactic value of INH, a drug of considerable value in the treatment of pulmonary tuberculosis. He used a technique similar to that of the addition of iodine to salt as a preventive measure in populations with a high incidence of goitre. INH is added to marewu, a cold acidulous drink almost universally consumed daily by Bantu. The quantity added is on the basis of 200 mg/man/day of INH calculated on observed average quantity of marewu consumed by a man.

A high rate of reduction of tuberculosis was claimed.

Dr. A. M. Coetzee, Director of Medical Service, Rand Mines, and Dr. J. Berjak, Senior M.O. Crown Mines, reported at the September 1968 meeting of the M.M.O. Association an investigation of the value of BCG inoculation covering the period from October 1964 to date of the Report.

In April 1963 Dr. L. R. B. Birt, Medical Consultant, Anglo American Corporation, wrote to the Research Adviser, Chamber of Mines, that the Corporation was prepared to undertake an investigation of tuberculosis in the mining industry. He considered that the cost of this, estimated at R15 000, should be borne by the industry as a whole. The subcommittee of Group M.O. s endorsed the proposal.

On 20 July 1963 a plan for this investigation was submitted by Dr. J. G. D. Laing of the Anglo American Corporation to the Chamber of Mines Research Adviser, and was agreed to. It was stipulated that interim reports were to be submitted from time to time.

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The first such report was submitted on 1 October 1963. This report principally dealt with the efficacy of the several techniques employed. Dr. Laing said at the meeting of the Infectious Diseases Panel held on that date that he considered that there had been satisfactory progress. The Panel confirmed this.

The second interim report, dated 15 January 1964, states that tuberculin negative ratios varied according to the territorial origin of the tested. The lowest ratio—2·5 per cent—was among the Bantu from the Republic. The lowest among these was among the Transkei Bantu — 1·4 per cent. The highest ratio was among Basuto on goldmines—19·5 per cent—but for Basuto on collieries the ratio was only 7·0 per cent. Ratios of Northern Rhodesians (Zambia) was 15·4 per cent; Nyasaland (Malawi)—24·7 per cent.

The third interim report, dated 10 April 1964, is a progress report and is noted as such by the Panel. The fourth interim report is dated 14 July 1966. This report was discussed at a meeting of the Panel on 23 July 1964.

The fifth interim report is dated 10 October 1964. This again is a routine progress report. It was dealt with as such by the Panel meeting on 26 October. At this meeting Dr. Laing said that the Anglo American Corporation was not at present considering the use of prophylactics against tuberculosis, 'but was studying the matter'.

Dr. Laing's final report (of some 100 pages) was submitted to the Panel on 9 February 1966.

The Panel agreed that the report should be carefully studied, particularly as regards the validity of the conclusions therein. A subcommittee for this task was constituted with Dr. K. H. Sartorius (Chairman), Drs. L. R. B. Birt and P. Smit, and was given discretion to co-opt any person it wished.

The subcommittee's report was considered by the Research Advisory Committee on 10 August 1967. This Committee requested that Dr. P. Smit's report on INH as a prophylactic against tuberculosis should be submitted concurrently.

The Group M.M.O.'s Committee considered the comments of the subcommittee (Sartorius *et al.*) on 11 December 1967, together with Dr. Smit's report on INH.

On the subject of research, the members and the Group Medical Officers' Committee thought that they should act independently of the Research Advisory Committee, as they had done in the past when it was deemed advisable to do so. Acting through the R.A.C., it was stated, caused unad-

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voidable delay. However, such investigations should be made known and reported upon to the Group M.M.O.'s Committee.

The implementation of the recommendations arising from the Laing report was discussed. It was agreed that this should be through the Gold Producers' Committee.

A memorandum, by Dr. Sartorius on behalf of his subcommittee, dated 30 January 1968, reported to the Group Committee that there were several problems arising from the Laing report which should be clarified.

On the subject of improving the medical and radiological examination of recruits, Dr. Sartorius stated that the present methods, and the standard achieved, were as good as any similar work in other large organizations. However, means of improvement should continue to be pursued.

On 29 March 1967, Dr. Sartorius advised the Group M.M.O.'s subcommittee that a trial of INH on lines similar to that of Dr. P. Smit was to be carried out on three mines in the Evander area. The difference from the Smit method was to be that the additive on one mine would be INH and on the two others a placebo. No one on the mines except Dr. Sartorius and the supplier of the substances used was to know which of the additives was used on which mine. The investigation was to continue for 18 to 24 months. The X-ray films would be read by three doctors, and would be submitted to the Mine Medical Bureau for verification in every case diagnosed as tuberculosis by the mine doctors.

The final report of the Sartorius subcommittee is dated 10 April 1968. It is in the form of a memorandum.

The main points are: The subcommittee accepts the validity of Laing's investigation and recommends the acceptance of the recommendations therein designed to improve the standards of diagnostics. To this end the report recommends additional training of M.M.O. in the techniques of diagnosis, including the interpretation of X-ray films.

The subcommittee suggests that each group might modify any of the recommendations to fit best its own organization and methods. It was suggested that the physical standard for acceptance of recruits required further study and this should be given high priority in the deliberations of the Medical Panel; and there should be an investigation on the risk of employing on surface work Bantu rejected unfit for underground work.

The subcommittee considered the report on INH prophylaxis by Dr. Smit and noted the BCG investigation by the Rand Mines and Anglo American

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groups. Finally the subcommittee stated that at that stage it could not express a firm opinion or advise with confidence on the value of these procedures as prophylactics of tuberculosis.

SILICOSIS

The first International Conference on Silicosis to be convened by the International Labour Office—and the only one convened by the I.L.O. in South Africa—was held in Johannesburg from 13 to 27 August 1930.

Dr. Louis G. Irvine, who was elected President of the Conference, with Dr. A. Mavrogordato, of the Institute for Medical Research, and Hans Pirow, the Government Mining Engineer, presented a joint paper, 'A Review of the History of Silicosis on the Witwatersrand Gold Fields'. They divided the history into four periods.

First period : 1886 to 1889. Complete ignorance of the danger, or even existence of silicosis.

Second period: 1901 to 1910. Realization of the menace and introduction of tentative preventive measures. It was during this period that Drs. Donald Macaulay, Andrew Watt and Louis Irvine, pioneered the inquiries.

Third period: 1911 to 1916. Systematic preventive measures were initiated and compensation introduced.

Fourth period: 1916 to 1930. Expansion of preventive and compensation procedures.

In the last three periods, and up to the present, silicosis prevention and compensation were the subjects of many commissions and legislation. The first of these, an important one, dates back to 1902: 'Miners' Phthisis Commission' appointed by Lord Milner. This Commission examined 1201 miners (white). Many refused to be examined, probably for fear of being thrown out of employment. Some 15 per cent were found to have 'miners' phthisis', and another 7·3 per cent were considered suspect. Most of these were men with a history of previous employment in mining, mostly in Cornwall. As there were no radiographic facilities, the incidence of the 'phthisis' was probably higher. In 1911 a 'Medical Commission' was appointed to inquire into the prevalence of miners' phthisis and tuberculosis, and to advise on compensation 'from the medical point of view'. This Commission examined 3 163 miners, 326 radiologically by Dr. A. H. Watt.

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This was, so far as is known, the first time radiography was used on such a relatively large scale for the diagnosis of silicosis. Definite disease was found in 26 per cent and doubtful in an additional 5·5 per cent. The average total duration of most to dust exposure was 8·2 years. For those who worked with rock drills it was only 6·1 years.

This Commission's report formed the basis of the 1912 Miners' Phthisis Act. Two stages of the disease were defined. The maximum total compensation was limited, and the miners had to contribute 2½ per cent of their wages to the compensation fund.

A series of commissions, and Acts, followed, as did also many regulations under these Acts. Much improvement in the avoidance of dust production and control was achieved.

From the point of view of mine medical officers, whose concern is almost exclusively the Bantu mineworker, the establishment in 1916 of the Miners' Phthisis Bureau is of major importance.

Until 1916 the certification of Bantu mineworkers was by the Medical Inspector of Mines. Mine medical officers notified the Inspector when they had cases considered by them as probably silicosis or/and tuberculosis. The Inspector then visited the mine and examined the patients submitted. His decision was final. There were of course then no radiographic facilities. This procedure was completely changed after 1916.

Under the law now in force the mine medical officers are 'Examiners' with prescribed duties. These include the surveillance of the Bantu mineworkers to prevent the employment of any suffering from tuberculosis or silicosis.

All new arrivals, the recruits, are examined clinically and radiographically at a reception depot—Wenela. Those recruited direct by a mine are examined by the mine medical officers.

Mine medical officers examine the radiographs taken at the six-monthly periods of work and on discharge from employment, as prescribed by law. They keep a watchful eye on patients in hospital who show any signs of lung trouble that arouse suspicion of silicosis, very often associated in the Bantu with tuberculosis.

Surveillance is also maintained at the monthly weighing routine. Men who show a loss of weight are subjected to clinical and, if it is deemed necessary, radiographic examination.

These prescribed procedures occupy a considerable portion of the time of the medical officers, as related for example by Dr. McDavid in his contribution (page 91).

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The colliery medical officers encounter a modified form of silicosis, anthraco-silicosis or anthraco-pneumoconiosis (now shortened to 'anthracosis').

Dr. F. T. Allen, for many years medical officer at collieries in the Witbank district, related his experience in a paper submitted at the September 1951 meeting of the Association. The total number of cases he reviewed was only 77. There were no cases of anthracosis in men with less than ten years' exposure to colliery dust. Fourteen of the 77 had been exposed also to goldmine dust. By itself this paper is of no particular significance, as the number observed was too small, but it is an example of the interest taken in this subject.

Another example of the interest of mine medical officers in pneumoconiosis was the invitation of Prof. E. H. Kettle, an eminent visiting pathologist, to address the Association. This took place at the August 1928 meeting. It was in this lecture that Kettle, basing his view on experimental evidence, propounded the theory that the fibrosis of silicosis was due to the chemical action of silica going slowly into solution in the tissues. Further, he advanced the theory that the presence of the silica in the lung favoured the development of pulmonary tuberculosis which, at that time, was the cause of the high death-rate of the victims of silicosis, and was probably the reason for the term 'miners phthisis' in common use. Both the theory of solubility of silica in the lung tissues and that the presence of silica favours the development of tuberculosis gained wide acceptance. However, only the latter had been confirmed.

Several other theories of the causation of silicosis have been suggested from time to time, though up to date none has been found to be convincing. In all these discussions the Mine Medical Officers' Association and many individual members showed much interest.

The Association also sponsored a symposium on silicosis which took place on 23 October 1930. The proceedings were published as a special supplement to vol. X, no. 18, March 1931.

This publication is a valuable contribution to the literature of the subject. The participants were all acknowledged authorities in their specialities. Drs. E. M. Simpson and A. Sutherland Strachan were pathologists on the staff of the South African Institute for Medical Research, Dr. L. G. Irvine was Chairman of the Miners' Phthisis Medical Bureau, now renamed the Miners Medical Bureau.

Most of the material presented holds true to this day, and indeed is the

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foundation on which, through improved techniques, accumulated data and acquired information, the present corpus of knowledge is being built up.

There was another occasion in which the Association participated: a joint meeting arranged by the S.A. Chemical, Mining and Metallurgical Society (now the South African Institute of Mining and Metallurgy) and the South African Geological Society. The meetings took place on 18 and 29 September 1933. The report of these meetings is published as a special supplement to the Proceedings of the Association, vol. XIII, no. 146, September 1933, and covers more than 50 pages. The main theme of the meetings was a paper by Dr. Wm. R. Jones, of the Imperial College of Science, London, a geologist. The interest in his theory was attested by the presence at the meetings of the then Minister of Mines, Mr. Patrick Duncan (later Sir Patrick Duncan, Governor-General of the Union of South Africa).

In brief, Dr. Jones presented certain petrological and other observations which led him to the belief that the true cause of pneumoconiosis was not silica but the associated presence of a substance named sericite—a hydrous silicate of aluminium and potassium. From this followed his suggestion that, as the use of water for suppressing dust did not affect the sericite content, protection should take the form of conducting fresh, dust-free air to the individual miner by connecting a clean air supply to a light cover worn over the mouth and nose—‘not a mask’.

In the discussion that followed Prof. R. B. Young, geologist, stated that sericite was present in every specimen of banket that could be taken from any mine on the Rand.

In the event this theory, too, was found to be erroneous.

Of particular value to mine medical officers was a paper, with demonstrations of typical radiographs, presented on 21 September 1950 by Dr. A. S. W. Verster, the chairman of the Silicosis Medical Bureau, as it was then designated. The criteria adopted by the Bureau were then, as they are now, of immediate practical importance to mine medical officers, as it is by these that they have to abide in their almost daily work as ‘Examiners under the Act’, which they are by virtue of their appointment as mine medical officers.

At the meeting of the Association on 19 October 1950 Dr. A. J. Orenstein reported on the proceedings at the conference on pneumoconiosis convened in Sydney, Australia, by the International Labour Organization, which he had attended on the invitation of the I.L.O. The others invited were: Dr. W. George of Australia, Prof. C. Gernex-Rieux of France and Drs. E.

PROPHYLAXIS AND THERAPY OVER 50 YEARS

Middleton of the U.K. and A. Vorwald of the U.S.A.

The Conference was attended by a number of delegates appointed by their respective governments, a total of about seventy-five participants. The agenda included discussion of recent advances in knowledge of the pneumoconioses; diagnosis; functional and laboratory tests relevant to assessment of disability as well as in diagnosis; the clinical manifestations of pneumoconiosis; investigation procedures; and preventive measures.

The Conference was in session from 28 February to 11 March 1950. Several resolutions were adopted, some of which had considerable influence on the orientation of future research. Of immediate practical importance was the recommendation that radiographic images be classified and coded. The coded classification would identify the radiographic features in communications between workers in this field, without having to describe the details seen. It was clearly pointed out, however, that the diagnosis must not rest solely on the radiograph.

The diagnosis of tuberculosis and pneumoconiosis puts much responsibility on the mine medical officer, inasmuch as in this matter not only is he acting as an agent of the Government and as a guardian of the health of the people in his care by eliminating possible sources of infection, but also because in the case of the non-white mineworker, unlike the case of the white worker, even the earliest detectable sign of silicosis—as well as of tuberculosis—excludes the worker from employment underground.

In the past decade much work was done in attempts to establish correlation between the various degrees of exposure to dust in the goldmines and the incidence of pneumoconiosis. This work has of necessity been confined to investigations on white mineworkers; because, as D. G. Beadle, who was* principally engaged in this investigation, pointed out at the meeting of the Association on 15 July 1965, the required essential data are not obtainable in the case of the migratory Bantu workers.

International conferences on pneumoconiosis were held in Johannesburg in 1959 and again in 1969, both sponsored by governmental agencies and the mining industry. In both of these conferences mine medical officers participated.

The Proceedings of both these conferences are published.

* D. G. Beadle died in June 1970.

ENTERIC FEVER

Enteric fever is known to have been almost endemic, but records are available only from 1915 onwards. Since then the rate per 1 000 of Bantu mineworkers has varied widely from year to year. A few examples taken from the records of Central Mining-Rand Mines illustrate this: 1915—3·34 per thousand; 1916—0·81; 1921—0·97; 1922—2·47; 1933—3·28; 1934—5·31. The mortality rates fluctuated correspondingly.

Mass TAB inoculation was tried, but the reactions encountered were often so severe that this had to be abandoned. Oral prophylactic vaccine pills developed by Bezredka were used for some years, and appeared to control occasional outbreaks.

In the 1930s Grasset of the South African Institute for Medical Research developed an endotoxoid type of vaccine. This vaccine was free from severe reactions. It was tried in outbreaks on two mines: half of the population was given the Grasset vaccine and the other half the Bezredka oral vaccine. There was little difference in the protective effect—both were fairly effective. The use of Grasset vaccine was discussed at several meetings of the Association in 1938 and 1939. Papers were presented by Drs. S. E. Grasset, F. A. Donolly, M.O.H. Springs, and A. W. Goldsmith, Mine Medical Officers' Association. These were discussed by Drs. Peall, Smith, Tucker, Daubenton, Sartorius and Orenstein. The discussions centred on whether inoculation of *all* new recruits should be carried out. Opinion was divided. A proposal that inoculation of all new recruits be carried out was withdrawn by the proposer. It was therefore left to the judgment of each mine medical officer whether to inoculate all new arrivals or inoculate only selectively, e.g. when an epidemic seemed to threaten.

The search for carriers among food-handlers, and the general improvement in the hygienic conditions, reduced the incidence of enteric fever to negligible proportions, and mass vaccination could be discontinued quite safely, as was done in recent years.

SCURVY

The first paper presented at the very first meeting of the Mine Medical Officers' Association on 12 April 1921 was on scurvy, by Dr. A. J. Orenstein. The author reviewed the recorded history of scurvy, and the various theories of its causation, all of which proved erroneous, until it was demonstrated by the experimental work of Ejkmann and Hopkins in 1906 that scurvy was caused by the absence in food of a then unknown factor. This factor was later identified as a water soluble substance and named vitamin C (ascorbic acid).

Scurvy was still attacking mine labourers; for instance on the mines of the Central Mining-Rand Mines group there were, even as late as 1920, 403 diagnosed cases, of whom 102 were so incapacitated that they had to be repatriated, and 16 died.

The experience was that Bantu arriving from areas where there was a food shortage showed no overt signs of scurvy, but developed the disease after working a few weeks, despite an adequate diet.

Cases of scurvy occurred on mines where the vegetable ration was for some reason curtailed or where the vegetables were overcooked, and among those who would not eat the vegetables.

Dr. Ellen M. Delf, of the Lister Institute, London, then working at the South African Institute for Medical Research, showed that cabbage, rich in vitamin C, lost 80 per cent of it when subjected to a temperature of 80—100°C for 20 minutes. The same amount was lost when the vegetable was exposed to a temperature of 60°C for an hour. Thus negligent cooking, even when an adequate ration of vegetables is provided, can be the cause of a serious outbreak of scurvy, simulating an epidemic of transmissible disease. In the past such outbreaks led some mine medical officers to believe that scurvy was an infectious disease. Indeed, a claim was once made [elsewhere] that the responsible organism was isolated.

Dr. Delf also showed that germinated pulses were rich in vitamin C, but it was easily destroyed by overheating.

SCURVY

Dr. Delf's work led to an amendment of the ration scale for mine labourers by prescribing the issue of definite quantities of vegetables and germinated pulses, and directing that these should be added to the cooking food less than half an hour before it was to be handed out.

Dr. Orenstein's paper was followed by a paper by Dr. S. Donaldson in which he described the clinical features of scurvy as seen in the mine Bantu. In the older men it took the form of debility, the patients complaining principally of shooting pains in the legs; in the younger men and boys there was a tendency to haemorrhage into the loose tissue on the flexor aspect of the lower leg, sometimes into joints, also into, and from, internal organs. This type might present difficulties in differential diagnosis.

Scurvy may be associated with vitamin B deficiency, manifested by tenderness and pain along the tibial nerves and cardiac arrhythmia.

Dr. Donaldson described the pathological appearances he had found at autopsies: cardiac dilatation, haemorrhage into the pleural cavity and the conjunctiva. He had also seen intra- and sub-peritoneal haemorrhages.

He discussed the anti-scorbutic properties of fruits, vegetables and germinated pulses, and the deleterious effects of overcooking, and described the technique of intravenous administration of neutralized orange juice for the treatment of severe cases of scurvy.

At a later meeting Dr. Donaldson demonstrated the technique of preparing and administering orange juice intravenously. He found it by far the most effective treatment of advanced scurvy.

Dr. Orenstein said he happened to have read about this treatment, and had spoken of it to Dr. Donaldson, who had had the courage to try it.

Overt scurvy continued to be an important cause of incapacity until about 1929. It seems that the principal cause of this was the difficulty of procuring sufficient quantities of vegetables, particularly during winter, and overcooking. Pulses frequently would not germinate because the germ was destroyed either by insects or by fumigation.

However, in course of time, as the importance of adequate vegetables and the consequences of overcooking came to be more fully understood, attacks of scurvy became infrequent incidents, hardly ever severe and almost never a cause of death. The issue of germinated pulses could then safely be discontinued.

In a paper by Dr. T. W. Fox, a biochemist at the South African Institute

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for Medical Research, which he presented at the March 1940 meeting, he stated that while a daily intake of 15 mg of ascorbic acid might be sufficient to keep a man in good health, at least double this amount should be provided for mine labourers. A subsequent paper, by Drs. Fox and L. F. Dangerfield, the latter a mine medical officer, supports the recommendation that the ration should contain at least 30 mg of ascorbic acid per person per day. As it is very difficult in practice to ensure that the quality and quantity of the vegetables and the method of cooking are completely satisfactory, the issue of citrus fruit, or addition of ascorbic acid to the ration, was recommended by the authors. This recommendation was generally accepted.

The present practice is to add ascorbic acid to marewu—an acidulated cold beverage made by the fermentation of maize-flour consumed daily by the great majority of the mine Bantu.

LEG ULCERS

So-called tropical ulcers, usually occurring above the ankle, were found fairly frequently among the Bantu workers. But occasionally the incidence became so high that it assumed the nature of an epidemic, incapacitating so many workers as to cause serious interference with production. Mine medical officers carried out a number of investigations, principally in therapy. At a meeting of the Mine Medical Officers' Association held in January 1921, it was decided to test the effect of several methods of treatment, viz.:

1. Rest in bed and medical treatment.
2. Plaster cast fenestrated over ulcer and antiseptic applications.
3. Surgical excision and/or curettage and
 - (a) rest in bed,
 - (b) plaster,
 - (c) ambulatory.
4. Effect of various antiseptics.

A few weeks later the part-time services of Dr. Millicent Pam were secured to direct the suggested investigations, centred at the ERPM hospital.

It emerged from these investigations that for moderate size ulcers the most effective treatment was NAB (Salvarsan) intravenously and applied locally on gauze pledgets covered with oiled silk. Excessive granulations should be curetted. Horny and undermined edges should be cut away. Very large, spreading ulcers required extensive surgical excision and usually skin grafting.

It is most probable, though never definitely proved, that these ulcers are a manifestation of malnutrition. No serious outbreaks have since occurred.

In later years various treatments, such as penicillin, locally and parenterally, were used by mine medical officers with considerable success.

ANCYLOSTOMIASIS (HOOKWORM DISEASE)

Infection with this worm is widespread among the Africans inhabiting the eastern coastal regions, from which many are recruited for mine work. This was well known for many years by mine medical officers. Most of the carriers of this infection do not suffer overt ill health, and only an occasional one requires treatment. Infection of white miners either did not occur or went unnoticed by themselves and their doctors.

The first intimation that white miners could also be infected came in December 1926. In that month the chairman of the Miners' Phthisis Medical Bureau wrote to the Chamber of Mines reporting that, in the course of the obligatory medical examination of miners, five white miners, who had worked on the City Deep, Village Deep and ERPM mines, and who were markedly anaemic, were found to be infested with hookworm.

Investigations of possible sources of infection were immediately instituted. Dr. W. O. Fischer, of Rand Mines group, who had many years' experience in tropical medicine research, was put in charge of this investigation.

It was found that the principal, if not the sole, source of infection was the underground bucket latrine. Having found that the antiseptic preparations generally used in and around the latrines were ineffective against the larvae of the hookworm, a search was made for a more efficient material. Fischer rediscovered that common salt had this property. The expression 'rediscovered' is used because, although this was unknown to Fischer, Lambinet had reported the effective use of salt in 1906, and it was also successfully employed by the Rockefeller Foundation workers in Grenada. The technique of the use of salt for the destruction of hookworm larvae was described in a report by Dr. M. Colwill of the Foundation. Dr. Fischer applied a modified version of this technique with great success.

Meanwhile intensive mass treatment for hookworm of all new Bantu arrivals on the mines was instituted. This was abandoned when the

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effectiveness of the salt technique virtually eliminated the transmission hazard, as was demonstrated by the fact that while, in the period July 1927 to August 1928, 298 cases were found among the white miners, only a residuum of 30 cases was under treatment in 1934, of whom 21 were from one mine. By 1938 none was reported.

This is one of a few instances on record of eradication of ancylostoma infection transmission and was thus commented on by the *Lancet*, 30 June 1934. An editorial in *The Mine Worker*, August 1938, was headed: 'War Fought and Won.' However, an occasional case is still found now and then among white miners.

Africans continue to arrive for work on mines in large numbers from areas where hookworm and other worm infections are common. Most of them have established a symbiosis with their parasites, but a few show the effect of the infestation, and have to be treated.

SPOROTRICHOSIS

It appears that the first report of cases of sporotrichosis was presented at the Association's meeting on 17 March 1927. At this meeting Dr. Millicent Pam demonstrated several patients with skin lesions which were difficult to cure and which tended to reoccur. All the patients worked in a part of the Modder East mine where there were old timbers on which grew a fungus. An apparently identical fungus was found in the skin lesions, later identified as a sporotrichum.

From the discussion which followed it appeared that some mine medical officers had seen similar cases occasionally. Drs. A. Pijper and Beatrice D. Pullinger, pathologists of Pretoria, had investigated such cases, and reported their findings in the *Lancet*, 19 October 1927.

Attention having been drawn to this disease, sporadic cases were thereafter reported from time to time. But it was not until May 1936 that an outbreak of sporotrichosis at the Simmer and Jack mine alerted mine medical officers to what rapidly became an important threat to the well-being of the mineworkers. When some white miners contracted the disease in 1938, the matter of compensation under the relevant law also arose. By this time there was considerable accumulated evidence that the source of infection was associated with the mine timber, and A. J. Orenstein drew the attention of the Rand Mutual Assurance Co. to this possibility.

Mrs. Brown of the Chamber of Mines Timber Research Laboratory was then asked to carry out an investigation of the possible role played by timber in the spread of this disease. In due course the timber was proved to be the source of the infection.

In 1941 Dr. L. F. Dangerfield reported that, in the past three years, he had treated 74 cases on the Simmer and Jack mine.

In 1942 ten mines reported a total of 1 583 cases of the disease, ranging from 2 cases on one mine (Crown) to 1 321 on another (Venterspost). Such fungicides and other measures as were then known and available were

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energetically applied, with some success.

In 1943 twelve mines reported a total of 425 cases, ranging from 1 case (Rand Leases) to 354 (Consolidated Main Reef). Venterspost in this year reported only 21 cases. No cases were reported from the other mines.

No cases were reported in the period 1944 to 1960, though this must not be taken to mean that none had actually occurred during that period, inasmuch as when returns were again called for, 295 cases were reported in 1960; 183 in 1961; 17 in 1962; 63 in 1963 and 59 in 1964.

In a report dated 25 February 1965 Dr. A. L. James, Research Consultant, Chamber of Mines, stated that there was a positive correlation between the number of cases in an outbreak of the disease and the amount of untreated timber underground, underlining once more the principal source of the infection.

In November 1941, owing to the increase of sporotrichosis cases, the Chamber of Mines requested that particulars of all suspected cases of this disease should be reported to Dr. C. J. du Toit of the South African Institute for Medical Research, who was investigating the disease in regard to its cause and prevention.

In January 1942 Dr. L. S. Williams made a significant contribution towards the solution of what was fast becoming a matter for serious concern.

He addressed a memorandum to the Executive Committee of the Mine Medical Officers' Association. The principal points he made were:

1. That there was doubt as to whether the fungus growing on mine timber was the same as that found in the skin lesions. This should be resolved.
2. Dr. du Toit had found that the fungus isolated from skin lesions grew readily in mine water and mud as well as on timber.
3. Dr. du Toit had also reported that the infection was widespread in the mines, but that only susceptible persons contracted the disease. He had inoculated himself with the fungus with negative result.
4. Both Miss Bowen, who had been studying the fungus, and Dr. du Toit had found that the 'mixture' used for spraying the timber had no value. Reports from America indicated that an efficient fungicide, non-toxic to man, had been evolved. An effort was being made to obtain or make this substance.

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5. Dr. du Toit had definite evidence that two Bantu had arrived on the mines direct from their homes with evident sporotrichosis. It may thus be that the disease had been introduced in this manner by undetected cases among recruits.

In view of the above Dr. Williams asked for a special meeting of the Executive Committee to consider this matter.

Accordingly a letter was addressed to the Gold Producers' Committee, dated 31 January 1942, signed by L. S. Williams as President of the Mine Medical Officers' Association. After setting out the position as regards the incidence of the disease, and what had been found by Miss Bowen and Dr. du Toit, the letter states that the Executive Committee of the Mine Medical Officers' Association felt very strongly that all research work on sporotrichosis should be co-ordinated, with the following objects:

- (a) To identify the sporotrichum causing the disease in the mines where cases are now found, and a survey made of all mines to assess the potential danger.
- (b) To evolve an efficient fungicide.

The letter also suggested that new arrivals should be carefully inspected for relevant lesions and that all suspects be kept at the Witwatersrand Native Labour Association depot for examination by the South African Institute for Medical Research.

In February the Gold Producers' Committee asked Dr. Williams to convene a co-ordinating committee to deal with this matter. The Chamber's representatives were Mrs. R. Brown and Miss J. W. Bowen, of the Timber Research Laboratory. The other members were Drs. L. S. Williams (chairman), A. I. Girdwood and H. Q. F. Thompson.

Mine medical officers were asked to carry out a careful inspection of all recruits, and also of all working Bantu on weighing days, to discover and isolate suspect cases.

They were also asked to attend monthly demonstrations of cases, in order to become acquainted with the various manifestations of the disease.

Accommodation was to be set aside at the Witwatersrand Native Labour Association hospital for the treatment of sporotrichosis. Potassium iodide was for the time being the drug of choice for routine treatment, but trials of other medicaments should be pursued.

Various investigations were suggested to the Timber Research Laboratory and the South African Institute of Medical Research.

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In April 1943 Dr. N. A. F. Helm advised that the 'vast majority of cases' gave negative cultures after having taken 400 grains of potassium iodide in four days, but occasional cases still had positive cultures after as much as 2 000 grains. Deep-seated lesions were very resistant. The return of men to underground work as soon as they were physically fit, regardless of whether cultures were still positive, did not affect adversely the gradual but rapid subsidence of an outbreak.

A report submitted by the co-ordinating committee, dated 29 December 1943, stated, *inter alia*, that it had been found that infection could occur through unbroken skin; that the infection fungus did not grow on timber that had been suitably treated, and that the growing fungus could be killed by sprays designated respectively 'Yard Mixture' and 'Domicide'. These were replaced later by an even more effective fungicide.

The suggestion was also made that, in view of the importance of this subject and the interesting findings of the co-operative investigation, the various reports and findings should be collated and published in book form. This was agreed to by the Chamber of Mines, and the book appeared in 1947. It is a valuable record of what happened up to the end of 1944.

The optimistic prediction of complete control was not realized, but no serious outbreaks have been reported in the following years.

HEAT-STROKE

By 1920 some mines in the Central Reef had penetrated to 1 300 m (4 000 feet) below the collar of the shaft and there was an increasing awareness that the heat and humidity of the air at these depths could affect the health and productivity of the Bantu workmen. The high temperatures and humidities were due to the relatively high virgin rock temperatures, the low air movement (the science of ventilation of mines had hardly begun) and the wetness of the stopes due to the legal requirement to water down the working places at frequent intervals in order to allay the silica-containing dust. As a result wet-bulb temperatures of 30°C (86°F), and even 32.3°C (90°F), were not unknown in working places.

The first action taken in this regard was by Dr. A. J. Orenstein. One of the first subjects he tackled, after his return from active service in World War I, was the human heat problem. In South Africa at that time (1919) was H. J. Ireland, Testing and Investigating Officer of H.M. Offices, who had had experience of research on worker fatigue and physiological reactions to heat with the Industrial Fatigue Board in the U.K. during World War I. He was invited by Dr. A. J. Orenstein to collaborate in research on the relationship between atmospheric conditions in the mines and the production of fatigue among Bantu workmen. Using a number of ergometric devices they were able to show that worker output decreased as wet-bulb temperature rose or wet-kata readings decreased. They also gave a table of the relationship between human responses and wet-kata readings as follows :

<i>Cooling Power</i>		
<i>Wet kata</i>	<i>Dry kata</i>	<i>Effects on men stripped to the waist</i>
25	10	Cool and refreshing to work in.
20	8	Quite comfortable for work.
15	5.5	Lower limit for comfort.

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<i>Cooling Power</i>		
<i>Wet kata</i>	<i>Dry kata</i>	<i>Effects on men stripped to the waist</i>
10	3.5	Distinctly oppressive; body temperature can be kept nearly normal only by profuse sweating; skin flushed and wet; pulse high.
5	1.5	Extremely oppressive; profuse sweating; rise in body temperature and heart rate; especially when working.

These studies should rank with Haldane's classic 1908 study in which he showed that 31°C (88°F) wet-bulb temperature was the limit at which men, at rest in still air, could maintain a steady level of body temperature. Orenstein and Ireland also foreshadowed the acclimatization of Bantu workers in their statement that 'It is not advisable to put a workman just back from holiday, or a new recruit, in a bad place. He will probably do better in a hot place after some training in good or moderately good places.'

The publication by Orenstein and Ireland of their paper and the introduction in 1919 into the goldmines by Orenstein of the wet-kata thermometer for assessing the heat-stress of working places did not lead to any dramatic improvement in underground atmospheric conditions and in 1924 the first heat-stroke death was recorded. The 'hot' mines took immediate steps to combat the condition by introducing a form of acclimatization to heat. The procedure, introduced by Village Deep in 1925 and City Deep in 1926, consisted of placing new recruits to the mine on light work in hot working places underground for a period of ten days. Men with previous mining experience carried out the same procedure for only five days. No provision was made to reacclimatize men who had been to hospital for either illness or injury.

These acclimatization procedures failed to halt the death-rate from heat-stroke and various modifications were made in the ensuing four years which generally increased the period of acclimatization. The measure of their failure was the twenty-six deaths from heat-stroke which occurred in 1930. The alarm which this high death-rate occasioned in the gold-mining industry is told by Dreosti in his classic paper to the Chemical, Metallurgical and Mining Society of South Africa at a meeting in November 1935. He states: 'Heat-stroke was now becoming a serious menace at City Deep mine, especially as still greater depths were contemplated. Further, during the period of acclimatization the average amount of work output per shift was



This apparatus is an ergometer set up in the City Deep mine in 1919 in the course of experimental research on heat trauma among mineworkers on the Rand. The machine was designed to record the expenditure of energy and effort by a 'hammer boy', a worker employed in those days in hand drilling. This machine had to be constructed to stand the force of some 14 000 hammer blows during the daily working period.

equivalent to only one-third of a normal shift. The financial position of the mine was such as to be profoundly affected by this loss in efficiency.'

Dr. E. Cluver, then Secretary of Public Health, carried out the first epidemiological survey of the causes of heat-stroke in the gold-mining industry. He found that of the ninety-two deaths from heat-stroke that were reported between 1924 and 1930, sixty-nine had occurred in two mines which by 1930 had reached a depth of 2 000 m (6 000 feet) below surface. Wet-bulb temperatures were relatively high in these two mines and in many working places they exceeded 30°C (86°F). Cluver showed, further, that sixty-seven of the ninety-two deaths had occurred in working places with wet-bulb temperatures in excess of 30°C (86°F) and estimated that, in 1930, 14 000 Bantu mineworkers were working in such conditions.

By 1930, therefore, the position in the deep Central Reef mines was critical as far as heat-stroke was concerned. It was at this point that Dreosti, senior medical officer of the City Deep Hospital, under the inspiration of Orenstein, carried out a series of investigations into the heat-tolerances of

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Bantu miners which led to the development of a new, improved method of acclimatization to heat. Dreosti's paper in 1935 has received world-wide recognition and acclaim as the first thoroughly scientific study of this subject. There can also be little doubt that the form of acclimatization that was introduced as a result of Dreosti's researches played a major role in reducing the rate of heat-stroke deaths in the gold-mining industry in the latter part of the 1930's and in the 1940's and gave the mining engineer confidence that he could plan for mining at even greater depths.

Dreosti's main contribution was to show that the Bantu recruits to the mines vary greatly in their tolerance to work in heat. He used a severe heat-tolerance test. The men shovelled rock for one hour at a wet-bulb temperature 35°C (95°F). In a sample of 20 000 men he showed that 15 per cent were heat intolerant in that their oral temperatures, after one hour of work in the test, rose above 38·8°C (102°F); 25 per cent were heat tolerant in that their oral temperatures rose to just over 37·8°C (100°F); and, the remaining 60 per cent were normal in their response in that their oral temperatures were intermediate between these two extremes. On a smaller sample of heat intolerant men he showed that 17 per cent did not become acclimatized even after seven days of work under the test conditions. The other 83 per cent did become acclimatized although the rate at which they did so varied from individual to individual.

As a result of these researches the method of acclimatization was altered in City Deep mine in March 1932 as follows:

‘Heat intolerant’ recruits were acclimatized for fourteen days.

‘Heat tolerant’ recruits received four days of acclimatization.

‘Normal’ recruits received seven days of acclimatization.

The success of these procedures at City Deep mine was such that in the three-year period 1932-5 there were only two more heatstroke deaths. In the whole period 1932-40 there were only four deaths from heat-stroke. This achievement must be seen in the light of eight deaths from heat-stroke in one year, 1930, in City Deep mine.

Part of the credit for the improvement in the heat-stroke position in the latter part of the 1930's and in the 1940's must go to the ventilation engineer. The condition of the air in the working places was improved by increasing the volume of air sent underground by means of powerful fans; by cooling the air entering the working places by refrigeration of the air entering the mine; and by better direction of air within working areas. The improvement of air conditions in working places in City Deep by 1939 was

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such that the mine was able to dispense with the heat-tolerance test and depended solely upon underground acclimatization for protecting the workers against heat-stroke. These two measures, improved ventilation of working places and the acclimatization of the workers, were so successful in the industry as a whole that, in spite of an increase in the underground labour force from 170 000 in 1930 to 280 000 in 1940, there was no increase in the numbers of heat-stroke cases, which averaged about twenty per annum in the latter period.

In the post-war period there was a sharp fall in the heat-stroke rate to an average of 8.2 cases per annum over the period 1942-50. In part this improvement was due to a decline in the numbers of men working underground from a peak of 280 000 in 1940 to just over 200 000 during most of the 1940's. Better ventilation and more extensive use of acclimatization procedures undoubtedly also played a part in this improvement.

In the 1950's a radical change occurred in the heat-stroke position. Shafts were sunk to hitherto undreamt-of depths in the Central Reef mines and mines were opened up in the Free State where there is a higher geothermal gradient than in the Witwatersrand. Also after 1957, the Bantu labour force increased markedly so that by 1960 there were once again 280 000 Bantu men working underground. As the mines went deeper so the numbers of Bantu working physically in high wet-bulb temperatures also increased. The estimate is that about 77 000 men worked in wet-bulb temperatures in excess of 26.7°C (80°F) in 1957 and that this figure increased to about 105 000 by 1961.

It would have been anticipated that with the large increase in the numbers of Bantu working in high wet-bulb temperatures since 1957 there would have been a sharp increase in the numbers of deaths from heat-stroke. This has not occurred because, through the far-sightedness of men like Sir Basil Schonland, Dr. F. G. Hill, Dr. A. J. Orenstein and Mr. M. Barcza, the Applied Physiology Laboratory was set up in 1950 under the direction of Dr. C. H. Wyndham to study the effects of heat and humidity on the health and productivity of Bantu workmen. The Laboratory was initially under the joint aegis of C.S.I.R., S.A.I.M.R. and Rand Mines Limited, but its researches in 1950 convinced the gold-mining industry that the goldmines would be faced with serious human heat problems by the 1960's and that the then A.P.L. would be able to tackle these problems.

One of the first problems the Applied Physiology Laboratory addressed

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itself to after it started was acclimatization. Investigation of the procedures then in operation showed that they had a number of serious shortcomings. A production stope was nominated as an acclimatization centre, but no systematic training was given to men placed in charge of the procedure and there was no way of deciding whether the Bantu recruits were acclimatized or whether they were becoming dangerously hot. The procedure consisted of putting the new recruits into a hot stope under the direct supervision of a boss boy, who was supposed to gradually increase the amount of work the men did over a fourteen-day period so that at the end of the period the men would be shovelling rock at the normal rate for the mine. In practice the men were made to work on a site where they did not interfere with production, and, being out of contact with the white supervisor, it was rare that the men ever achieved the full rate of work. In fact, the boss boys, being fearful of having a heat-stroke case develop under their control, took the easy way out and made sure that the men did not work at the normal rate. In consequence the men were not acclimatized when they completed the fourteen-day period. This was evident in the fact that most heat-stroke cases occurred *just after* they completed the procedures, and in the production figures, taken out by A.P.L., which showed that the men were producing only one-fifth of the normal rate for the entire period, for that area of the mine. The mine's method of dealing with this problem was to extend the acclimatization period by making the recently acclimatized recruits wear a 'red armet'. Such men could not be made to work hard for a further period of between seven and fourteen days. This extended the total period of acclimatization to twenty-eight days in most hot mines during which the men were only one-fifth productive.

As the system of acclimatization in operation in the early 1950's was neither safe nor efficient, the A.P.L. decided to introduce a new system which it first tried out under the direct supervision of the Laboratory in the stopes of City Deep G.M. for a period of three months. An innovation was to have the men shovelling rock in production stopes, at full production, for twelve days under close supervision. The first six days were in relatively cool stopes and the second six days in the hottest conditions the men would be likely to experience subsequent to acclimatization. Thus the men *while under supervision* were first conditioned to physical work in mild heat and then acclimatized, in the second week, to work at the full rate in the most severe heat they would subsequently experience. The European supervisors

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were trained by the Laboratory and it was laid down that there should not be more than one European to a hundred acclimatizees and one Bantu boss boy to ten acclimatizees. The European supervisors were taught to use clinical thermometers and the oral temperatures of all acclimatizees were taken before each acclimatization shift and also during work on the first two days in the cool and hot stages of the procedure. The European supervisor was also taught to take an immediate measurement of oral temperature if a man under his care behaved strangely or if the boss boy reported that the worker either complained of feeling ill or if the boss boy on his routine inspection (he visited each man under his care at least once an hour) discovered a man who felt hot. These various duties and responsibilities of the supervisors were laid down in a 'Guide to Acclimatization' from which managers framed their 'Code of Practice'.

The acclimatization trial in City Deep G.M. in 1953 showed that Bantu recruits could be properly acclimatized in this way and that they were fully productive during the whole period of acclimatization. Thus two important objectives were realized. Firstly, the men were fully protected by careful supervision during acclimatization and by being properly acclimatized when they left the centre. Secondly, mine management achieved full production and there was soon competition between miners to have the acclimatization centre in their stopes.

By 1957 nearly all of the hotter mines in the industry had adopted this new Chamber of Mines method of acclimatization on a voluntary basis, i.e. the A.P.L. merely advised on the procedure and trained the supervisors. The procedure evolved as further research was carried out but the basic principles remained unchanged. By 1960 some 200 000 Bantu (new recruits and reacclimatizees) were being acclimatized by these methods each year. There were 125 European miners and nearly 1 000 Bantu boss boys engaged on supervisory tasks. Two new controls were introduced. One was to have scientific staff of the Laboratory visit acclimatization centres at least twice a year in order to check on the procedures and to interrogate the supervisor. The results of the visit were reported back to mine management, whose responsibility it was to take corrective action where it was needed. The second control arose out of an examination of the oral temperature records during work from different acclimatization centres. This showed that there were significant differences between centres. In order to rectify this 'out-of-control' situation and to give mine management a simple visual scheme for

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checking the standard of an acclimatization centre, a 'control chart' system was introduced. The supervisor was required to plot upon a graph the daily, average oral temperature of his acclimatization gangs. If these plotted, at random, around an 'industry' mean value, then the procedure was 'in control'. If, however, a run of three values plotted either above or below certain limits then the centre was 'out of control' and mine management would have had to take appropriate action to correct the situation.

The A.P.L. had hoped that heat-stroke would be eliminated from the gold-mining industry once the new acclimatization procedures were in general operation. By 1960 it was clear that this was not the case. The Laboratory therefore carried out a detailed survey of the causal factors of each heat-stroke case that occurred in the period 1956-61 with the object of identifying the main causal factors and of dealing with them.

The training of acclimatization supervisors was revised and tightened up in certain respects and a recommendation was made and accepted by the Chamber of Mines that *all* underground officials should be trained in the prevention of heat-stroke, in the recognition of early signs and symptoms, and, in the underground cooling of suspected cases. The A.P.L. assisted in getting this training scheme into operation.

The survey of clinical aspects of the heat-stroke cases, which occurred in the 1956-61 period, revealed a number of shortcomings. One was that there were no adequate criteria laid down for diagnosing the various forms of heat illness. Drs. Barry and Wyndham, with the assistance of Mr. Peter, put out a report on the diagnosis of heat illnesses to clarify this position.

Another shortcoming brought out by the survey was that when heat-stroke cases were transported immediately to surface without being cooled underground, which was the general medical instruction in such cases, they usually were admitted with severe hyperpyrexia and serious involvement of the central nervous system.

These findings gave strong support to the recommendation of the Human Sciences Laboratory (as the Applied Physiology Laboratory was renamed) that all cases of suspected heat-stroke should be cooled underground until the rectal temperature falls below 38.9°C (102°F) before being sent to surface. This step has been the single, most important factor in reducing the mortality of heat-stroke from 40-50 per cent to the present level of about 10 per cent.

The survey also brought out the fact that there were large gaps in the



The executive committee of the Mine Medical Officers' Association in 1970-1, the year of the golden jubilee.

Seated: Drs. J. de W. Becker, L. Hurwitz (Vice President), J. G. D. Laing (President), A. T. Halliday (Immediate Past President), R. C. T. Pearson.

Standing: Drs. J. B. Rossiter, R. D. W. Reid, D. Mirman, R. C. Dickson, D. J. van der Merwe, I. Potgieter, E. W. Geddes, Mr. F. L. W. Austin (Secretary), Dr. W. M. McFarlan.

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knowledge of the pathological and biochemical changes in heat-stroke and in consequence the treatment of the conditions was largely symptomatic. A proposal was made to the Chamber of Mines that research into the clinical aspects of the disease be started and this proposal was supported by the Chamber of Mines. Detailed studies were made in 1962 of six cases of heat-stroke of which five were severe in the acute stage. The studies were made by a team of medical consultants, including a general physician, a neurologist, a pathologist and a biochemist. The research team was subsequently expanded and centred on the S.A. Institute for Medical Research.

Their findings indicated a severe metabolic acidosis which was presumably due to the increase in cell metabolism associated with the increase in temperature. The oxygen supply to the tissues was often poor, due to hypotension. This combination of factors resulted in anaerobic metabolism and a metabolic acidosis. The treatment of this condition was urgent and called for massive doses of intravenous bicarbonate. Dr. Barry in the Welkom area was the pioneer of this form of therapy and used up to 33 grams of intravenous bicarbonate in severe cases with dramatic improvements. Another important finding of this team was a consistent increase in glutamic oxaloacetic acid transaminase (S.G.O.T.) from 36 in the normal to 496 units; in pyruvic acid transaminase (S.G.P.T.) from 33 in the normal to 195 units; and, in lactic dehydrogenase (S.L.D.) from 460 in the normal to 1 786 units. There were three normal people and twelve cases of heat-stroke in this study. Serum enzyme levels have proved to be a very important diagnostic sign in heat-stroke and also a good index of the severity of cellular damage.

In 1965 all clinical research was centralized under Drs. Seftel and Kew of the Department of Medicine of the University of the Witwatersrand and a steady stream of absolutely first-rate scientific publications have emerged from this group. They have filled in many of the gaps in the knowledge. Therapy is now on a more rational basis.

In 1965 a radical change was made in the method of acclimatizing the Bantu recruits to the mines. This came about because it was increasingly difficult to provide the correct combinations of work rate (from shovelling rock in stopes) and atmospheric heat, due to the greater use of mechanical aids in the removal of rock from stopes. A new acclimatization procedure was therefore tried out on the surface of a mine in a room in which the temperature and humidity of the air could be controlled to within narrow

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limits. The acclimatization procedure lasted for eight days and the men worked for four hours each day.

Although this new procedure was only started in 1965 on one mine, it has now, by 1971, been adopted by 32 mines spread throughout the goldfields with 28 climatic rooms, holding between 60 and 200 men. It is estimated that some 250 000 Bantu mineworkers are acclimatized by this means each year. The rapid switch-over to this new method of acclimatization is due to the many advantages it offers over the old Two-Stage, underground, method. These are:

- (a) It is safer because every man who completes the full period can be regarded as fully acclimatized.
- (b) Because of the moderate to moderately hard physical work for four hours each day the men are conditioned for physical underground work in the mines.
- (c) The procedure lasts only four hours each day and the rest of the shift (four hours) can be used for instruction in Fanakalo or in job and safety instruction.
- (d) Supervision is more effective and is easier because the 100 to 200 men are under bright light and can all be seen by supervisors walking up and down between the benches. Because of this it has been possible to reduce drastically the numbers of supervisors without impairing the safety of the procedure.
- (e) Because the men are in a confined space it is possible to measure the body temperature of the men during the four-hour period on every day of acclimatization, which adds greatly to the safety of the procedure.
- (f) If a man should develop hyperpyrexia, or any other form of heat illness, he can be sent to hospital within minutes by contrast with the minimum period of one hour from underground centres.
- (g) The load on the shaft is reduced as these men are not sent underground.
- (h) The reduction in the period of acclimatization from twelve to eight days makes four fully productive shifts available to mine management.

It has been estimated that the reduction in period of acclimatization and the reduction in numbers of supervisors means a saving of between 1 and 2 million rands to the gold-mining industry. In addition the procedure has been made safer and the men are better acclimatized.

In spite of the increase in the numbers of men working in hot conditions

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The average number of deaths per annum over the five-year period 1965-9 was only *four per annum*. This is a great improvement over the average of nine per annum over the period 1956-61 when there were fewer men working in wet-bulb temperatures above 26.7°C (80°F). It would not be unreasonable to claim that this improvement in the heat-stroke position was due mainly to the better acclimatization of the Bantu in the new procedures.

APPENDICES

Past Presidents of the Association

1921-1922	H. T. H. Butt	1945-1946	J. R. Counihan
1922-1923	A. Frew	1946-1947	C. H. Hutchinson
1923-1924	A. J. Orenstein	1947-1948	G. F. Eagle
1924-1925	S. Donaldson	1948-1949	W. G. McDavid
1925-1926	A. I. Girdwood	1949-1950	E. T. Clifton
1926-1927	A. Smith	1950-1951	N. R. MacColl
1927-1928	J. F. Young	1951-1952	J. S. Lawrie
1928-1929	H. T. H. Butt	1952-1953	L. F. Dangerfield
1929-1930	C. Justin Scott	1953-1954	R. C. T. Pearson
1930-1931	A. Percival Watkins	1954-1955	C. Berman
1931-1932	H. Q. F. Thompson	1955-1956	A. O. Dreosti
1932-1933	W. G. Goudie	1956-1957	R. A. Caldwell
1933-1934	A. B. Tucker	1957-1958	L. R. B. Birt
1934-1935	H. J. Brady	1958-1959	H. Le Helloco
1935-1936	F. Daubenton	1959-1960	S. J. Levy
1936-1937	A. W. Goldsmith	1960-1961	D. Oberholzer
1937-1938	J. H. G. van Blommestein	1961-1962	M. A. F. Helm
1938-1939	L. E. Miller	1962-1963	R. C. Dickson
1939-1940	P. A. Peall	1963-1964	M. E. Barry
1940-1941	A. O. Dreosti	1964-1965	A. M. Coetzee
1941-1942	L. S. Williams	1965-1966	E. M. McLean
1942-1943	F. Retief	1966-1967	V. M. F. Wright
1943-1944	A. Miller	1967-1968	P. Smit
1944-1945	K. Sartorius	1968-1969	A. T. Halliday

List of Awards

GOLD MEDALS AWARDED

<i>Year</i>	<i>Subject of Paper</i>
1969	Honoris Causa Award of Gold Medal to Dr. A. J. Orenstein for 48 years service to the Association of which he was one of the founders.
1958	DR. N. J. WEINBERG: <i>'Knotting of the Bowel in Africans.'</i>
1959	DR. E. M. MCLEAN: <i>'An Investigation into the Occurrence of a Specific Dermatitis in the Native Mineworkers in the O.F.S.'</i>
1961	DR. R. C. DICKSON: <i>'A Pilot Survey of Otitic Conditions in Bantu Mineworkers of the East Rand.'</i>
1963	DR. G. H. ELLACOMBE : <i>'Cross- infection—The Story of a Hospital Outbreak.'</i>
1967	DR. R. C. DICKSON: <i>'The Normal Hearing of Bantu and Bushmen.'</i>

SILVER MEDALS AWARDED

1967	DR. M. E. BARRY :	<i>'The Medical Contribution to the Safety of Rescue Brigadesmen on the Mines.'</i>
1968	DRS. A. M. COETZEE AND J. BERJAK:	<i>'B.C.G. in the Prevention of Tuberculosis in an Adult Population.'</i>
	DR. J. G. D. LAING:	<i>'Tuberculosis in the Mining Industry.'</i>
	DR. P. SMIT:	<i>'Chemoprophylaxis of Tuberculosis.'</i>
1969	DR. J. N. D. WRIGHT:	<i>'Nitrous fumes pneumonitis—a therapeutic rationale, treatment of respiratory failure by intermittent positive pressure ventilation.'</i>

BRONZE MEDALS AWARDED

Year	<i>Subject of Paper</i>
1967 DR. C. H. HUTCHINSON :	<i>'Hand injuries due to the injection of cement under pressure.'</i>
1968 DR. J. P. LOWE :	<i>'Management of shock with special reference to the use of the central venous catheter'—adjudged the best clinical presentation of the year.</i>
DR. LE R. LATEGAN :	<i>For the consistently high standard of his clinical presentations during the year.</i>
1969 DR. J. FRONEMAN :	<i>For his clinical presentation: 'Clinical trial of Metronidazole (Flagyl) in bilharziasis.'</i>