

## CHAPTER 25

### LATER EVENTS ON SINGAPORE ISLAND

At the end of December 1942 the risks of overcrowding the Changi area became apparent. The population of the area had been considerably reduced by the departure of working parties, but when these parties returned in December, the numbers were increased uncomfortably. There were in addition those who had been returned to hospital, and parties from other places, such as the N.E.I. Within a short period the numbers in Changi rose by 5,644, and the A.D.M.S. reported if something was not done to alleviate overcrowding there was a risk of epidemics of communicable disease.

#### PREVENTIVE MEASURES

As the incidence of deficiency states increased the burden cast on the Changi administration grew, for it was necessary to meet the needs of many of the men admitted to hospital, and even those being treated as out-patients, for example those attending the Selarang eye clinic. Yet stocks had to be conserved, and in January 1943 a definite policy was adopted by the A.I.F. for the treatment of deficiency diseases. "Marmite" was used only for the treatment of beriberi, keratitis and "retrobulbar neuritis", spastic paraplegia, dysentery, and in general for patients requiring dietary supplements who could not take rice polishings. The dosage was also laid down as follows:

	<i>Marmite</i>	<i>Rice Polishings</i>
Neuritic beriberi . . .	360 grains 7 days	then 2 ozs. daily 6 weeks then 1 oz. daily
Keratitis . . . . .	120 grains 28 days	plus 1 oz. for 30 days or more
Amblyopia . . . . .	360 grains daily plus	1 oz. 7 days
	240 grains daily plus	1 oz. 7 days
	120 grains daily plus	2 ozs. 28 days
Painful feet . . . . .		3 ozs. 14 days, or 2 ozs. with $\frac{1}{2}$ pint yeast 14 days
Glossitis, stomatitis, and scrotal dermatitis . . .		3 ozs. 7 days, or 2 ozs. with $\frac{1}{2}$ pint yeast 7 days 2 ozs. 7 days, or 1 oz. with $\frac{1}{2}$ pint yeast 7 days

Fortunately some stocks of "Marmite" were still held by the medical units. Yeast production was the subject of considerable trial and research at this stage: in January about 80 gallons a day was being produced at the

A.I.F. centre. Work was further pursued by the medical research officer, Captain Woodruff with the objective of obtaining accurate data concerning deficiency diseases in the area which might lead to improvements in the health of the A.I.F.

It is an appropriate place to mention the emphasis laid on the educational and scientific side of the medical life in Changi. At meetings and instructional rounds knowledge was disseminated by lectures and discussions, having regard not only to the pressing problems to hand, but also the basic subjects of post-graduate study.

Interest in nutrition was maintained at the highest level, and from this time onwards attempts were made to relate nutritional deficiencies to the clinical syndromes which swept in turn over the military community. Accurate clinical accounts were also compiled by medical officers. Continued efforts were made to improve the dietary, and in addition to the provision of supplements, all possible pressure was applied to the representatives of the Japanese to supply an adequate ration. During January 1943 a list of the requisite additions to the diet was presented to the Japanese, for although general health was then fairly good in the area there were signs of decline due to malnutrition.

Matters of hygiene received close attention during 1943. Towards the end of 1942 the engineers were able to connect the high pressure water main, and an intermittent supply was secured. This was improved later when the Singapore water supply was restored, but water used for sanitation was still obtained from shallow wells. In January 1943 the Australian engineers and members of the 2/5th Field Hygiene Section succeeded in restoring to use two sedimentation tanks for the sewerage system, and some time later brought into commission the whole septic tank installation, thus allowing the whole Selarang area to use the sewerage system. The greatly increased numbers using this system threw a strain on the water supply and the sedimentation tanks, but by the use of local auxiliary tank and bucket supply for toilets, and separate disposal of paper, practicable and efficient sanitation was maintained.

The hygiene section was also busy in other directions. The attachment of members of the R.A.E. to this unit was most useful, and standards were laid down to ensure efficient methods of hygiene in kitchens and elsewhere, as well as improved sanitation. Education and the employment of picquets kept the cause of hygiene before the men.

Anti-mosquito measures were necessary from the start, as has been pointed out earlier. Later in 1943 the A.I.F. anti-malarial party at Selarang under Major Burnside had managed to carry out quite an extensive programme. The area was surveyed for larvae of vectors, and dangerous areas were treated by oiling until September when the supplies of oil became very scarce. Since April 1943 no larvae of *A. maculatus* had been found, and by economy and care the area remained free. Maintenance work was also carried out on the drains in the camp. Constant liaison was kept with the British force in this work, and Lieut-Colonel Strahan gave valuable help.

*HOSPITAL WORK*

In the hospital, medical work was in some ways less pressing, because the numbers served were reduced, and prophylaxis in some directions was more successful. The Nutrition Committee cooperated with the hospital services in obtaining a better basic diet, containing fish and towgay. Deficiency diseases became less intense and less numerous, owing in part at least to the improved dietary organisation by the force itself. There was no positive evidence of deficiency of ascorbic acid and free exhibition of this vitamin in the treatment of hospital patients produced no change in their condition. Lieut-Colonel Harvey noted particularly that the average standard of physique had deteriorated. The men tired more easily, became infected more easily, for example in minor lesions of the skin, and broke down more readily under strain. With the persistence of an inadequate ration of protein and fat this was to be expected. In October 1943 Harvey stated:

We are in short working on a fine margin, our bodily reserves have been seriously encroached on, and we are not in a fit condition to face any emergency, should it arise.

Dysentery became less severe. Early in 1943 severe and occasionally fatal infections were seen, especially in those entering the area from Java, but since February no deaths had occurred. Amoebic dysentery still appeared both as a primary illness and in relapsing form. Bacillary dysentery in its severer types was controlled by sulphonamides. Following observations by Major T. P. Crankshaw A.A.M.C. an investigation was carried out in April by Bruce Hunt on the value of sulphapyridine in this disease; at this time the evidence had not been accurately assessed, though several British and Australian observers in Changi thought it worth full enquiry.

The patients investigated were those with an acute illness severe enough to warrant specific therapy, and an equal number were at first treated by sulphapyridine and by the conventional use of sulphates with free fluids. The latter group was used as a control, but the results of the drug were so incontestably better that after three weeks only sulphapyridine was used. In all clinical respects the original two groups were alike; it may be noted that some 20 per cent of both series suffered from severe toxic dysenteric symptoms. The total dosage of sulphapyridine was at first 12 grammes, later reduced by one-third: and was given within one and a half days or less in most cases. The swift subsidence of symptoms, the restoration of the stool to normal, and the lessened stay in hospital were striking, and Hunt concluded that the drug was a specific for bacillary dysentery. A further observation on chronic dysentery was made, and clinical and sigmoidoscopic evidence pointed to the value of sulphapyridine here also, but further trials were required. Stevens in a similar but uncontrolled series arrived at the same conclusions as Hunt as to the great value of sulphapyridine in acute bacillary dysentery. No other infectious epidemics occurred during 1943. It was interesting that, while no cases of faucial diphtheria were seen, there were several of the cutaneous form.

The number of dyspeptics admitted to hospital steadily increased, and it was observed in several men operated on for inveterate peptic ulcer that ulceration was both active and extensive. Radiological examination was not readily carried out with restricted facilities, but confirmation of the diagnosis of ulcer was often obtained. As many as half the patients in the medical wards had dyspepsia of varying severity. Some of the most seriously ill men were admitted from the Japanese gaol, where they were submitted to conditions which caused severe malnutrition. The diets received by these men were deficient in all respects.

Three patients were admitted to hospital with pulmonary tuberculosis; one died from tuberculous broncho-pneumonia. One was treated with artificial pneumothorax, but without good response. Respiratory disease was not common, but asthma was very persistent in a number of men, and kept them for long periods in hospital. An inflammation of the lower parts of the urinary tract of apparently non-specific origin was often seen.

Reports of an outbreak of cholera in Singapore stimulated a tightening of all measures of hygiene in the area, and all ranks were inoculated with 0.5 cubic centimetre of cholera vaccine in August. Very little vaccine was available, but second doses were given to those who were handling food and water.

In the surgical wards the work diminished progressively as more men were transferred to other areas. Gastric surgery was an important feature. In addition to a number of operations for acute perforation of peptic ulcers, Osborn carried out deliberate surgery for the relief of ulcers resistant to medical treatment. The operations performed included anastomoses and partial gastrectomy.

Radiological work continued as long as the films lasted, when fluoroscopy alone was available. The Australian Ultrays unit developed a fault in the transformer, but the Siemens portable Heliosphere did all A.I.F. X-ray work from February to October 1943. This unit was originally on loan from the Selemban civil hospital to the 2/10th A.G.H. Major Bridgland of the A.I.F. by using the transformer of this unit was able to operate the tube and tube stand of the Ultrays set and this worked satisfactorily for screening. Film supplies at this date, November 1943 were practically exhausted. While they lasted the Australian films of Kodak Ltd. were much superior to other varieties used in Malaya, withstanding the climate better.

During August the Japanese ordered the removal of the hospital from the Roberts Barracks to the Selarang area. On 25th August this move was completed, and the A.G.H. occupied three barrack blocks and one other building. A common operating theatre was established with the X-ray department in the same block, which had been converted for this purpose during the campaign. A new A.I.F. dental centre was opened here, and the A.G.H. medical stores, and ration stores, shared a floor with the skin clinic and the dispensary. All the medical inspection rooms were closed when this move was made, and aid posts were set up in their stead. The convalescent depot continued to work as before and held some

200 men. Since the end of May the precaution had been taken of holding convalescents for a time in hospital, so as to safeguard them from being included in working parties by the Japanese while they were unfit for any work. The average strength of the A.I.F. troops in the Selarang area was about 1,100 at this time.

The growing proportion of men left in the area who were unfit for all types of duty led to the adoption of a system of medical classification based upon the capacity for work. This was made up as follows:

Class I . . . .	Fit for heavy duty.
Class II . . . .	Fit for light duty.
Class III (a) . . . .	Fit for very light duty.
Class III (b) . . . .	Fit for no duty.
Permanently unfit . . . .	(a) No duty.
	(b) Able to do certain duties in camp.

*Artificial Limbs.* One of the difficulties attending the care of the relatively unfit was that of keeping the morale high. Efforts were made to keep men interested in doing what their physical condition permitted. One important medical activity concerned with rehabilitation was that of making artificial limbs. This began at an early date in Changi, when during March 1943 a conference was held at the convalescent depot by Lieut-Colonel Glyn White, Lieut-Colonel Webster, Captain C. Hill (ordnance), Lieutenant Campbell (engineers) and Warrant Officer A. H. Purdon 2/30th Battalion. Purdon was authorised to organise a workshop, with the aim of producing an artificial lower limb adapted for a long and a short stump. With very modest equipment the staff of what was afterwards known as the Artificial Limb Factory made a start. Material used comprised 3/64 inch motor body steel from discarded vehicles, rubber tree wood, wrought iron from splints, rubberised fire hose and copper wire. No plaster of Paris could be obtained for making moulds, but the shape and size of the stump were moulded by a copper wire cage, from which a wooden mould was made and a panel was fashioned to fit by a panel beater. The joints were welded and hinges were constructed from iron. The first leg made was of the peg leg construction, but the next leg was provided with a metal foot which could flex at the ankle, with its positioning controlled by a spring in tension. A corset fitting the upper part of the limb was made from fire hose. The first limbs were designed for amputations below the knee, but higher amputations were treated also. These limbs had knee hinges stabilised by a spring fixed to the rear of the true axis of the knee and weighed about 8½ lbs. and those of the lower amputation about 6 lbs. Great care was expended in eliminating faults and improving their comfort and manoeuvrability. Attempts were made to lighten them, but though aluminium water tanks and containers were obtained by various means they were not successful, as the gauge of the material was too heavy. An improved ankle joint was devised and was used successfully. This highly

ingenious and painstaking work was of great value, not merely for the physical help it gave mutilated men, but for its demonstration of what could be done under the most unpromising conditions.

*Soap.* Another activity in Changi was the manufacture of soap. Its constituents were obtainable in the area, fat from palm oil, or coconut oil, and alkali from potash in wood ash. Palm oil, being readily saponified, was a suitable fat which did not produce too brittle a soap. In manufacture the oil and alkali were boiled together, the soap was precipitated in a saline solution, and the product purified by successive washings with alkali and water. The percentage of alkali in wood ash varied widely, but the yield of a given regional sample was roughly assessed by the charcoal content. Considerable difficulties were encountered from unduly high content of water or of oil in the product, but these could be overcome. As a by-product glycerin could be recovered by evaporation of the liquor after precipitation.

*The Red Cross Society* continued to give what help was possible by purchase, the local commissioner acting through the representative of the International Red Cross. On 7th September the Japanese told the local representative that he was not to order further medical supplies through the International Red Cross, on the grounds that it should rest with the I.R.C. to obtain supplies and to try to arrange that fair average requirements should be met from their central store in Singapore. On 1st October a further obstacle was imposed to obtaining Red Cross assistance by the Japanese refusing to recognise the A.R.C.S. representative because he was a prisoner of war. After this, money received was from officers' bank balances and was handled by the army paymaster.

#### PROBLEMS OF NUTRITION DURING 1943

In November 1943 there was some increase in the incidence of sickness among the A.I.F.: this was due to tropical ulcers and septic abrasions, which were often associated with adenitis. Trouble was found with rice polishings becoming rancid on growing a fungus and thus being too unpalatable for use. However, more success was gained in making an extract, which was prepared by heat derived from an old electric water heater. The pathology department could make only a rough test of the efficacy of this extract by its effect on the growth of yeast cells, or by occasional tests on fowls with some signs of thiamin deficiency, but the process was a success and for three months an extract of condemned rice polishings was used on a small scale without any clinical evidence of lack of potency.

By the end of 1943 some views had been formed of the value of various supplementary sources of vitamins. Of course the value of supplements did not lie only in the accessory food substances they contained, for in this way the main constituents of the diet were also augmented. Examples of food bought from money derived from levy on officers' pay, A.A.M.C. pay and other ranks' working pay were sweet potatoes,

whitebait, peanuts, towgay (green dhal), maize flour, eggs, pineapple, coconuts, and gula malacca. Had purified vitamins been available in any but small quantities more critical information might have been obtained as to their therapeutic or prophylactic effect, for the amount of vitamins contained in the foods actually consumed by the men was only approximately known. Difficulties with rice polishings have been described; even with administration of fresh greens such as towgay and kang kong, believed to be good sources of riboflavin, the dosage was uncertain. Nicamide given by injection of 2 cubic centimetres a day produced definite improvement of painful feet, but patients who were unimproved showed little change after treatment in hospital by green leaf extract. Increased production of grass and leaf extracts was undertaken in May 1943 to permit further enquiry into their effect on painful feet and amblyopia. In this ocular deficiency the Nutrition Advisory Committee suggested that those patients whose eyes showed a stationary condition but without atrophic changes should be given massive doses of riboflavin in the hope of arrest of the condition.

The value of yeast was also questioned, not because of doubt of the existence of vitamin *B*<sub>1</sub> in it, for it was recognised that more vitamin *B* complex was present in the product than in its constituents. But the project of manufacturing large quantities of yeast for prophylactic purposes was not found practicable. The doubts as to the propriety of using sugar in the process have been mentioned; the A.D.M.S. probably expressed the general view when he pointed out late in 1943 that apart from the value of sugar as a sweetening agent and the greater importance of a substance of a dietetic and therapeutic value, the large scale manufacture of yeast was impracticable. It had, in fact, been given up as a major project by the A.I.F. late in 1942. However, this did not mean that the therapeutic value of yeast was disregarded or that its production was discouraged. The manufacture of grass extract in bulk became difficult late in 1943 through mechanical problems, and therefore yeast production was continued.

Another activity which began during 1943 was the production of surgical alcohol. Major Rosson, senior dental officer in the A.I.F. in March made a trial production of alcohol by fermentation of sweet potatoes and gula malacca. Three pounds of each with the addition of yeast produced one pint of absolute alcohol. The residue of about 2 lbs. made a substitute for "Marmite", which was named "Changimite". It proved satisfactory on clinical trial, and during a period of six months the dental centre made in this way twelve gallons of alcohol and twenty gallons of "Changimite" per week. Alcohol was later regularly produced from the grass extract centre.

#### *THE RETURN OF WORKING FORCES*

In December 1943 members of "F" Force began to arrive back in Changi. In all the A.I.F. troops in this part of the force numbered 1,658; they were in a poor state of health, and a considerable number were admitted to hospital. It was evident that more men would collect in Changi

who needed medical attention. Among "F" Force there were 256 cases of eye disease due to malnutrition and at least 56 men so affected were known to have died from other infective and nutritional diseases. Of 134 patients from "F" Force seen at the eye clinic in January 1944, 56 had amblyopia, but fortunately the number with vision 6/18 or worse was small. Dark glasses were being provided by the Red Cross to men considered to need them by the medical officers. A large proportion of men were suffering also from chronic malaria. Little primary malaria was seen in Changi at the beginning of 1944, though anopheline breeding had been discovered outside the perimeter and strict precautions were being observed.

The position then was fairly good for vitamin supplements; a reserve of "Marmite" was held, grass extract was available for out-patient use, and extract of rice polishings was now being made by Burgess for therapeutic use. Amongst the extra items of food obtained by purchase eggs played an important part. Some of the men had private supplies from home-grown poultry; they were permitted to sell eggs if they wished at predetermined rates, and eggs were also presented by some of the growers. The Australian Red Cross Society helped greatly in supplying eggs to the British and Australian hospitals on an equal basis. The need for extra protein for these undernourished men was pointed out by Harvey, Bye and Osborn. A reserve of frozen meat and milk was held in Changi, and the A.D.M.S. was able to assure the hospital staff that though lives had been lost in the "up-country" through lack of food, this would not occur in Changi.

On 22nd January 1944 the Japanese notified the Changi administration that 150 patients might be expected in the hospital from the Sime Road camp following their return with "H" Force. Already men with amoebic dysentery had been seen from "F" and "H" Forces. Instructions were also given by the Japanese that all men with malaria were to be treated in hospital: primary cases were seen, though only in moderate numbers, but it was evident that many relapses would appear among the men returning from Thailand. A malaria centre had been set up for treatment of men not needing hospital care, and early in February this was full; there were 279 A.I.F. men under treatment. In March the Japanese further ordered that all patients with malaria would be retained in hospital till the convalescent period was complete. This was quite impracticable and the convalescents were treated in their own lines. In order to conserve supplies of anti-malarial drugs restricted courses of treatment were laid down. Benign primary infections were treated with atebirin five days and plasmoquine five days, and recurrences with quinine 20 grains for seven days. Malignant infections were treated with quinine two or three days, atebirin five days and plasmoquine after two days' rest for five days. In April the work of the malarial centre was resumed and terminated in May. Supplies of drugs were received irregularly: sulphaguanidine was obtained from the Japanese in January 1944, but anaesthetics and anti-amoebic drugs were very scarce. Acriflavine, alkalis, zinc oxide and *Tinct.*

*Benzoïnæ Co.* were obtained from the American Red Cross. The Japanese supplied anti-typhoid and anti-dysentery vaccines.<sup>1</sup> At Sime Road Marsden fortunately still held some supplies taken with "H" Force.

In April a new deficiency syndrome was observed, characterised by skin rashes, ulceration of the lips, mouth and throat, and in some cases reduction of the granular white blood cells. The symptoms were believed to be due to dietetic deficiency accompanied by infection. At the end of the month another party of "F" Force arrived without warning; 124 men were admitted to hospital, including 5 with amputations. The following day a further party arrived with 80 patients.

A summary of the figures of "F" and "H" Forces at the end of April showed that 3,662 A.I.F. troops left with "F" Force of which 2,223 returned; 666 left with "H" Force and 494 returned.

#### CHANGI AND KRANJI

In May notice was given by the Japanese of further changes in hospital arrangements. A "base" hospital was set up by the British medical services at Woodlands near the Johore causeway, and a "camp" hospital at Changi gaol by the A.I.F. This move divided the Changi gaol medical area into two. One section moved to Kranji, in the Woodlands area, and was staffed predominantly by the British and the other in the gaol area was staffed by Australians. Reconnaissance of the gaol area showed that there was considerable danger of overcrowding and a request was made for additional quarters. There was also a risk of insufficient space for sanitation, as this partly depended on borehole latrines. On 28th May the patients were removed by trucks to the new area at Kranji. The new arrangements entailed some alteration in administration. Lieut-Colonel Neal was in charge of the medical services, with Lieut-Colonel Collins in charge of Woodlands and Lieut-Colonel Glyn White in charge of the gaol area. Lieut-Colonel Summons took charge of the hospital as before and Major Gunther of the hygiene. In the medical area of Changi gaol camp were accommodated the camp hospital, the artificial limb factory and the vitamin extract centre.

*Work at Changi.* During the next month there was a vast amount of work done in the gaol area; much construction and adjustment of accommodation was required to utilise the very cramped space without undue overcrowding. Dysentery was prevalent and attendances at the skin clinic were rising, and increased by the frequency of scabies at this time.

The move to the camp hospital was completed by the middle of June, but even then the necessary huts were not all constructed. Some of the buildings were of permanent type, others were huts, some of which were made of attap with earth floors and sleeping platforms. Fortunately there was enough permanent housing to serve the seriously ill and provide a satisfactory operating theatre and medical stores. A medical inspection room was placed in each working group area of the camp, and out-patient

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<sup>1</sup> It may be noted that at the Singapore General Hospital the Japanese maintained a research unit which produced essential sera and vaccines, and apparently did valuable work.

clinics were provided both in the gaol and in the medical area for the occupants of these respective compounds. These clinics were used as before, mainly for the purpose of diagnosis and classification, and there, with meagre equipment and poor facilities good work was done. Laboratories, chiefly for malarial diagnosis, were set up and gave prompt service.

Sanitation was only of water-borne type in the gaol buildings: the remainder of the area was serviced by boreholes which could only be used for ten days then rested twenty days. An improved design was introduced by Gunther which could be flushed by buckets into the sewerage system.

It was noticeable that the experience of the past two and a half years had made the men more conscious of hygiene, and much less trouble was caused than previously. The mild dysentery outbreak of the early weeks soon subsided. Diet was not good; in fact the official supplies were as bad as in 1942. Though only two Red Cross issues had been made, in December 1942 and January 1944, reserves were still in hand and local purchase was exploited as much as possible. The previous organisation by which the British and Australian wings of the hospital had separate messing arrangements and reserves of food was revised by agreement, and all reserves were pooled, three-fifths going to Kranji and two-fifths to the gaol. In this way the A.G.H. was able to make a substantial contribution of meat, vegetables and tinned milk to the common cause.

Special food for hospital patients was distinctly limited in supply and had to be controlled with care. Local purchase supplied eggs, greens, sugar and oil. The economy and wisdom with which the dietetic affairs of hospitals were managed on Singapore Island are worth note, for special diets were devised for certain conditions such as beriberi, peptic ulcers and pulmonary tuberculosis, and while all shared in the common stringency of food, those most in need were given a chance of recovery. The meagre nature of even the best diets will be evident from studying the tuberculosis diet, which consisted of the standard hospital diet plus 3 ounces of rice, two pieces of bread made from rice flour, soya bean flour and raggi, 1 ounce margarine,  $\frac{1}{2}$  ounce palm oil, 3 ounces dried fish. If necessary milk and eggs were added. The possibility of an emergency was always before the administrators, who felt that it was imperative to hold some reserves, even though the individualistically minded physicians might ask for more for patients in particular need of help. The average strength of Changi gaol camp was then 10,000, 2,850 patients reported at the inspection rooms daily, and from 1st June 1944 to 28th February 1945, 14,661 patients were admitted to the gaol hospital; of these 5,252 were British, 7,869 Australian and 1,540 Dutch. The commonest diseases seen in hospital were dysentery and malaria, and in nine months 6,755 fresh cases of deficiency diseases were seen in the out-patient clinics.

Surgical work was mainly limited to the relief of emergencies, owing to the scarcity of essential supplies. The work of the hospital was made more difficult by the callous outlook of the Japanese on prisoners of war, and, as before, the basic ration supplied rose little above the starvation

level, while the demands for the performance of heavy tasks were not abated.

*Work at Kranji.* The tasks involved in establishing Kranji hospital were similarly great. Only with great difficulty were the staff able to direct their own labour to the essential tasks of accommodation and hygiene, which were barely finished when the patients arrived. The proportion of patients was 650 British to 550 Australian. The patients were accommodated in atap huts in an old rubber plantation

J. C. Collins, R.A.M.C. commanded the Kranji hospital, and Webster the A.I.F. wing; Cotter Harvey and Osborn were in charge of the A.I.F. medical and surgical divisions respectively. The Australian staff consisted of 14 officers and 103 A.A.M.C. other ranks. In the main A.I.F. patients were cared for by A.I.F. medical officers.

The original idea of the Japanese was to use Kranji as the base hospital, and to send patients over there regularly from Changi gaol, but difficulties of transport hindered this plan, and patients eventually accumulated in Changi beyond the originally intended numbers. Kranji was somewhat cooler, and after initial difficulties had been lessened, though not overcome, with the ration scale as supplied to the hospital, the health of patients and staff was reasonably good. Calories were lacking in the diet, but the thiamin/non-fat calorie ratio increased slightly with a rise in the amount of green vegetables supplied.

Though loss of weight was noticed, deficiency diseases lessened in incidence somewhat and in severity. Some of the long-term patients were in a very unstable physical state, particularly those who had chronic dysentery. Very slight alterations in diet or in their general condition would precipitate oedema again, and cardiac symptoms also appeared in some, including one of the medical staff. A few deaths occurred among men from "F" Force, probably due in part at least to cardiac beriberi. Limited quantities of thiamin for parenteral administration helped the patients with severe neuritic symptoms, and their low protein intake was augmented by eggs obtained through the A.I.F. officers' messing fund in Changi. Malaria was fortunately uncommon in the primary form, thanks to an efficient malaria control group, which carried out regular inspections with draining and oiling of potential breeding areas. Recurrent malarial attacks were still seen among the men previously infected in the working camps.

Sulphaguanidine was available in small quantities and controlled acute attacks of bacillary dysentery. Amoebic dysentery, as in other areas, was an anxiety, for, although some degree of immunity was attained by some patients, the very serious nature of this infection was emphasised by the lack of specific drugs. A short course of emetine, consisting of only four grains, was used during 1944, while supplies lasted, but the condition of emetine resistance increased the difficulty of treatment. Enemata of acriflavine gave some symptomatic relief.

In September 1944 a case of pulmonary tuberculosis was diagnosed in a member of the A.I.F., and another was seen in October. No Australian

soldier was discovered with tuberculosis until the force had been in captivity for over a year, and the number seen was very small. This was a tribute to the care of selection, and to the use of fluorography, as shown by the greater number appearing in the British forces, thirty in the first six months. Five men with tuberculosis were under treatment in the A.I.F. wards at Kranji in 1944, where artificial pneumothorax was used for suitable cases. Later the tuberculosis patients were sent back to Changi, with a number of other men with chronic conditions of various kinds.

A mental ward in Kranji was busy; unfortunately deterioration of some of the patients was observed at this time, no doubt due in large measure to the long continued nature of the psychic strain to which they were subjected.

In October 1944 air raid precautions were carried out; the exercises held both by day and night were thorough and included training of fire fighting and demolition squads. A reserve of water was provided in Kranji in case of failure of the supply. After slit trenches had been dug during the following month the protective measures were complete. By the end of the year there were few very ill patients in Kranji, as most of those transferred from Changi were ambulant.

#### FURTHER STUDIES IN NUTRITION

In the Changi gaol hospital the work on deficiency diseases was pursued. The appearance of the "new syndrome", previously mentioned, stimulated enquiry into the inflammatory and haematological symptoms of this condition. Detailed clinical studies were carried out in the A.G.H. on the lesions of the mucous membranes of the lips, mouth, tongue and pharynx, and the bacteriology was studied, but no useful information was so gained. A wide variety of skin lesions was encountered, ranging from mild erythema to generalised exfoliative dermatitis. Photo-sensitivity was a common feature. Vesiculation and haemorrhagic lesions of the skin were troublesome. It was particularly noted that scrotal dermatitis was at this time uncommon. Blood changes were not invariable, but leucopenia occurred and three fatal cases were observed in which the total white cell counts were very low. It was pointed out that the disease occurred after two years of exposure to poor dietetic conditions, in which the diet supplied was of a low Asiatic standard.

The other syndromes which had swept like waves over the community of Changi were seldom seen in this later period, though exacerbations were easily excited. This applied with particular force to beriberi. Loss of weight was universal, and it is probably fair to assume that metabolic activity was also reduced. The effect of a flare of dysentery in reactivating beriberi was evident. The vitamin *B* complex had been insufficient in the diet of the men consistently and over a long period. It is not surprising then that in April 1944 of 3,746 men in the Changi area 324 showed signs of the pellagroid type of deficiency. It should be added that no mental signs were observed in these men. A persistent residual symptom was sensitivity of the skin to sunlight, but sensitisation of the skin to various noxae is a

common phenomenon. The outstanding feature of the camp diet was probably, as Burgess showed, the significant fall in nicotinic acid from January 1944 onwards: riboflavin fell in amount also; as always it was deficient, but the fall was not substantially greater than before. It was harder too to obtain the dietary supplements required. Another factor was the greater strain of sick men in camp, particularly those returning from working camps, where they had often been grossly underfed and overworked. Therapy was not very satisfactory, as enough of the specific vitamins was not held for the treatment of the sick.

The cultivation of gardens in the Kranji area was intensified during the latter part of 1944. There was a permanent garden staff and further demands for labour were met as far as possible by using patients fit for such duty. One advantage in this arrangement was that the patients received full pay for their rank and a daily extra meal prepared at the garden. The extra greens thus obtained were welcome, especially as Claffy had found that the deficiency type of amblyopia, also known as retrobulbar neuritis was improved by kang kong leaves in particular. In addition to the official gardens controlled by the Japanese there was considerable gardening activity round the individual huts.

The diet available for December 1944 at Kranji may be noted. For workers the Japanese supplied rice 420 grammes, oil 24.3 grammes, sugar 18.7 grammes, tea 5 grammes, soya bean 27.5 grammes, vegetables 393 grammes and fish 48 grammes. To this the messing fund added tawgay 10 grammes and oil 25 grammes. The daily ration in all provided (reckoned in grammes) protein 56.8, fat 62.8, carbohydrate 474.8, a total of 2,700 Calories. The thiamin/non-fat calorie ratio for workers was 0.36 and for non-workers, who had an issue giving 2,560 Calories, this ratio was 0.39. It will be seen that there was but a slender safety margin. Rice polishings were, however, supplied at the rate of 10 grammes per day.

In the Changi gaol area two other points concerning nutrition were discussed, the use of black beans, and the conservation of "Marmite". Black beans were bought early in 1944, and during the wave of sore mouths and affected skins which pointed to a pellagroid affection the A.I.F. was much more heavily attacked than the British. During March 8.7 per cent of the A.I.F. strength suffered from these lesions, and they were at this time consuming a greater quantity of black beans. The beans were bought to provide additional vitamin *B*, and in view of some of the arguments which have been raised as to the cause of pellagra the propriety of using these beans was considered. The camp nutrition committee decided that the results of thiamin deficiency might be much more serious than those of the other sequels of deficiency of other components of the *B* complex, and thought it best to leave the committee to advise when beans should be added to the diet.

In October 1944 the reserves of "Marmite" had so dwindled that the rate of consumption was based on a six month period, and its administration depended solely on medical causes. This meant a 50 per cent reduction in dosage in the hospital: it was being used chiefly for beriberi,

amblyopia and skin lesions. The dangers of beriberi were still imminent in the Changi hospital, where numbers of men with severe types of this deficiency were seen. They were drawn from the chronically sick returned from the up-country parties, those with dysentery in particular, from men returning from neighbouring working camps and from Java. In the Changi camp during November the thiamin/non-fat calorie ration was 0.308 early in the month and later only 0.267, a figure indicative of danger. An important radiological survey was carried out by Major Uhr on the patients returned from "F" Force, and others with the diagnosis of cardiac beriberi. The results of this investigation established that most of these men had at that time no radiological evidence of cardiac damage; this was of considerable importance in allowing these men to resume activities such as lay within their physical capacity. In the parties from Java gross malnutrition was common: once again the dietetic needs of these sick imposed a strain on the resources of the hospital. The severe outbreak of B2 deficiency has already been noted. In Changi as in Kranji the level of nutrition was sinking, the dietary position being as bad as in 1942.

#### HOSPITAL WORK IN 1944

Dysentery was still occurring, and a limited bacteriological survey revealed that the predominant infection was of the Schmitz type. Amoebiasis continued to occur among the hospital patients, showing the wide spread nature of the infection in the camps from which they came: treatment was severely hampered by lack of drugs. Sigmoidoscopy continued to be of great diagnostic and prognostic value, and a room was specially equipped for carrying out this manoeuvre.

Malaria was common among the men from other areas. Atebrin was found to be of definite prophylactic value, in the sense of preventing relapses, and though the stocks were scanty, a true economy was effected by its judicious use. Malarial relapses were steadily decreasing in number. Several deaths from blackwater fever occurred, and one from cerebral malaria.

Surgical work was added to by the unexpected admission of men of British, Australian and Dutch nationality who had been torpedoed while *en route* to Singapore from Sumatra. A strain was thrown on surgical expendable supplies, in particular on saline solution, and the pathological department worked hard with the object of supplying present needs and acquiring a reserve stock of 50 litres. The surgical division of the camp hospital ran smoothly under Lieut-Colonel J. Huston, R.A.M.C.; Majors Nairn and Fagan looked after A.I.F. patients. At the end of 1944 Major Rosson reviewed the work done by the dental service. The paucity of dental material had been remedied to some extent by the manufacture of substitutes of dental rubber and plaster for the making of dentures, and of amalgam alloy for fillings. Necessary materials such as mercury and cements were fast disappearing, and the opportunities of carrying out

conservative dentistry were thus dwindling. Nevertheless, the work done was a notable achievement. In 1943 when the peak of the work was done over 10,000 patients were treated.

#### *MEDICAL CONDITIONS DURING 1945*

In Changi early in January 1945 a significant event was the injury, fortunately slight only, of several men in one of the working areas following an air raid. The Japanese though as usual reluctant to supply an adequacy of medical requirements, produced quinine, prophylactic vaccines and other items of drugs, including small quantities of injectable vitamin *B*. They also asked for information about men suffering from ocular defects; of particular interest were questions about present treatment, whether the patients thought anything could be done for them and whether they blamed anyone. Later in the year they required returns of the number of officers who had lost limbs and who had defective vision, and additional information concerning medical officers.

Rations were much the same as before, but a new scale was announced in February, together with a prohibition of pooling of dietaries, by which the A.I.F. had tried to make a fair distribution. It had been hoped that with the dietary additions beriberi might become less common, but there was little fall in the incidence, and some severe cases were seen, including a number with massive oedema. These latter were not regarded as uncomplicated beriberi, for they did not respond to thiamin alone. In the parties arriving from Java severe forms were encountered also, particularly with cardiac affection. Though no substantial changes occurred in the level of vitamin *B* complex in the diet there were some relapses of the "new syndrome" with neutropenia, and towards the end of May there was a sudden increase of lesions of the pellagroid type. This at least showed that there was no connection discernible between these deficiencies and the use of maize flour and black beans.

Amoebic dysentery continued to give anxiety. The maximum amount of emetine allowable for an individual patient was 8 grains; in May the position was slightly better, but even then the total of the drug held in stock was only 136 grains, while in Kranji alone there were over 100 patients needing treatment. The needs of this and other essential drugs were hard to estimate, owing to the continuation of troop movements. For example a party arrived on 25th May from Palembang, numbering 350, and while parties were still leaving for working camps in 1945, returning troops usually called for special attention.

In Kranji an increasing number of men needed special "ulcer" diets, and these were very difficult to supply, particularly as most of the patients also showed evidence of malnutrition. The supply of alkalis for treatment gave trouble, but was helped greatly by the production of magnesium hydrate, which was made in the soap factory from sea water. Dietary difficulties arose with patients suffering from infectious jaundice, as the curtailing of fats caused serious loss of calories. Similar difficulties were encountered in treating patients with chronic amoebic infections, some

of whom weighed only about 100-110 lbs., and needed careful yet adequate feeding.

Malarial relapses gave anxiety in debilitated patients, such as those returned with "F" Force. In some instances epileptiform seizures occurred during the relapses of benign tertian malaria, and a few patients died. No evidence was found of cerebral malaria, and autopsies failed to reveal parasites in the capillaries of the brain. It was thought that the cause of these seizures was often intercurrent disease.

At the beginning of 1945 the thiamin/non-fat calorie ratio was only 0.27, and there were still large numbers of men with beriberi. It was noticeable that men admitted from certain working camps had beriberi of types differing from those seen in others. For example hydrothorax was common in some, in association with general anasarca, whereas in others neuritic types with little oedema were seen. In a considerable number of these oedematous patients well-marked dilatation of the heart was proved by radiological examination, more often involving the left side. Pulmonary oedema was often demonstrable, and was associated with attacks of breathlessness. The clinical picture often resembled that of hypertensive heart failure. The small supplies of injectable thiamin were used on the worst of these patients: in addition they received the special beriberi diet with added rice polishings. The receipt of Red Cross parcels in April improved the ration somewhat for a short time. A further supply of drugs was also received from the Japanese.

The arrival of a working party into the Kranji area made inroads into accommodation space and also labour, as men were required for wiring off the area, and patrolling the boundary. During March 1945 an air raid damaged the piped water supply to the Kranji hospital, making it necessary to fall back on wells. No other damage was done. In spite of the persistence of chronic disease, malnutrition, loss of weight and vigour, and the asperities of life of prisoners of the Japanese, the spirit of the men in hospital remained good. Educational and diversional activities had been a feature of the life in the hospital areas throughout the period, and additional efforts were made successfully along these lines. Knowledge of the turning of the tide of war, gained from the perilous working of radio sets helped the prisoners greatly. But sustaining of the spirit was more difficult in proportion as fatigued and ravaged bodies became weaker. The long years of privation and cruelty were showing their effect in a steady deterioration of the force.

#### PULAU BLAKANG MATI

References have been made to the physical condition of parties returning from working camps. It is convenient here to follow briefly one working party, which was in a camp on Pulau Blakang Mati, an island south of Singapore Island from April 1942 to August 1945. The party numbered over 1,000 in all, of whom some 250 were Australians. Accommodation was in barracks and good in type, and hygiene was also good. The work was in the handling of bombs, petrol and oil for the Japanese air force. As the Japanese advanced the work grew heavy, but in later times it became

less arduous. During busy times day and night shifts were required for loading ships, and the conditions at the ships were bad. All manner of other special work was also carried out by the party, and long hours were generally worked. The usual conditions prevailed of harsh discipline and violence, particularly at the hands of Japanese privates to whom responsibility was delegated.

In 1942 and early in 1943 deficiency diseases became so common as to affect 25 per cent of the strength, the most frequent forms being those with lesions of the mouth, throat and tongue. Later scrotal dermatitis became common, and rice polishings were supplied by the Japanese and used with good effect. About the middle of 1943 keratitis and amblyopia appeared; the men so affected were allowed to attend the eye clinic in Changi and if necessary to be treated there. At Christmas 1943 the Japanese presented a hundredweight of "Marmite" which was used chiefly for the men with failing sight, and lasted till August 1945. Beriberi was seen to a slight extent only and then in the later period.

Malaria was a major problem after August 1943; in spite of requests the Japanese refused to allow anti-malarial measures to be adopted. Captain Puffett, A.A.M.C. brought a microscope to the island in August 1943 and the exact diagnosis could then be established. Later the microscope could only be used jointly with the Japanese, and after an "incident" it was not seen again till August 1945. Most of the infections were benign tertian. Further representations were made for the making of a survey of the island, which had been free of malaria up to the time of the Japanese invasion. A survey was carried out by the Japanese, but the presence of malaria was denied until the disease appeared in Japanese troops. A more reliable survey by Indian civilians in 1944 revealed anopheline breeding grounds, but only inadequate measures were adopted. Treatment was with atebirin and plasmoquine till atebirin became unobtainable in April 1943, and the scanty stock of quinine was then used. A Japanese order in September 1944 kept malarial patients off work for twenty-eight days and a follow-up course of quinine gave the men a chance to recuperate properly. Later this period was shortened, with correspondingly less satisfactory results. Most of the men in the camp at one time or another had malaria. The camp started with fairly good stocks of medical supplies which with purchases and Japanese issues lasted till the end of 1943: thereafter supplies were unsatisfactory. Dysentery also occurred on the island, and good results were obtained with the small amounts of sulphapyridine available.

Little difficulty was encountered in treatment or evacuation until 1944. General health was fairly good, but loss of weight was common. This was due to a falling off in rations; the scale of issue was in conformity with the customary Japanese scale, but gradually dwindled. Meat, varied by fresh fish, was replaced by dried fish in 1943, and the supply became irregular in 1944. Fresh vegetables were adequate though variable in amount. In 1945 in common with the other camps Blakang Mati camp suffered a reduction of rations, which were inadequate for men doing

hard work. In August 1945, 403 men of average age 29 weighed on the average 122 lbs; most of them lost some 40 lbs. in weight. Gardens were allowed after some haggling, and expanded greatly in output. The garden was an activity of the camp itself and was found to be of the greatest value in the later period.

No Red Cross medical supplies were received, but large quantities of food and clothing came from the South African Red Cross in September 1942. Further supplies came in November from India, and in 1944 parcels were received from the British Red Cross, which were dated June 1942. American Red Cross parcels also arrived late in 1942, and a limited amount again in 1945. Some of the parcels had clearly been rifled before their receipt.

This working party was a good example of one performing laborious work under reasonably good conditions, as judged by Japanese standards: even so the incidence of illness was higher than would have been the case had proper anti-malarial precautions been allowed, and had a proper dietary been available for the whole period.

#### WOODLANDS CAMP

Woodlands camp was still in being when the war ended. Most of the work was on petrol storage, and conditions and treatment were on the whole reasonable. Rationing was unsatisfactory, and considerable deficiencies in weight were common with rice and other bulk items. The scale of 600 grammes of rice per man per day was never reached, and there was occasionally an acute shortage. The sole source of salt was from sea water from the Johore Straits. Daily rations were most unsatisfactory, as the Japanese kitchen staff only passed on what they did not want. Medical supplies were very scanty, and mostly could only be bought from a Chinese pharmacist. Rice polishings were readily purchased in the rice factory at Johore Bahru.

After March 1943 it was almost impossible to have a patient transferred to Changi for treatment. One man who had a fractured spine was refused transport to Changi until the medical officer slung him from the roof with borrowed block and tackle and successfully applied plaster. The Japanese two days later consented to send him to Changi where he did well.

#### OTHER WORKING PARTIES

Several working parties were sent out to various places mostly on Singapore Island during the first few months of 1945, and remained at work until hostilities ceased. These were stationed at River Valley Road, Johore Bahru (X.1. and Q parties); Keppel Harbour camp, Jurong Road (X.8. party) and Pasir Panjang (Yokata Tai camp).

Conditions varied in these camps. Some of the work required was heavy, for example tunnelling, digging trenches and making wells. Most of the work was for defensive purposes, and some required the men to work underground with the poor ventilation. Some of the men were still

weakened from their experiences in the working camps in Thailand, and not fit for hard work. Reasonable consideration was sometimes given them, but the rations supplied were inadequate both in calories and in protein for men doing physical work. Hygiene arrangements were usually primitive and unsatisfactory.

Major Stevens, S.M.O. of A.1. hospital reported that a warning was given that recurrences of malaria must be expected; in addition it was recognised by the Japanese that the site was bad and that primary malaria would occur, therefore quinine and nets were issued. In "Q" party quinine was unobtainable by the A.I.F. except by resourceful means from the Japanese hospital. Deficiency diseases were not common, but a few cases of beriberi occurred in some parties, and other *B* complex deficiencies were manifest occasionally. The men in these groups, though affected with the usual diseases of working camps maintained fair health on the whole until relief came: fortunately the period was brief.

Before leaving the subject of medical conditions in the various A.I.F. camps on Singapore Island it should again be observed that the actual and proportional figures for nutritional diseases as seen in the medical units in the Changi area or in Kranji can be misleading because military strengths were constantly changing, and because the men returning there were drawn from areas where there were differences in conditions of diet, work and intercurrent disease. But a perusal of the figures of patients attending the medical inspection rooms and admitted to hospital shows that, while some deficiency diseases were more common and persistent than others, all their clinical forms kept repeating themselves throughout the period. Under the worst conditions severe beriberi and pellagroid states appeared, but lesser manifestations were always to be seen, perhaps not in epidemic form, but yet in a degree of constancy. The so-called "retrobulbar neuritis" was one which demanded particular attention because of its functional importance. At the end of the period there is a clear picture of a body of men, thinned and weakened, only maintained in an unstable equilibrium with difficulty. The last hurdle they had to pass was the final reduction in rations in 1945, and it is probably true that liberation came with a small margin of safety for many of them, in fact only just in time. The A.D.M.S. of the 2nd Australian Prisoner-of-War Reception Group observed that the Changi men looked in worse condition when liberated than those who had experienced some improvement in their diet in the Thailand bases.

The working parties began to return to the central camps by August 18th and on the 19th supplies of Red Cross rations and medical supplies were received.

We now have to leave the story of the camps on Singapore Island and follow the parties who proceeded overseas or up-country, some to exchange one camp area for another, others to a destiny of a very different kind on the Japanese railway that was to link Burma with Thailand.