

CHAPTER 24

CAPTIVITY IN CHANGI

THE depression consequent on capitulation of the forces on Singapore Island, and the spiritual suffering of defeat were to a certain extent offset by the cessation of enemy bombardment which had intensified the difficulties of resisting the pressure of the enemy land troops. The mounting numbers of casualties imposed increasing stress on the medical services, and during the later days of the battle for Singapore some units were combined in order to conserve staffs. It has been already pointed out that the two field ambulances ran a combined M.D.S. and a combined A.D.S., and near their final location in St. Andrew's Cathedral and the neighbouring Adelphi Hotel were accommodated the motor ambulance convoys, the advanced depot medical stores and the field hygiene section. The 2/10th A.G.H. and the convalescent depot during the last phase of the battle were located in the Cathay building. Though the movement to these new combined areas involved toil and some risk, it enabled more efficient service to be given. Uneasiness had been felt for the relatively isolated 2/13th A.G.H., not without cause, as it was feared that the same fate might await some of the staff and patients as befell the British Alexandra Hospital at the hands of the unpredictable Japanese.

MOVEMENT TO THE CHANGI AREA

However, the anxious period immediately following the surrender passed without special incident, and early on the following day 16th February, Brigadier Stringer informed the A.D.M.S., A.I.F. that the Japanese authorities had stated that all sick and wounded were to be removed from the Singapore area to an undisclosed destination. There were in all some 9,000 sick and wounded within the Singapore area, and orders were issued later in the day that these would be moved to concentration camps and barracks in the Changi area, over fifteen miles away in the north-eastern tip of the island. The A.I.F. moved by route march to the Selarang Barracks, Changi, on the 17th February, accompanied by the 2/9th Field Ambulance and the 3rd Advanced Depot Medical Stores. The mobile bacteriological laboratory managed to move early with its own transport and equipment and was soon able to assist in such matters as malarial diagnosis, which had been virtually impossible in the turmoil of the later days of fighting. These medical units set about establishing a camp reception station for the troops, and by noon on 19th February the experienced staff of the 2/9th Field Ambulance had a 270 bed hospital ready in one of the barrack buildings on Selarang Square.

The Japanese staff officer ordering the move set a period of seven days for the movement of patients to Selarang, and would allot only five motor ambulances for the transport of lying sick. Stringer strongly and fearlessly protested against this inadequate arrangement. This protest

produced little effect at first, but permission was eventually granted for lorries parked along the Changi road to be used. No order had been given for the method of transfer of the preliminary medical units, but the taking of field medical equipment was forbidden. Motor transport marked with red crosses was used for this purpose and encountered no interference. Fortunately all the orders of the Japanese medical directorate could not be readily enforced in these early days, and the time taken to move the patients gradually increased to nearly three weeks. During this movement the number of motor vehicles was increased, and the officially allowed ration of petrol augmented by collecting it from tanks of abandoned vehicles. Finally fifty-five ambulances were brought into use, twenty 3-ton trucks, and a car.

Certain essential stores such as dressings and drugs like anti-malarials, were distributed in small parcels among the troops, and the vehicles also carried medical supplies. Precautions were taken that no single officer or man knew the whereabouts of all supplies. In this way supplies were laid by which were found invaluable in the hard days to come. The 2/10th Field Ambulance was transferred to the 2/13th A.G.H. soon after capitulation, as this unit was greatly in need of staff. Glyn White observed from the administrative point of view that the sudden removal of all trained nurses from a large hospital during an emergency reveals the defects in nursing efficiency of the lay staff. Without doubt higher standards of performance in technical medical and surgical procedures are attained in field units, because of the greater experience obtained by their orderlies who, unlike those in hospitals, have no nurses on whom they can rely.

During the brief time available before the general transfer of forces took place, patients in hospital were sorted into national and service categories, and taken over by their own people. The 2/13th A.G.H., still outside the A.I.F. area on the island, continued work during the first week with little interference from the Japanese, and then was moved to Selarang; the increased number of vehicles available allowed the heavy equipment to be taken to the new site. It was fortunate that the Japanese guards did not check the number of vehicles used, and that they overlooked in their search some miscellaneous drugs in the boot of a car; these included sulphapyridine, emetine and atebirin. A quantity of atebirin was afterwards successfully concealed in Changi by laying the black plastic cylinders along a black picture rail in a building, where it was never noticed during the whole period. The problem of fuel supply on this movement was so satisfactorily solved, even by "milking" Japanese vehicles, that after the transfer of all British, Indian and Australian patients 350 gallons of petrol remained. A request that walking patients should be allowed to ride on top of the loaded lorries was granted, so that in the end the only patients who walked to Changi were a few from the 2/10th A.G.H. and the convalescent depot who were then quite fit to march. Moreover, instead of the 250 beds which the Japanese apparently thought sufficient for 2,600 A.I.F. patients, 1,120 hospital beds were taken, and 1,400 mattresses. In addition X-ray equipment and an alter-

nator set were moved to Changi. In all sixty-five 3-ton loads were removed. The A.I.F. movement was thus made early, and was completed on 23rd February. The British medical units began to move the next day, and were in their new sites by 2nd March. This involved the transport of some 4,000 patients and staff and ninety-seven 3-ton loads of equipment. On 3rd March three Indian general hospitals began movement; this too was successfully completed. The British were established in the Roberts Barracks and the Indians in Nee Soon.

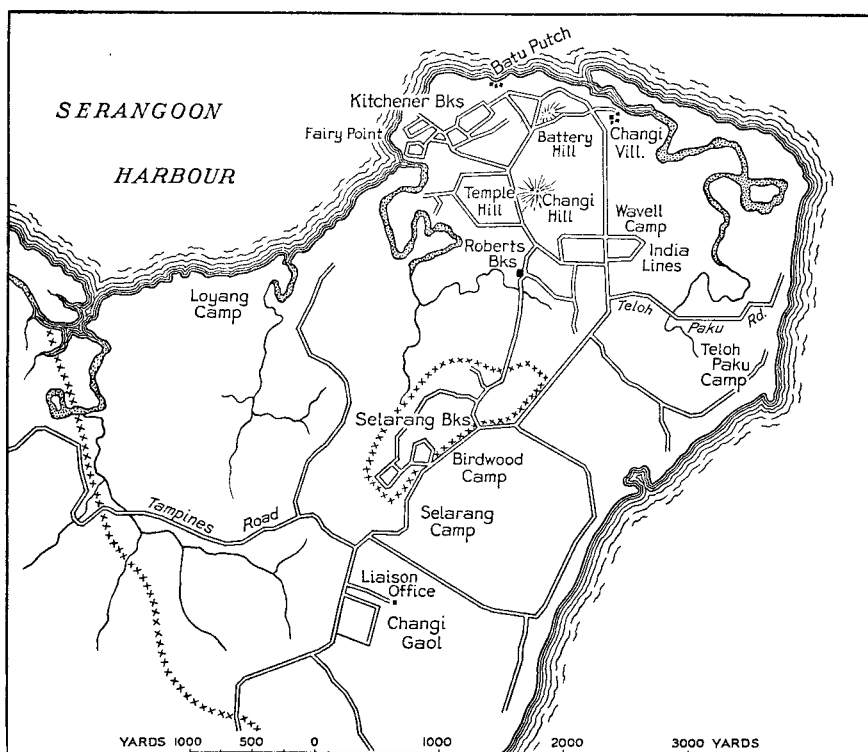
The first fifteen days after the capitulation were of great importance to the whole of the forces involved, and in particular to the medical services. The safe and humane method by which the sick were moved, and the transfer of quantities of invaluable equipment and supplies were owed to the courage and persistence of Brigadier Stringer, and Lieutenant-Colonel Glyn White, to the services of Major R. Dick, commander of the 2/3rd M.A.C. and his officers, and Lieutenant G. C. Middleton, transport officer of the 2/9th Field Ambulance. Their work was reflected in the high morale of the men, and their reward was the well-being of the sick and wounded.

When the A.I.F. arrived in the Changi area the strengths of the medical units were approximately as follows:

	Officers	Other Ranks	Total
2/9th Field Ambulance	15	229	244
2/10th Field Ambulance	17	246	263
2/5th Field Hygiene Section	1	19	20
2/4th C.C.S.	11	96	107
2/2nd M.A.C. Medical Wing	—	12	12
2/3rd M.A.C. Medical Wing	2	19	21
2/10th A.G.H.	30	185	215
2/13th A.G.H.	25	183	208
2/2nd Convalescent Depot	12	85	97
2nd Mobile Bacteriological Laboratory	1	5	6
3rd Advanced Depot Medical Stores	1	3	4
Total	115	1,082	1,197

The Changi Area. The Changi area at the eastern tip of Singapore Island was roughly four miles by three and a half miles in its longest diameters, and about one-third occupied a blunt promontory jutting into the Straits of Singapore. The Selarang area was roughly in the centre, on rising ground, well grassed, with palms and trees, and some rubber. At each side and in the middle the land fell away into irregular ravines. The soil was mostly sand and clay, and to the east and north-west there were swamps. Most of the ravines though not all were well drained, but after rain the subsoil water rose rapidly, and seeped through to the surface on some of the roads and other places. There were obvious potentialities for mosquito breeding.

The barracks could accommodate some 5,000 to 6,000 troops without much overcrowding, but the Australians found that 15,000 men were allotted to the barracks including a hospital of 1,000 beds. There were about sixty buildings, weatherproof and in reasonable condition, but these were quite inadequate. Even with bivouac accommodation of extemporised kind some 3,000 troops could not be sheltered from the weather. One block contained eight times its normal peacetime complement. The convalescent depot was at first accommodated in the adjoining Birdwood Camp, to which the A.I.F. artillery regiments were originally allotted, but these units were also crowded into the Selarang area.



Changi Area.

Early Organisation. Within the areas occupied by prisoners of war the Japanese army left organisation of the medical services entirely to the Malaya Command, and as before, internal arrangements of the A.I.F. medical services remained the responsibility of the A.I.F. command. At first all units in the Selarang area were separate, and each had its own regimental medical officer, until the Japanese altered the arrangements.

On 22nd February 1942 Major-General Callaghan, appointed as G.O.C., A.I.F. after Major-General Gordon Bennett left, appointed Colonel Derham as A.D.M.S., A.I.F., Major B. H. Anderson as



Nurses' quarters, Camp Reception Station 2/4th Casualty
Clearing Station Malaya.

(A.A.N.S.)



A.I.F. ward in Malayan Hospital.

(Sydney Morning Herald)



The 2/4th Casualty Clearing Station, Fraser's Hill, Malaya.

(A.A.N.S.)



A.I.F. nurses returned from Singapore, March 1942.

(Argus)

D.A.D.M.S., A.I.F., and Major C. E. M. Gunther as D.A.D.H., A.I.F. The administrative headquarters now disappeared; Lieut-Colonel J. Glyn White was meanwhile engaged in the evacuation of the medical units and patients from Singapore.

During this early settling down period the brief respite of time, and better conditions of transport obtained from the Japanese were invaluable; among the wounded were many men suffering from dysentery and malaria. When the hospital patients from Singapore arrived considerable difficulties were experienced, as the Japanese refused to allow equipment to precede patients; even in their housing there was often unavoidable delay, which would have been greater had there not been a C.R.S. ready. Rations and cooking materials sometimes went astray and it was necessary to place guards over dumps of foodstuffs. Numbers of patients who were considered well enough to be independent, had to be sent to their units and told to return for treatment as out-patients. The Japanese wished to complete these moves as speedily as possible, but all delays which could possibly be interposed by various manoeuvres were much to the advantage of the British and Australians. Most of the equipment held by the 3rd Advanced Depot Medical Stores was dispersed among other medical units, but certain valuable stores were still held when the unit arrived at Selarang; these included dressings and anaesthetics.

EARLY PROBLEMS AND ACTIVITIES

The first weeks in Selarang were full of difficulties. When the Australians arrived the area was dirty and flies were breeding profusely. Dysentery was already occurring to some extent among troops from Singapore. The area was seweraged, and had possessed an adequate water supply, and three sedimentation tanks. Bombing, shell-fire, sabotage and ill-judged attempts to use the sewerage system without water made it unusable. Deep trench and borehole latrines were constructed, and breeding of flies and mosquitoes was attacked. The hygiene section under Major Gunther did valuable work, particularly through N.C.Os. attached to various units for advice and help. Engineer services also cooperated in technical matters. Education of the troops themselves as usual was not simply accomplished, but lectures, and visual instruction with posters, and the influence of hygiene picquets helped to maintain hygiene discipline.

Water at first caused some anxiety, as the forces could rely on only a few shallow wells dug to supplement outlets from the subsoil drainage. Engineers quickly brought into use twenty-two water carts brought with the troops, and instituted a delivery service of drinking water. Other sources used were a swimming pool in one of the ravines, a Malay school reservoir and two underground storage tanks. This permitted a ration of half a gallon per man per day, increased to one gallon for the hospital; all water was chlorinated. Owing to shortage of petrol the carts were moved by man haulage. Later engineering development will be described in due course. The important bearing of these factors on hygiene will be obvious, for even personal cleanliness was difficult to maintain. Long

queues of dispirited men waited at points where meagre washing and bathing facilities were provided from subsoil overflows. Glyn White described the men on the morning after most of them had arrived in Selarang as follows:

Men exhausted by continuous fighting, and finally a long march to the area, dirty, unshaven, hungry, their fondest dreams shattered with nothing to look forward to—they were the men called on to dig latrines, clean up the area, to clean themselves, and to remember the principles of hygiene.

When these tired men could be rallied to help in the fight against disease dysentery had gained a foothold in the camp and a long struggle was begun for its mastery. Accommodation was severely strained, and fourteen medical inspections rooms were opened by unit medical officers, each holding ten men. These rooms were found most useful, they were of course used only for men with mild illnesses. All patients with dysentery were concentrated in one building and cared for by the 2/13th A.G.H. Washing of patients, linen and utensils raised great problems: the carriage of all water by hand from a source down a valley 200 yards away imposed hardship on the staff. Dressings and sterilisation of instruments caused similar difficulties. Most of the wounds became infected, and profuse suppuration was common: many were fly blown. Weight loss was often extreme in badly wounded men, and gross suppuration, added to deficiency of protein in the diet, increased bodily wasting. An operating theatre and X-ray room were set up in another block, and were the responsibility of the 2/10th A.G.H. staff. As the buildings were of three stories it will be seen that food distribution from outside cookhouses was a laborious procedure. It cannot be said that complete cooperation was always given to the medical services by combatant units, whose members did not understand that their unhappy circumstances increased their personal responsibilities in the fight against disease, which knows no discrimination. Once more greater efficiency was found in self-reliant field units than in the more dependent base units, with their lesser opportunities for gaining knowledge of technical procedures.

Move to Roberts Barracks. It was just at this stage, when the organisation was beginning to run smoothly that the Japanese authorities on 6th March ordered that all sick men in the Changi area were to be concentrated in a central hospital in Roberts Barracks, where the British hospital already occupied some buildings. At a conference with the D.D.M.S. of Malaya Command the A.I.F. medical administrators learnt that this move had to be completed within seven days, and that one hospital was to be founded under unified command. It was at once evident to the Australians that this order could cause administrative difficulties, being contrary to the agreed policy of the A.I.F., that as far as possible Australians should be treated in Australian hospitals under independent administration. At this conference it was decided that the Australian hospitals should set up a single unit at the Roberts Barracks or an Australian section of a combined British and Australian general hospital. Lieut-Colonel J. W. Craven was

appointed to command the hospital area: hygiene and sanitation were administered by Malaya Command. The A.D.M.S., A.I.F., after a further conference with commanders and quartermasters of A.I.F. medical units appointed Colonel D. C. Pigdon of the 2/13th A.G.H. to command the Australian section, with Major A. R. Home of the 2/13th A.G.H. as registrar and Captain E. N. Lee of the 2/4th C.C.S. as quartermaster. Colonel E. R. White of the 2/10th A.G.H. relinquished command for such period as the hospitals remained combined, and acted as organiser of post-graduate medical courses. The staffs of the field ambulances reinforced the staff of the combined hospital, and the 2/4th C.C.S. and 2/3rd M.A.C. moved to the Roberts Barracks with the other units. The D.A.D.M.S. of the hospital area was responsible for the distribution of the pooled ordnance equipment. To lessen strain on the hospital the 2/9th Field Ambulance maintained an out-patient service with special clinics attached.

The move was completed by 11th March 1942 with 3-ton trucks and man-powered trailers supplied by a transport company engaged in work for the Japanese. The patients were of the following categories: surgical 351, dysentery 283, malaria 80, typhus 32 and other medical 176.

In the Roberts Barracks hospital the conditions were described by Brigadier Stringer as appalling. There was gross overcrowding. Each ward held 144 men in the space designed for 60; there was no running water, no arrangements existed for sterilisation, nor was there any lighting except one extemporised oil lamp on each floor, and the sanitation was primitive. Even the dysentery ward had only two or three bed pans. Feeding utensils were few, and there were not enough bed clothes: sometimes patients had to remain on the stretchers. But even in these meagre conditions, with only six orderlies for 144 patients, Pigdon endeavoured to maintain a good standard of nursing, and insisted on regular instruction of orderlies. In this way a nucleus of men with practical training was built up and proved of great value later.

Administrative difficulties. As was expected, administrative difficulties arose. The difference in record systems alone made a separation of the hospital sections necessary: the same applied to pay, rations and discipline. By 24th March there were 2,600 patients in the combined hospital, and a vast amount was still to be done to ensure efficiency. Stringer suggested that Glyn White should fill a position corresponding to that of Lieut-Colonel Neal, I.M.S., in the hospital, with respective control of Australian and British sections, and both acting under Colonel Craven the commander. Derham, however, pointed out that it was more useful to all parties for Glyn White to act as D.A.D.M.S., A.I.F. for the hospital area, since the sectional commander naturally looked to the A.I.F. headquarters which was already responsible for all his needs. This arrangement was adopted, but it did not work well in all ways, as the system of divided control made it very difficult to obtain outside help and cooperation in matters of construction or alteration.

Difficulties arose too with the allotment of buildings; independence of tenure was not practicable, and complete pooling of stores was undesirable. By the end of April General Callaghan thought that the whole question should be re-opened, since the experience of two months showed that the arrangement did not work satisfactorily. In effect, the A.I.F. command held that an outward appearance of conformity to the Japanese order for a combined hospital was all that was necessary, and that the Australian general hospital should retain independent identity with responsibility to its own command. Stringer, in reply, held that all matters of difference were minor, and that the general good was to be aimed at, regardless whether it affected British or Australians. Friendly conferences were held between the parties, and it was agreed that without doubt the Japanese looked to the D.D.M.S. Malaya Command as the responsible medical authority. It was recognised too that the cause of economy would not be served by sundering the overall control of the combined hospital. The A.I.F. officers still felt the difficulty of serving two masters, and could not relinquish their basic responsibility to their own administration. Derham suggested that if these broad principles were accepted there was no reason why future difficulties could not be adjusted in the spirit of cooperation and friendship. Difficulties did recur, such as those of accommodation, and adjustments of amenities pay within the hospital, but these were settled. It was agreed too that if moves were contemplated, this would be by policy of the command and fully discussed with A.I.F. headquarters. Intermittent discussion of difficult points continued until a stable arrangement was reached.

Conditions in the Changi area. During the early months of life in the Changi area an orderly military life was maintained. Movements of troops in and out of Changi had been going on for some time: these will be described presently. For a time at least the senior officers were permitted to be with their men and to encourage the cohesion of a united force.

General Percival was in charge of Malaya Command, which controlled four formations, one being the A.I.F.; each of these had a distinct enclosed area. This command received all orders from the Japanese command. Major-General Callaghan maintained a normal headquarters staff for the administration of the A.I.F. War diaries were kept by units with the usual administrative records, and were later buried in sealed containers in a safe place whence they were finally recovered. Training was continued as far as possible, discipline was maintained and several ceremonial parades were held. Technical courses and education classes were begun, entertainments were given by various units, and a concert party was formed. Officers' rank badges were removed by order of the Japanese, and a single star on the left breast was worn by all officers. Rations will be described in a separate section. Red Cross amenities were to some extent available at first but the Japanese were not cooperative, and would not allow International Red Cross representatives to visit the camps. Three truck loads of rescued Red Cross stores were taken to Changi with

the equipment of the hospitals, and some supplements purchased, but in April the Japanese refused to allow the Red Cross representative to go to Singapore except with special authority. Little of value could be bought, and that mostly by stealth from a Chinese outside the camp area. Arrangements for mail were made, but again the Japanese were not cooperative. During June 1942, postcards for home were written by all prisoners of war, but over the whole war period an average of only one letter per man per year reached Australia.

The Question of Repatriation

In April 1942 Malaya Command raised the question of repatriation of medical and surgical patients who would not be able to serve again in the war. Stringer asked the medical authorities of the other commands to prepare such lists for submission to the representatives of the Japanese Army. A list of 129 patients from the A.I.F. suitable for repatriation was sent to Stringer who made application through Malaya Command on 11th May 1942. In June a further request was proposed by three senior medical officers, that in addition to medical personnel who would be sent with repatriated sick and wounded, if their return was approved, members of the medical services should also be returned who were surplus to local requirements. They pointed out that there were two fully staffed hospitals with a virtual excess of specialists. They further considered that personal application was in order on this matter, in view of the fact that Britain and Australia had both been signatories on 27th July 1929 at Geneva to an International Convention for the amelioration of the condition of the wounded and sick by armies in the field. However, Derham pointed out that from the legal point of view the application was invalid, since Japan would not ratify the Convention relating to treatment of prisoners of war. He further thought that under the peculiar conditions of Malaya it was doubtful if there would be surplus medical personnel, and likewise doubted the wisdom of the proposal. A conference was held with representatives of A.I.F. Command in Malaya; it was pointed out by Colonel W. S. Kent Hughes representing the A.I.F. commander, that examination of the probable requirements of medical staff in the event of extension of the sickness rate showed that there would not be a surplus, rather a deficit. The A.I.F. commander therefore reached the conclusion that the correct action was to continue to importune for the return of invalids, but this request was not granted by the Japanese. Stringer finally pointed out that he had petitioned the Japanese in various ways to secure this humanitarian measure, but feelingly admitted complete failure.

SENIOR OFFICERS SENT TO JAPAN

In anticipation of his departure with other senior officers from Singapore the G.O.C., A.I.F. in Malaya on 21st July 1942, appointed Lieut-Colonel F. G. Galleghan to administer command and to assume command after he had left the area. All officers over the rank of lieut-colonel were included in the party which left for Japan on the 16th August. This move

followed the expected action by which the senior administrative officers are taken from their men when they are in the hands of the enemy. The A.I.F. medical personnel included in this Japan party were Colonels A. P. Derham, E. R. White and D. C. Pigdon, Captains D. J. Brennan and P. N. O'Donnell acting as R.M.Os. and eight other ranks. General administration was in no essential altered. A firm combined front was presented to the Japanese in all joint matters, while the A.I.F. command continued to keep its autonomy in matters of individual significance which did not affect Japanese administration over the camps as a whole. Good relations and full cooperation were maintained between Malaya Command and the A.I.F. command. This applied also to the medical corps. When Brigadier Stringer left Changi Lieut-Colonel W. L. Neal took over the duties of D.D.M.S. of the Malaya Command. Lieut-Colonel H. F. Summons was at first appointed as A.D.M.S., A.I.F. and to command the A.G.H., but after discussion with Lieut-Colonel Galleghan he remained S.M.O., A.I.F. and commanded the A.G.H. in the Roberts Hospital, while Lieut-Colonel J. Glyn White carried on the duties of the A.D.M.S., A.I.F.

Changes in hospital administration. The changes incident upon the departure of the senior officers re-opened the problems of the combined hospital in Roberts Barracks, where difficulties still existed in some important details of administration. A conference was called by Neal and at this a clear understanding was reached and ratified. This provided that the commander of the Changi hospital area should allot accommodation between the British and Australian sections and that British and Australian sections of the hospital draw their own rations, and be responsible for accounting to the Malaya headquarters, except for supplementary items, for which the commanders of each section were responsible to their own headquarters. The A.G.H. dealt only with A.I.F. in the matter of clothing, but all other "Q" matters were adjusted through Malaya Command, and engineering services were a responsibility of the British command unless Australian help was required. This arrangement proved much more satisfactory, and maintained the independence of the A.I.F. medical services in essential respects.

This period marked the close of an epoch. The statement that general administration went on as before indicates that the tradition of leadership was handed on. Some of the anxieties immediately incident on the capitulation were blunted, but the dazed incredulity of a new and unreal life was replaced by a perception of the future as an incessant struggle; a struggle against illness, disease and death, against hunger and the weakness of malnutrition, and against both crude and subtle yet endless attacks on morale. The pettiness and unreasonableness of restrictions and irritating regulations, the saluting of Japanese and Indian guards, the harshness even amounting to brutality, these were trials which had to be borne without loss of spirit. On the administrative officers fell the endless and too often fruitless task of protesting against privations and injustice, in

an effort to better the conditions of the men. This moral fight against the Japanese was well exemplified in the incident now to be described.

THE SELARANG BARRACK SQUARE INCIDENT

On 30th August 1942 all area commanders were ordered to meet Japanese representatives because of attempts to escape by the men in the Changi area. The matter had been brought to a head by the capture of two British and two Australian soldiers who had been trying to escape. The A.I.F. men were recaptured on Banka Island and were very ill when brought back to Changi. A demand was then made that all troops should sign the following undertaking:

I, the undersigned, hereby solemnly swear on my honour that I will not, under any circumstances, attempt to escape.

All the area commanders refused this on principle. On 1st September the Japanese army representatives informed Colonel Holmes, administering Malaya Command, that all who refused to sign this undertaking would be subjected to "measures of severity" and would be transferred to a smaller area. Not long after midnight orders were received by Malaya Command for all British and Australian forces in the area to be moved to the Selarang Barrack Square. As all troops in the Changi area had been given the opportunity to sign and all had refused, arrangements were made for the transfer. The A.I.F. command agreed entirely with the decision to refuse signature.

The barracks square concentration area had an overall size of 800 x 400 feet; on this were seven barrack blocks each of three floors, each of which had a total floor space of 150 x 60 feet. In this area were to be confined 13,350 British and 2,050 Australian troops, a total of 15,400. The combined hospital remained at Roberts Barracks, and the Australian convalescent depot which was at Selarang, held 235 convalescents out of a total of 331 men. Of these 104 were unfit for any duty and 78 had a limb amputated or were severely incapacitated.

It was evident that the most important problems concerned in the herding of so many men into so restricted an area were medical. At A.I.F. headquarters arrangements were made for the shifting of stores of different kinds, and in particular for the provision of adequate hygiene, which was non-existent. Organisation for the move began at 4 a.m., and by 9 a.m. the necessary work of making trench and bore-hole latrines on the tarred barrack square began. There were only three water points in the whole area. At first it was thought that kitchens placed off the road could be used, but the Japanese insisted that they should be brought within the area. In the afternoon of 2nd September the four soldiers who had tried to escape were executed by the Japanese; all formation commanders were required to witness the execution.

By evening all details of the move to Selarang were completed. The troops had taken rations with them, but none had been received from the Japanese for two days. The presence of the convalescent depot was

helpful, as this unit had received 360 lbs. of meat and a large quantity of vegetables from a working party which drew supplies from other areas on Singapore Island. This was very useful for feeding the convalescents, who represented some 70 per cent of men in Changi. The A.I.F. commander congratulated the troops on their excellent spirit, and advised them not to show resentment, and to refrain from any provocative acts and in particular not to attempt to escape, which could only lead to reprisals. That evening Lieut-Colonel Okayama addressed all senior officers and advised them to persuade their men to sign the undertaking, but the British commander asked permission to explain in writing their point of view.

On 3rd September the priority of sanitation projects was recognised as paramount. The area available to each man was less than 4 square yards, much of which was taken up by kitchens, and shelters, and would be daily encroached on by latrines. The A.I.F. had the task of digging six pits 16 feet deep and two pits 6 feet deep in the square, which was already densely crowded. Water was rationed to a gallon a day. At a further conference the Japanese commander ordered the troops to sign the form, under the threat of having their rations halved. A party sent to collect rations was warned that the ration would be cut to one-third. The position was now becoming more serious. Temporary accommodation for sick was provided, and sick parades were held, but the Japanese would allow only patients with dysentery or diphtheria to be sent to the Roberts Hospital. Colonel Neal expected that 400 cases of illness would occur within the next few days, and up to 1,000 in the next week, whereas the general hospital could take only 300 more patients. Dysentery and diphtheria were already occurring. The A.I.F. commander placed the joint views of all commanders before his senior officers, advising them to sign the declaration under duress, recognising that it was the duty of the whole force to stand united, and to conserve itself as a force instead of exposing the men to serious losses by illness. The officers were in entire agreement with this decision, the men were in good spirit, and that evening the A.I.F. concert party gave a performance in the square.

On the 4th, efforts were made to induce the Japanese to accept a compromise declaration admitting duress. The Japanese refused amendments, but eventually agreed to replace the original order for concentration by one demanding signature of the declaration. This face-saving manoeuvre of the Japanese was regarded by the British force as a moral victory. Galleghan addressed his troops, and in congratulating them on their firm stand and admirable A.I.F. spirit, advised them to sign. This decision was reinforced by the medical appreciation of the situation made by Glyn White earlier in the day. He pointed out the dangerous sanitary position, the meagre water supply, allowing them no washing of clothes and limited ablutions, and the risk of infections arising in the cramped cookhouses. Review of hospital admissions since capitulation was far from good, and evidence of nutritional deficiency diseases were appearing. Diphtheria was increasing, and already some 300 contacts were in the

area. In a few days he expected serious epidemics to begin, with a high accompanying mortality: medical supplies would be exhausted in ten days, and Roberts Hospital would soon be unable to cope with admissions.

On 5th September all forms of declaration were completed, and by direction of Galleghan the force, when allowed to resume its previous location moved as a disciplined body, showing neither enthusiasm nor resentment. Arrangements were made to clean up the area and to take all precautions against the spreading of infection. So ended an episode which consolidated the force in resolve and amity, and enabled Colonel Holmes as British commander in Changi to "look to all ranks to continue in good heart, discipline and morale".

HOSPITAL WORK

As soon as the forces moved to the Changi area both preventive and curative medicine assumed the greatest importance. The magnitude of the obvious task of the medical services, that of curing the sick was subject to more than usual fluctuations. These were owing in the first place to the number of casualties from combat and disease that represented a legacy from the Singapore battle. Next there was a rise in illness due to infective and nutritional causes, arising within the concentration area itself. This varied from time to time, partly owing to the upsurge and subsidence of ordinary prevalent or epidemic diseases, some of which was preventible. During the first few months the commonest diseases in Changi were disorders of the skin, dysentery, other digestive troubles, and to a lesser extent respiratory diseases. Typhus, and malaria mostly contracted before capitulation, were also seen in hospital, and diphtheria appeared, though in fewer numbers in the A.I.F. than in the British force. Another reason for rise and fall in illness was related to the nutrition of the men; malnutrition was a constant menace throughout the whole force, and varied in degree with the ration supplied and the supplements that could be procured or devised. Finally the amount and to some extent the type of illness occurring in Changi depended upon the military population itself, which fluctuated considerably. In March the Japanese began to send out working parties into different parts of Singapore Island and the neighbouring mainland, and in May a series of oversea and up-country working forces was sent away. These varied in size from small parties to large forces of several thousand. Some returned after a time; others, bound for more distant destinations, found terminals elsewhere and never returned. Their coming and going, and for a time also, the arrival of parties from the Netherlands East Indies where they had been taken prisoner not only produced temporary swings in the local population, but also caused variations in the local sick rates.

In order to lessen the strain on the A.G.H. medical attention outside the hospital wards was well organised. When the A.G.H. moved to the Roberts Barracks the 2/9th Field Ambulance set up a classification centre, and thus controlled the admission of patients to hospital. The movement of patients was carried out by motor ambulance, and for this service the

stocks of fuel obtained during the move to Selarang were invaluable, since none was supplied by the Japanese till June. Even then supplies were fitful and meagre. All fuel was scarce; it could not be spared even for lighting the hospital wards at night and to make medical attention possible after dark poor substitutes such as malarial were sometimes used in lamps, for there was no other source of light. Economy in the routine use of motor fuel in ambulances was so pressing that man-drawn trailers were sometimes used, and as far as possible patients were not discharged from hospital unless they could walk reasonably well. Medical inspection rooms were found valuable. Their number depended on the number of troops in the area, and during the early period before working parties moved off, the provision of twelve to fifteen beds for cases of mild illness was most helpful. Later they became aid posts, and when the prophylactic treatment of deficiency disease was organised, these posts served a useful purpose in distributing yeast, "marmite" or rice polishings. So as to distribute work and experience evenly among the medical officers, especially when they were liable to movement with the working parties, officers working in aid posts were exchanged with others in the hospital.

From these activities developed out-patient clinics at which A.I.F. troops were treated, and also from time to time, British and Dutch troops quartered in the area. A surgical clinic under the care of a succession of medical officers attended men with minor disabilities, and here too minor operations were performed. A number of special clinics were also formed, not all at the same time, but in response to particular needs. Clinics for the diagnosis and treatment of special diseases included ear, nose and throat, eye and skin departments.

Preventive Medicine in Changi. The early start of practical hygiene in the Changi area has been already mentioned; Major C. E. M. Gunther, with previous tropical experience, was well equipped to set and maintain a high level of work. Much labour and time were saved by the adoption of standard methods suited to the circumstances. The success of measures adopted during the few anxious days of the Selarang Barrack incident showed the value of standardisation. All hygiene work was carried out under the supervision of members of the field hygiene section, and regularly inspected by the D.A.D.H. and A.D.M.S. of the A.I.F.

The most important measures were those directed to the control of dysentery and similar diseases and of malaria. Lieut-Colonel J. H. Strahan, R.A.M.C. commander of the 6th British Malaria Field Laboratory, directed the anti-malarial work, which began within the perimeter. Many bomb craters were filled, and the areas oiled where water collected in marshy ground and in seepages. In April the Japanese permitted working squads to go beyond the barbed wire, and A.I.F. troops filled in craters, cut drains and oiled all possible breeding places for a belt over three-quarters of a mile around the A.I.F. perimeter. Gunther reported at this stage that within the camp there was no evidence of breeding of

Anopheles maculatus, the significant vector, but that outside the wire there was at least one dangerous area.

Instructions were circulated to all medical officers concerning treatment, which was with quinine and plasmoquine for primary cases and atabrin for relapses. Atabrin was recommended for suppression for all patients with relapses or showing debility; the dosage was 0.2 gramme, two days a week for three months. This recommendation was made by a sub-committee on malaria appointed by the A.D.M.S. Five months later the Civil Health Department was reconstituted and took over this outside work, and for over six months maintained this work with coolie labour. A certain amount of work inside the perimeter was also undertaken, and while this was done the malaria rate was kept at a reasonably low level. Up to early in April only seven primary cases had occurred in Changi.

Water supply received much attention from the engineering services. A great improvement resulted when underground tanks were linked with low pressure mains from Singapore, and lines were laid which enabled water to be pumped to points where it was to hand for cooking or drinking. Towards the close of 1942 the engineers brought the high pressure system into use, and by intermittent pumping managed to assure an adequate supply through the pipe-lines. Water was delivered by water carts; that used for drinking was chlorinated, but not that used for cooking. For ablution hand pump showers were constructed in which subsoil water was used. Chlorination was no longer necessary in the A.I.F. area when the Singapore water supply was first restored, but daily tests were carried out to ensure purity of the water. However, in November 1942 the supply of chemicals used for mass purification in Singapore failed, and chlorination for drinking water was resumed.

Sanitation, as has been already described, was perforce achieved by the construction of latrines. When the water supply was improved late in 1942 it was planned to restore the water sewerage system, but technicians capable of carrying out the work were not available, and the project was deferred. Its further developments belong to a later period.

Medical conditions. Of the 571 patients in medical wards on 10th March 283 had dysentery, 80 malaria and 32 typhus. Malaria patients fluctuated in numbers between 50 and 100 for a time, but the numbers declined during the year, as precautions improved. While this applied to the patients from the Changi area others were seen from other camps where the facilities for prevention were often limited. One man died from blackwater fever, the first malarial death in two years.

Dysentery infections rapidly increased in numbers, which reached 469 at its peak on 22nd March. This was proved to be due to a true epidemic incidence, for the numbers lessened again and by the early days of April had fallen to 169. This resulted from improvements in local hygiene, and nursing care given under very difficult conditions must also be given credit. The death rate in this epidemic was 0.8 per cent: three of the deaths occurred in one small severe series. Chronic states were seen in

some men, but special dietetic care and thorough observation by regular sigmoidoscopy by Major Hunt saved many patients from prolonged illness; microscopic proof was necessary before treatment of amoebic infections was begun because emetine was very scarce. Later when more supplies arrived greater latitude was possible. Stovarsol was later available too and gave good results. The treatment of bacillary dysentery at first depended chiefly on general measures, but in October a small supply of sulphaguanidine arrived. This could be used for only about twenty severely ill men; the results were very satisfactory. It was observed that some of the Dutch arriving from Java suffered from a severe type of dysentery; in fact, another epidemic wave occurred, though the rate among the A.I.F. remained low.

Dengue fever had already been experienced in the force during 1941, when an epidemic occurred; this was repeated in 1942. Sporadic cases appeared early in the year and by May an epidemic was in full force, characterised by well marked rashes. The peak was reached in July, after which it rapidly subsided.

Diphtheria needed some care, especially when of the cutaneous type, which was sometimes associated with other conditions, such as scrotal dermatitis. Over 100 cases of all varieties were seen, with two deaths. Antitoxic serum was very scarce and hard to get. Peripheral neuritis was a not uncommon sequel, but no other complications were seen. British and Australian patients were isolated together. No search was made for carriers for no measures of value could have been taken had they been found. The so-called benign lymphocytic meningitis appeared in small numbers, but three deaths among twelve patients occurred in a period of a few months.

NUTRITION

Deficiency diseases were always present and measures were taken to investigate their nature and onset. Alimentary disease was not common. Functional dyspepsias related to stress were not seen, but peptic ulcer became steadily more frequent. During the early phase of concentration at Changi five cases of ruptured peptic ulcer were seen; all these men recovered after operation. The difficulties of treating peptic ulcer in so unfavourable an environment will be evident. It is interesting that the occurrence of what the patients described as "black-outs" replaced the older symptoms of neuro-circulatory asthenia as seen in 1914-1918. The same was observed in the Middle East. Respiratory diseases became more frequent, including bronchitis and asthma. No pulmonary tuberculosis was seen in 1942: the first case came to light in January 1943. Skin disease provided a good deal of work. Some severe toxic dermatoses appeared, and environmental factors were also responsible for some skin disturbances, rendering some men unfit for prolonged exposure to the sun. Tinea was also troublesome. Mental disease was rare; only seven cases occurred: one man died of organic nervous disease, *pachymeningitis haemorrhagica interna*, five others were returned to their units.

In March 1942 the G.O.C. Malaya warned the representatives of the Japanese Army that a balanced and sufficient diet was essential, especially if the men were required to work. He pointed out that the inadequacy of the Japanese ration was proved in the Russo-Japanese war, and requested that supplements be issued. Burgess and others informed Stringer that the substances required were rice polishings, ground nuts, soya bean, dhal and yeast. Rice polishings had the drawback of becoming rancid after prolonged keeping, and brewer's yeast might present difficulties in manufacture. Baker's yeast had only one-tenth of the vitamin value of brewer's yeast, a quarter ounce of which in the dried form would supply a man's daily needs. Fat was obtainable as a vegetable oil, such as red palm oil or oil from ground nuts, which had other nutritive value in addition. Green leaves could supply vitamins *A* and *C*, if given in quantities of 2 ounces daily.

From April onwards energetic steps were taken to provide supplementary vitamins for the diet. The first case of beriberi was officially notified on 20th April, but before this date two sudden deaths had occurred from cardiac failure of obscure origin. On 28th April a third occurred and no doubt was then entertained as to the cause. This sudden cardiac death was known to the Japanese as *shoshin*, and was regarded as a manifestation of cardiac beriberi. Whether this retrospective diagnosis was justified or not might be questioned, since no further deaths occurred in this series, though similar cases were encountered later usually under much worse circumstances. It was certainly significant that two of the subjects were men in their third decade of life, apparently in good health. Clinical beriberi was recognised in its more familiar forms during the next few months, followed by scrotal dermatitis, glossitis and stomatitis, painful feet, spastic paralysis, granular cornea, and amblyopia. By the end of 1942 all these varieties of deficiency disease impressed their clinical syndromes on the medical officers in Changi.

After the appointment of a research officer to the A.I.F., Captain Woodruff, a standard method of record was adopted. A scheme of classification was drawn up as follows:

- | | |
|----------------------------|-----------------------------------|
| A Burning hands | (b) glossitis |
| B Painful feet | (c) lesions of buccal mucosa |
| C1 Encephalopathy | (d) palatal erythema |
| C2 Spastic paraplegia | F1 Scrotal dermatitis |
| C3 Peripheral neuritis | F2 Pellagroid lesions of the skin |
| D1 Cardiac beriberi | F3 Tropical ulcers |
| D2 Nutritional oedema | G1 Keratitis |
| E Stomatitis and glossitis | G2 Deficiency amblyopia |
| (a) angular glossitis | |

In addition to the presenting signs detailed above it was necessary for investigation to show that the condition was due at least in part to dietetic deficiency of some kind. It will be observed that the classification had an anatomical basis and aimed at avoiding assumptions as to the cause of

the lesions. Chronological numbers were allotted on the basis of date of admission or date of onset if known. All other usual details were recorded for each patient. The method permitted a reasonably accurate statistical analysis, though there were the usual drawbacks, such as lack of relevant detail in the history and record. A special *pro forma* was adopted in place of the usual I 1220. A follow-up clinic was also instituted.

Some interesting conclusions were reached. Battle injuries, malaria and dysentery did not appear to predispose to deficiency disease. Certain states showed grouping, such as the beriberi group, and the syndromes believed to be related to deficiency of the vitamin *B2* complex. There was a significant association between peripheral neuritis, "nutritional oedema" and cardiac beriberi. Few conclusions could be reached about duration, by reason of the impossibility of determining completeness of cure in some syndromes particularly those affecting the nervous system. For the present it is sufficient to indicate the approach to the problem which laid emphasis on prevention and cure, but also strove to observe due economy with precious materials. As in every area where significant malnutrition became manifest the clinical features were studied with great care and full accounts were written and hidden until the day of liberation.

Ration Scales. Food was the dominant consideration in the maintenance of health and strength of body in the Changi area. Fortunately a number of experts on nutrition were with the British and Australian forces, assuring the ready availability of a great amount of information concerning the dietary aspects of life in Malaya, and the nutritional value of local foodstuffs. The medical services in Changi also possessed a sufficiency of scientific and medical literature on malnutrition, which was of great value. For example one article in a Malayan journal was illuminating, as it described the clinical syndromes observed locally. The medical units included in their staffs a number of highly trained physicians who were interested in nutritional disease, even though they had not had previous opportunity of witnessing the mass effects of malnutrition on a population; they devoted continual study to these aspects, and in particular to the epidemic incidence of specific clinical syndromes. In the first few days at Changi all foodstuffs except medical comforts were pooled. The ration issue consisted chiefly of tinned meat or herrings, condensed milk and biscuits. After this early period more regular rationing was arranged, and the necessary supplementation of the insufficient rations provided by the Japanese became an individual problem for the respective components of the force.

A committee on rations was appointed for the A.I.F. on 1st March 1942. This committee reported that at that stage the food supply received from the Japanese which then contained no meat, was deficient in protein and fat and yielded only 2,050 Calories. The Army Service Corps then held limited stocks of tinned meat, and a small quantity of tinned fruit and jam.

The standard ration scale approved by the Japanese yielded 2,296 Calories, made up of 462 grammes of carbohydrates, (derived chiefly from rice), 66 grammes of protein and 20 grammes of fat. The Australian Army ration gave 488 grammes of carbohydrates, 175 grammes of protein, and 170 grammes of fat, totalling 4,220 Calories.

The committee pointed out that in order to maintain health and permit a reasonable amount of work, a diet of 2,800 to 3,000 Calories was necessary. At the time there was no certainty that the amounts and proportions of foods laid down even in the Japanese scale were actually being supplied. Doubt was further felt whether the quantity of protein in this scale would be supplied. The committee recommended that honey and golden syrup be supplied to help the men to eat their rice, and also dried fruits and meat extracts. Changes occurred in this official scale from time to time, usually in the direction of increasing meagreness.

During these early weeks of captivity, the technical advisers on nutrition to the British force were also active, and Strahan, Burgess and others drew up statements for transmission to the Japanese by the D.D.M.S., setting forth the grave deficiencies of the diet and urging that supplements be made to ensure basic requirements. Before Brigadier Stringer left for Japan he appointed a nutritional advisory committee, which contained an Australian representative, but long before this the influence of its members was felt. Burgess of the British 1st Malaria Field Laboratory was particularly helpful to the A.I.F. medical services: his experience and knowledge in nutrition were always freely available. On 10th March Derham drew up a statement on the Japanese dietary and sent this to the D.D.M.S. and G.O.C. of Malaya Command. He emphasised the need for adding at least 50 grammes of protein per day to the ration, and pointed out that deficiency disease would attack and seriously affect the forces unless an adequate ration was provided. Lieut-Colonels W. C. B. Harvey and W. A. Bye, Major Bruce Hunt and officers of the medical division of the combined hospital also drew up detailed statements of the basic requirements of a diet, with particulars of the sources and functions of the chief constituents. From the very first the great risk of serious malnutrition was clearly realised by the medical services in Changi, and close study was made by the physicians of the initial signs of dietary disorders as well as the developed clinical syndromes. The forecast was made that unless substantial appropriate additions were made serious manifestations of deficiency diseases would quickly appear, beginning with beriberi, owing to the limited capacity of the body to store thiamin. The importance of avoiding an excess of carbohydrate in relation to thiamin in a dietary was realised by the dietetic and medical advisers of the force. Some of the "eat your rice" campaigns went too far in the other direction, and Glyn White recognised from the administrative angle the importance of not increasing the carbohydrate unduly when thiamin was seriously lacking. The early onset of the thiamin and riboflavin groups of deficiency was expected; only too soon was this prophecy fulfilled. At this stage it is interesting to compare the nutritional value of the rations actually supplied

1. TABLE OF FOOD ITEMS ACTUALLY SUPPLIED BY THE JAPANESE

	Carbohydrate	Protein	Fat	Calories		Minerals			Vitamins				
						Calcium	Phosphorus	Vit. A	Vit. B ₁	Vit. C	Riboflavin	Nicotinic	Thiamin
								I.	Micro	Milli	Milli	Milli	N.F.C.
Normal Requirements	gms	gms	gms	Total	N.F.C.	gms	gms	Units	gms	gms	gms	gms	Ratio
		100	100	3400		.75	.75	3000	1000	30	1.5-1.8	15	Should be over .3
1942													
March	418	49	21	2119	1915	.236	1.010	3785	372.9	1.2	.769	6.0	.196
April	428	43	16	2088	1936	.162	.850	302	372.9	0.2	.694	5.78	.194
May	458	47	18	2554	2076	.127	1.002	231	564.3	2.5	.879	7.625	.273
June	460	53	22	2310	2103	.190	1.103	2324	719.4	18.7	1.191	8.23	.345
July	525	49	19	2358	2181	.156	.940	2330	504.9	17.6	1.045	7.25	.235
August	525	47	18	2519	2345	.239	1.211	2402	481.8	18.7	.924	6.69	.205
September	499	53	18	2441	2265	.227	1.146	3805	464	35.6	1.12	7.75	.205
October	445	36	21	2170	1975	.138	.724	1946	421	35.6	1.069	6.54	.213
November	432	35	23	2134	1970	.112	.630	721	392	31.7	.981	6.08	.200
December	451	35	32	2291	1997	.136	.783	817	443	39	1.092	6.19	.22
1943													
January	485	37	21	2335	2141	.235	.849	4618	492	62	.942	5.11	.23
February	478	37	23	2332	2108	.197	.825	3184	426	56	.911	5.12	.20
March	436	32	22	2120	1920	.139	.763	1209	406	54	.840	4.74	.21
April	431	33	21	2100	1907	.129	.687	917	370	50	.837	4.48	.19
May	397	31	24	1982	1758	.127	.697	1251	363	30	.640	5.150	.20
June	322	32	22	2065	1864	.137	.753	570	387	21.7	.817	4.607	.21
July	398	32	8	1834	1759	.109	.731	88	318	12	.606	4.470	.17
August	444	37	36	2311	1975	.169	.934	200	456	61	.994	5.816	.23

2. TABLE OF FOOD ITEMS ACTUALLY SUPPLIED BY A.I.F. SUPPLY DEPOT

	Carbohydrate	Protein	Fat	Calories		Minerals		Vitamins					Thiamin
						Calcium	Phosphorus	Vit. A	Vit. B ₁	Vit. C	Riboflavin	Nicotinic	
						gms	gms	I. Units	Micro gms	Milli gms	Milli gms	Milli gms	
Normal Requirements		100	100	3400		.75	.75	3000	1000	30	1.5-1.8	15	Should be over .3
1942													
March	418	49	21	2119	1915	.236	1.010	3785	372.9	1.2	.769	6.0	.196
April	428	43	16	2088	1936	.162	.850	302	372.9	0.2	.694	5.78	.194
May	458	47	18	2554	2076	.127	1.002	231	564.3	2.5	.879	7.625	.273
June	460	53	22	2310	2103	.190	1.103	2324	719.4	18.7	1.191	8.23	.345
July	525	49	19	2358	2181	.156	.940	2330	504.9	17.6	1.045	7.25	.235
August	525	47	18	2519	2345	.239	1.211	2402	481.8	18.7	.924	6.69	.205
September	501	57	19	2474	2289	.241	1.296	3805	618.0	35.6	1.164	10.27	.270
October	536	86	51	3030	2551	.508	1.740	3536	1221	78	2.096	21.33	.479
November	526	85	54	3024	2554	.518	1.751	2311	1343	74	2.036	24.37	.53
December	491	69	48	2771	2312	.256	1.074	1738	1206	76	1.693	19.27	.52
1943													
January	489	40	27	2413	2163	.250	.979	4618	596	63	1.078	5.82	.27
February	489	43	47	2429	2177	.262	1.335	3184	840	56	1.131	7.423	.39
March	456	49	33	2365	2068	.422	1.279	1231	1139	55	1.298	16.50	.55
April	473	58	33	2511	2177	.476	1.515	1032	1323	50	1.718	20.01	.61
May	471	85	61	2863	2277	.251	2.419	4468	1545	52	1.860	22.748	.68
June	532	103	48	3053	2590	.942	2.384	3807	1668	64	2.354	22.652	.64
July	513	95	16	2631	2486	.645	2.346	88	1346	46.8	2.276	20.698	.58
August	545	86	49	3056	2596	.864	2.192	545	1363	88	2.620	17.486	.53

3. TABLE OF INCIDENCE RATES OF MALNUTRITION

Month	Beriberi	Scrotal Dermatitis	Stomatitis Glossitis	Painful Feet	Keratitis	Retrolbulbar Neuritis	Spastic Paraplegia	Pellagra
1942								
March	3	—	—	—	—	—	—	—
April	26	—	3	—	—	—	—	—
May	63	3	2	4	—	—	—	—
June	61	5	4	1	—	—	—	—
July	50	16	1	5	—	—	—	—
August	121	111	47	100	29	3	1	4
September	31	81	63	89	58	17	1	1
October	23	93	72	143	118	60	3	4
November	24	22	11	101	48	49	—	—
December	9	29	23	26	35	58	1	1
1943								
January	4	101	183	69	146	215	—	—
February	4	65	169	28	49	167	—	1
March	9	56	139	32	47	120	—	1
April	6	60	92	29	53	119	—	—
May	4	26	31	41	52	189	—	—
June	2	20	4	3	7	25	—	—
July	5	7	7	5	7	28	—	—
August	—	3	2	6	4	11	—	—

by the Japanese for the period March 1942 to August 1943, with that of the somewhat augmented diet issued by the A.I.F. supply depot.

It will be noted that the total Calories never substantially exceeded 2,500 during the period March to December 1942, and, that the thiamin/non-fat calorie ratio was almost persistently about 0.2. This last deficiency in the diet was of serious significance, as this ratio should never fall below 0.3 for minimum requirements. With this figure so constantly low, it will be seen that the men were between the dangers of a starvation ration and those of a ration perhaps containing more carbohydrate in the form of rice, but without a proportionate amount of thiamin, thus likely to precipitate beriberi. Supplements to diets were made by the various units out of regimental messing funds, which were formed from deduction of six days' pay from all ranks, the spending being judiciously done from canteens by messing officers.

Notwithstanding efforts to improve the diet, malnutrition occurred. Table No. 3 shows the order and frequency of the various clinical forms as they appeared in Changi. It will be seen that beriberi and lesions of the skin and mucous membrane due to lack of elements of the vitamin *B* complex other than thiamin soon demonstrated how poor the dietary was. It was evident that further measures were necessary in order to supply these essential elements, and thus were formed organisations for filling these needs.

On 12th August Stringer appointed a nutritional advisory committee, on which Hunt was the A.I.F. representative. This committee continued to meet at intervals throughout the period of captivity in Changi, and rendered useful service, in checking constituents of the diet, and advising as to the selection and provision of supplements. Some of the problems referred to this body were the use of rice polishings, clinical assays of green foodstuffs, such as towgay and kang kong, and the value and local production of yeast, and marmite. Attempts were made to assess the effect of certain dietary supplements on specific deficiency states, and the prophylactic value of supplements as estimated by clinical and statistical evidence. This account of the work done to combat malnutrition of course mainly concerns the A.I.F. The measures adopted by the A.I.F. and its medical services were technically similar to those adopted by the British force, for, while the Australian administration shouldered its own medical problems there was free interchange of information and opinion.

Even before the first officially notified case of dietetic deficiency state was recorded special measures were being taken to manufacture preparations rich in vitamins. Burgess produced a table setting out the estimated vitamin contents locally obtainable. Yeast and ground nut meal and leaf extracts were already being used as additions to the diet, but it was evident that these were not sufficient to make up the leeway.

MEASURES TO SUPPLEMENT DIETS

Yeast. A yeast centre was established at the end of April to produce large quantities for distributions to the troops. Large containers were

necessary and were obtained by requiring an official return of all suitable vessels from all units. Unit production was also encouraged, though this could not cope with the demand. After research two types of media were prepared, one for small scale production for seeding the cultures, the other a large scale method for bulk production. The original cultures were obtained from the Japanese, and these were continually seeded to keep them vigorous. One of the working parties on the island was able to obtain brewer's yeast direct from a brewery in Singapore, and used this for direct distribution to the members of the party and also for local production on a small scale.

Potatoes, sweet potatoes and rice were used, with the addition of sugar. Other root vegetables were also used. The use of sugar was questioned at one time, but in spite of its food value it seemed more fitting that it should be used making yeast. Gula malacca was found useful in place of ordinary sugar: this was a sort of caramel brown sugar in block form. Hops were added to the "starter" batch to prevent rapid growth of fermentative bacteria which could spoil a batch by souring and would destroy yeast cells. Accepted formulae were distributed among all parties interested. By June allocation of yeast supplies needed some revision. An allotment of 5 ounces per man was aimed at, but the A.D.M.S. desired an issue of one pint daily for each patient with beriberi; this threw considerable strain on the yeast centre. A.I.F. headquarters therefore suggested that yeast manufacture should be a responsibility of the A.A.S.C., and its distribution be made by the A.D.M.S. This obviated shortages in units unable to produce much yeast for curative purposes. The quality of the yeast was tested by cell counts carried out by Burnside's unit, the mobile bacteriological laboratory. In June only 14 out of 124 counts showed a figure over 50,000 cells per cubic millimetre. This raised the question whether it was economic to produce low grade yeast from useful foodstuffs; but only separate units were involved, as the yeast centre controlled its own counts, which were uniformly higher.

Woodruff, in charge of the yeast centre, in June was supplying 126 gallons of yeast per week; this quantity could be increased if more raw materials were available. Cell counts showed that the majority of the cells were identical with the original culture: there appeared to be other varieties of yeast also present. It was admittedly difficult to know the exact value of this yeast as a source of vitamin *B1* without being able to estimate the *B1* content. On the suggestion of the A.D.M.S. Woodruff was appointed on 9th October 1942 as A.I.F. medical research officer, in which capacity he investigated the deficiency states in Changi, with special reference to treatment. Numbers of other subjects presented themselves to various scientific workers in Changi, such as the search for a more potent wild yeast, or for methods of producing vitamin *B1* from other foodstuff, but local opportunities were too limited for most of these to bear fruit.

Rice polishings were used when obtainable, but though theoretically obtainable from the Japanese they were not always supplied. Some

samples were dirty and unpalatable: good samples were probably more effective prophylactics of B1 deficiency than yeast with a possibly low cell count. Polishings were most palatable if soaked, they were sometimes extracted, but it was generally considered that this lowered the vitamin content.

Tempe. One of the methods of making soya bean palatable and effective as a food was by preparing tempe, which was a product containing soya bean, preferably unhusked and partially predigested by fungus action. The soya was crushed and mixed with cooking oil and then cooked. Demonstrations were arranged for the method of preparation at which representatives of various units attended. The advantage of this preparation was the greater digestibility of the bean, which otherwise tends to pass through the alimentary tract undigested. By allowing a native fungus to grow on the pulverised husked beans a more palatable dish was obtained, and this method of preparation was used at the vitamin extraction centre where seed of the fungus could be obtained.

Grass or Leaf Soup. Pasture grass was limited in amount in Changi, and the coarse "lalang" grass was a poor source of riboflavin, which was the desired constituent of the extract. In Changi an extract was prepared in amounts ranging from 15 to 20 gallons a day to 80 gallons a day in later periods. The grass was used fresh, cut, and broken up and extracted in percolators. Leaves were also used, these kept better but were less palatable. Some of the native vines, like the Malayan wild passion vine, were good sources of riboflavin. Various ingenious mechanical devices were contrived to make this extract, and when electric power was available in Changi this speeded up the process considerably. Cotter Harvey obtained the services of the May and Baker representative in the Far East, and with engineering assistance and the ingenious use of various spare parts, machinery was constructed which turned out some 50 gallons of extract a day.

Gardens. The Japanese encouraged unit and group gardens, which provided all British, Australian and Dutch ranks and units with a highly valuable means of providing additional food. Seed was supplied by the Japanese and labour on a small scale was provided by the men themselves. It was not easy to maintain interest in central gardens, in which culture of vegetable foods was carried out on an extensive scale. On 5th March 1942 a scheme begun in the A.I.F. was merged in a central scheme. A garden was started outside the camp perimeter in an area of 120 acres worked and controlled by a prisoner-of-war group, but supervised by the Japanese. In anticipation of later developments it may be stated here that by October 1943, 85 acres were in production, bearing 320,000 lbs. of leaf vegetables and 90,000 lbs. of root vegetables. The produce was issued as rations by the Japanese, and helped considerably to supply certain basic needs. The struggle to maintain central gardens had to be

made, as they helped to make the men fit by supplying food, even though the local working parties were already weary from routine occupations. An elaborate scheme of urine collection for manure was organised.

Cooking. Galleghan's official report for the first half of 1942 contains special references to the ingenuity of the cooks, most of whom were not normally cooks in the army. They converted the basic ration to a much more palatable form, and helped thereby to maintain both health and morale.

Marmite. An original stock of the proprietary compound was held in Singapore where it was an army supply, and this was taken into Changi. The Japanese also held stocks obtained from the British supplies at the time of capitulation. From these sources enough could be obtained for treatment, though as the quantity was limited the distribution was carefully controlled. A substitute was manufactured, chiefly from yeast, but it was not found very effective, and was discontinued.

In dealing with the general medical and surgical activities of the medical services of the A.I.F. in Changi an account will be given of the methods by which attempts were made to record the details of deficiency diseases and to assess the value of the methods of treatment at hand. Judgment, described by Hippocrates as difficult, is no more easily made in the isolation of a poorly equipped prison than elsewhere, and, though the medical officers tried to maintain a critical mind, it was inevitable that schools of thought should sometimes differ. As we shall see, the shifting population of Changi introduced a disturbing factor in the therapeutic and prophylactic side of nutritional studies.

Hospital Dietaries. It has been pointed out already that diet available for hospital patients as received in the Changi area was inadequate. There was at the time a fair store of those extras classed as "medical comforts", but with unknown medical commitments spread over an unknown future these could not be regarded as taking the place of a sufficient daily ration. The position was made worse by the attitude of the Japanese with regard to the sick. The issue of rice was graded according to the type of work done by the men: a heavy worker was allowed 300 grammes, a light worker 250 grammes and a non-worker 200 grammes. As the sick were classed as non-workers it will be seen that men requiring a full or even a special ration to restore them to the grade of a worker were not considered at all. Under ordinary conditions it is possible to draw upon a certain floating surplus of rations in a hospital, owing to temporary inability of patients to consume the allotted portion, but when this ration approaches the starvation line there is virtually no margin. This point was often argued with the Japanese but without effect. Nevertheless a certain reserve of food was achieved through the use of the camp messing funds, from which the messing officers bought useful items through the local Japanese commander; such items were soya beans, pigeon peas, dried fish and cooking oil. To these were added Red Cross supplies when available;

one shipment arrived towards the end of 1942 and was added to the slender stores which were bought by the Red Cross representative before the prices rose to an impossible level.

Special priorities were given to hospital patients where the speed and completeness of recovery depended on having certain foods: this applied particularly to the vitamin substitutes, whether obtained as medicinal preparations or manufactured in the camp area. Frequent changes were made in the ordinary ration with regard to such items as fish, meat or grain, and shortages were very common. A special ward with a diet kitchen attached was set aside for men who had lost much weight and needed extra nutrition. This "fattening pen", as the men called it, was most successful: it was closed early in 1943 but a special kitchen for ulcer diets and other special diets was retained.

SURGICAL AND SPECIAL WORK

When the wounded arrived at Selarang the work of the 2/9th Field Ambulance in setting up two wards and an operating theatre, gave great assistance in accommodating patients under conditions of hardship and overcrowding. Three men suffered secondary haemorrhages after the movement, and required operation. Two eventually died. The next day the 2/10th A.G.H. arrived, and set up wards, a theatre and an X-ray room, but suffered the same overcrowding and were hampered by the same shortage of water, the same primitive sanitation and the same swarm of flies. The rapid increase in dysentery affected many surgical patients and many medical officers, but on 6th March the dysentery patients were transferred to special wards in the 2/13th A.G.H., until the Japanese decreed the further move to Roberts Barracks.

In the buildings at Roberts Barracks, damaged by bombing and defective in hygiene, suppuration of wounds, instead of being rare, became only too common, and maggot infestation was widespread. Gradually these conditions were controlled, and an amalgamated surgical staff was fully employed. The officers worked constantly, for they had to assist in general nursing, and supervise diets as well as all ward work, and taught the orderlies, many of whom were quite inexperienced. In both medical and surgical work the high standard attained under these trying circumstances was highly creditable to all who took part, especially when it is remembered that all skilled nursing help was suddenly removed from the hospitals before the capitulation. Equipment was adequate, but sterilisation with only one autoclave in use brought by the C.C.S. with an insufficient supply of fuel, and partly dependent on extemporised methods, was a major problem. After the first six months an electric supply was provided, and small surgical dental sterilisers could be used. The British hospital in June 1942 was able to utilise the steam from the cookhouse for operating a large autoclave; this helped greatly.

Lack of electricity forced the staff back to the use of small smoky lamps burning "dieseline" or "malarial". A combined theatre was jointly used by the staffs of the British and Australian hospitals: this was housed

in a room large enough to permit the use of two tables at each end. Only the flickering and inconstant glow of carbon lamps from a noisy diesel motor generator was available for lighting. In July a separate "clean" theatre was obtained and was used by both hospital staffs with great success. Rubber gloves soon were unobtainable, and infection seemed to be more common when they were not used. Lieut-Colonel C. H. Osborn, in charge of the surgical division of the combined A.G.H. reported that from March to 31st December 1942, 367 major and 575 minor operations were performed, a total of 942.

Prevailing sepsis and malnutrition presented serious hazards to surgical patients. Severe weight loss was often encountered, owing to the difficulty in making good the excessive loss of protein by a diet rich in this component. A ward was set apart for the subjects of chronic sepsis, with a special diet kitchen attached, and here up to forty patients were treated, the meagre stocks of reserve food available being used. Great care was taken in assuring fair distribution of this extra ration, for as soon as a patient's condition warranted it he had perforce to revert to the routine diet, chiefly rice, while others in greater need were fed. This work saved many lives.

Early in 1942 all Australian soldiers in Changi who had suffered battle injuries were reviewed. Classification was decided, and also any indications for further treatment. This review showed the following distribution of wounds:

Nerve lesions—

Upper extremity	27
Lower extremity	26
Major arterial lesions	10
Compound fractures of the femur	14
Compound fractures of the upper extremity	40
Compound fractures of the lower extremity (excluding femur)	64
Penetrating chest wounds	25
Penetrating wounds of knee joint	24

A consultation service was set up at the convalescent depot, to which the senior physician and surgeon paid weekly visits.

Artificial limbs were the subject of early study at Changi and special arrangements were made for their production. Facio-maxillary surgery was carried out chiefly by Lieut-Colonel Middleton, R.A.M.C. and Lieut-Colonel Osborn, and special instruments made locally by Private Russell and others were used. Nerve injuries were separately reviewed.

Notwithstanding the unfavourable conditions only nine patients died in 1942 in Changi as the result of wounds, and in four of these intercurrent disease was the actual cause of death.

An ophthalmic clinic was carried out at first by Major F. P. C. Claffy and later by Major R. G. Orr. The lack of electric light was an early disadvantage, but when light and power were later restored to the camp the eye work was considerably extended. This was of particular value

when amblyopia caused by malnutrition became common in the area. By the end of 1942 the number of tests of refraction was rapidly growing, and a little later three medical officers, two opticians and attendants were all busily occupied in this clinic. In April enquiry by Malaya Command showed that 33 officers and 742 other ranks claimed that they needed spectacles. The G.O.C., A.I.F. approved of the official issue of glasses only to those who needed them for the sake of efficiency or for the relief of serious discomfort. An optician in Singapore supplied spectacles under Japanese order, but after difficulties in finance arrangement was made between the A.I.F. paymaster and the Australian Red Cross Society that the society should meet the entire cost.

Ear, nose and throat diseases were looked after at first by Major A. W. Farmer, and later Major H. A. W. Watson. Infections of the upper respiratory tract were fairly common. Vasomotor rhinitis was only occasionally observed. Cases of deafness were sometimes seen believed to be due to avitaminosis. Suppurative *otitis media* was uncommon, but *otitis externa* occurred frequently, though less troublesome both in incidence and severity than during 1941.

A skin clinic was established by Captain P. N. O'Donnell, and carried on later by Major C. E. M. Gunther. Attendance reached a peak when scrotal dermatitis became common, and numbers were also increased by the high incidence of tinea of the feet, and other types of the commoner dermatoses. Scabies was rare in the A.I.F. and was seldom seen except in men transferred from other areas.

Pathology. The mobile bacteriological laboratory arrived early in Changi in its own transport, but this had to be handed over to the Japanese. Work began at once, and an investigation was begun by Major Burnside and his staff on the possibility of making a dysentery vaccine for prophylaxis. After great difficulties in standardisation and in preventing contamination under primitive conditions enough vaccine was produced to inoculate 1,000 men during April 1942.

When the combined hospital was established an A.G.H. pathological laboratory was begun under Major R. B. Maynard which was based on the pathological service of the 2/10th A.G.H. and which was joined by the pathological staff of the 2/13th A.G.H. who had managed to retain most of their equipment. There were great difficulties at first, especially with water, but after a month engineers had provided a piped supply. The laboratory moved to a new location in August. Though the 2/10th A.G.H. pathological unit had lost much of its equipment in the hurried evacuation from Oldham Hall, the combined unit was able to carry out all types of work. Material had to be conserved, as expendables could not be replaced, and fuel for purposes of heat was scarce. It was possible for subsidiary equipment to be supplied to working parties leaving Changi, though obviously this drain could not be continued indefinitely. Major Maynard and Major G. F. S. Davies were the senior members of the staff.

All urinary examinations were carried out for the wards to conserve material; all common tests of the blood chemistry and of the cerebro-spinal fluid could be done. Occult blood tests could not reliably be done as hydrogen peroxide had poor keeping qualities and other methods were unsatisfactory. Most usual forms of haematological work could be done, but investigation of local standards was necessary, as they were not identical with those acceptable under ordinary conditions. Bacteriological work was limited to some extent, but fortunately most of the cultural and typing methods for investigation of bacillary dysentery were possible.

Diphtheria was at first verified by direct smear, but as culture was found necessary, a coagulated egg medium was prepared which fortunately gave results consistent with those of the commercial Difco medium, of which the department held only a small quantity. A great amount of work was done on the preparation of a pure culture from which a toxin could be made for immunisation. Eventually a toxoid was produced, but the peak of the epidemic had passed, and immunisation was not then thought necessary. Late in 1942 tellurite cultures could be made and useful diagnostic help was gained from these. The technical staff carried out highly creditable work in these investigations under difficult conditions. Water examination, and all other common diagnostic tests were also carried out by this department. A few blood cultures were made but without positive result. Vaccines were also produced, chiefly for dermatological conditions. Kahn tests were performed jointly with the laboratory of the British hospital, which held a supply of the antigen. Parasitological work was considerable, and in the diagnosis of amoebiasis collaboration with the physician who performed sigmoidoscopy was found most helpful. Finally morbid anatomy, and, with some ingenuity, histology were studied in the laboratory.

Radiology. The X-ray gear of the A.I.F. was transported safely to Changi, but owing to the move to Roberts Hospital, it had to be re-assembled and dismantled twice. Major B. L. W. Clarke was radiologist to the combined hospital till August 30th 1942, when he was transferred to dermatology, and Major Uhr took over the X-ray work. Two rooms were shared by the British and Australian hospitals, one used for processing only. Power was supplied by a trailer unit until the supply was provided in the area. Work was done with an Ultrays and a Siemens portable unit. At Roberts Hospital the equipment was pooled; this did not work very well at first as the A.I.F. had 350 dozen films at first and the British force none. The British Solus unit broke down late in 1942 but a G.E.C. unit was placed in commission. Radiography was done in the mornings, and fluoroscopy at night. In ten months 1,384 patients were examined by X-rays.

Dental Centre. The work established early under Major Rosson continued as long as supplies could be obtained. During 1942 additional purchases were made in Singapore by a dental officer attached to a party working there. While it was possible a great amount of work was done to

make and keep the men in the area dentally fit. A surprising feature of the dental state of the troops was the healthy appearance of the teeth and gums. This may have been due to the lessened amount of food residue, and the necessity for more thorough chewing. Damage due to biting hard foreign substances in rice and other food caused more trouble than caries. Shortage of rubber made denture work difficult and finally impossible, but while facilities existed large numbers of repairs were carried out. Casting work for the British dental service was done also in the A.G.H. dental clinic, and work was performed for A.I.F. parties arriving from Java and other parts of the Netherlands East Indies.

Physiotherapy. Remedial exercises and other physical methods of treatment were found necessary, and a department of physiotherapy was opened, and used a trained masseur. Major Clarke and S/Sergeant Buck devised an infra-red apparatus, and Captain Bush constructed appliances for various purposes. Some of the patients suffering from the effects of some of the deficiency states benefited greatly from these methods.

WORKING PARTIES

At this stage it is necessary to look back over 1942 in Changi and give some attention to the various parties of men who were coming into and leaving the Changi area. Parties of Allied troops and civilians arrived in or passed through the area from time to time, and up to the final phases of captivity these population changes continued. They were of importance themselves as they introduced some differences in the hazards of life to the men and they also gave opportunity for the introduction of infective diseases. Other working parties of variable size were sent by the Japanese to carry out various projects chiefly on Singapore Island or the adjacent mainland. Some of these parties returned to Changi after a period, others were diverted to other projects. In addition considerable numbers of men were returned to the main concentration area for medical reasons. On a larger scale were the parties which were known as "A" Force, "B" Force *et cetera*, which were dispatched to other more distant camp areas. Some of these were merely transferred to other concentration areas, such as Japan where the "Senior Officers'" party was sent; others were moved up-country to Burma or Thailand for specific works, such as the railway built by the Japanese to connect Moulmein with Bangkok.

Shortly after the concentration of British and Australian troops in the Changi area the Japanese army demanded men for working parties, and though accurate records were not kept during this early period, the numbers of the A.I.F. working parties in various camps in Singapore rose from 577 at the end of February to 2,769 at the beginning of April, in addition to 652 who had returned on medical grounds.

All these working parties were provided with adequate medical assistance and supplies. Medical officers and orderlies were attached to them, having regard to the number to be served and the estimated duration of their absence. The smaller parties were issued with enough equipment for

a medical inspection room, and the larger ones for a small camp hospital. Until the end of June 1942, replacements of medical stores were made when sick returned to Changi, and others sent back in their place, but the Japanese then forbade the sending of supplies to working parties, stating that they themselves would provide supplies. This undertaking was not kept, and working parties had to purchase what they could out of the working pay they were allowed. Naturally the supply of drugs obtainable dwindled, and prices rose fantastically; one atebirin tablet cost 50 cents. By October Changi administration decided to ignore the Japanese order and resumed the practice of sending replacements of drugs.

Fortunately the working parties received a relatively better food ration than that issued in Changi. The rice ration was adequate, 24 ounces a day, some meat was supplied until the frozen stocks were exhausted and fresh vegetables were supplied in varying amounts which were sometimes satisfactory. Some supplements could also be bought at canteens established in the camps. It was disappointing that dietetic deficiency states appeared just as frequently in Changi; this was probably due to the much harder work done in the camps, and possibly also to the greater proportion of carbohydrate to vitamins, but it was convincing proof of the small margin of nutritional safety in the diet. The Japanese often would not allow patients with nutritional diseases to be sent back to the A.G.H., and many of them were treated in camp hospitals, where excellent work was done by the medical personnel so far as the limited supply of essential drugs would permit. British and Australian troops worked together in many of these camps; they supplied their own medical attention, and the details mentioned hereafter refer in the main to the A.I.F. The following are some brief references to the work done in individual camps.

Great World. This camp was one of the earliest and was located at the Great World Amusement Park under good conditions. The men did hard work moving freight to and from railway trucks and godowns. There were 1,686 men there on 29th July 1942, and the average number attending sick parades was 150. A camp hospital of six wards accommodated eighty men, but there were seldom more than thirty in it. The medical arrangements were very satisfactory. On 22nd October 1942, the camp was closed and the men were moved to the River Valley Road camp.

Adam Park No. 1. This camp was also good, though the work was arduous, on roads and building construction. The first party on 4th April 1942 included 2,000 A.I.F. and 1,000 British troops, who were accommodated in concrete houses with electric light and sewerage. The camp hospital had 150 beds equipped, in May the number unfit for work was 400, and sick parades sometimes numbered 200 twice daily. In July and August beriberi was very prevalent and many men were sent to Changi for treatment; no specific cause for this high incidence other than dietetic insufficiency was revealed by investigation. In July the camp population was halved by sending a detachment to form Adam Park No. 4 Camp, and after a party of over 550 had been sent overseas in December

the camp was closed. A great amount of medical work was done in this camp: in seven months 3,634 patients were admitted to the camp hospital, mostly for short-term ailments, and 190 minor operations were performed. Much dental work was carried out, and dental officers even treated some of the Japanese. The troops were 50 per cent dentally fit at the end of the period. Pathological work was carried out in this camp. Malaria, which was demonstrated microscopically in 291 out of 1,986 examinations, was an important hazard. Amoebic infection was discovered in a few men.

Bukit Timah No. 5. This party did not have good conditions. Its original strength on 4th April 1942 was 800, housed in poor shops and huts, and the malarial rate was high. Requests were fruitlessly made to the Japanese for anti-malarial measures to be applied. The work was hard, at the Ford Works and on roads. The party left for the River Valley Road camp in November 1942, and returned to Changi at the end of the year.

Mersing Endau. This party left Changi on 18th April 1942 and was well housed in barracks at Mersing. Water supply and sanitation were good. The work was dangerous, involving the removal of mines; three men were killed and eleven injured by explosions. Scrotal dermatitis from food deficiency appeared in July, but the most serious disease was malaria, which infected 75 per cent of the men. It was fortunate that no deaths occurred for the Japanese would not permit drugs to be sent from Changi and yet supplied the most inadequate amounts themselves. The party worked for a short time removing mines along roads near Batu Pahat, and returned to Changi late in August 1942.

Pulau Bukum. Two hundred and twenty men left Changi on 21st April 1942. Conditions were bad on this island. The work was heavy, the incidence of malaria was very high, and with the totally inadequate supplies given by the Japanese, would have been more serious only for the arrival of drugs and a microscope for diagnosis from Changi. Several men died from malaria. In July there were 118 men off duty out of a total strength of 265; 95 men paraded sick and 25 were in the camp hospital. In August the party was split into two sections, one going to Pasir Panjong and the other to Woodlands.

Thomson Road. No. 3. On 5th May 1942, 1,900 men left Changi for this camp which was well housed in concrete structures. Road and construction work was fairly hard, but owing to good conditions the sick rate was low. The Japanese allowed malaria control and purchase of extra foodstuffs, including rice polishings and yeast. Late in November 1942 the camp was transferred to River Valley Road.

Johore Bahru. This party of 160 left Changi on 5th May 1942 and occupied good quarters in the civil gaol and with good water supply, sewerage and electric light. The party did light work for some weeks and returned.

Lornie Road. This party numbered 750 and also left Changi on 5th May 1942; the work was fairly hard, but conditions were good in an area near Adam Park camp where the party was transferred in August.

Serangoon Road. This party of 300 left on 25th May 1942, and encountered bad conditions at first in dirty native huts. Work at the Ford Works was very hard, but general treatment was good. Malnutrition appeared within a month when up to 18 per cent of men were unfit for hard work, through diarrhoea and beriberi. Scrotal dermatitis appeared later, but health improved after a time: the camp was merged with Adam Park in October.

Adam Park No. 4. The strength of this camp on 15th July 1942 was 597. Quarters here were good, the work was hard, but general conditions were good. Health was satisfactory in the main, and food fair by local standards, though scrotal dermatitis was fairly prevalent. This camp also moved to River Valley Road on 31st October.

Woodlands. The 103 A.I.F. troops transferred here from Pulau Bukum were well quartered and conditions were satisfactory. Relapsing malaria acquired in Pulau Bukum was troublesome. The party was sent to Pulau Blakang Mati on 5th August 1943.

Pasir Pajang. The men from this camp were redistributed in November: conditions were reasonably good.

River Valley-Havelock Road. The original party left Changi in March 1942 being one of the earliest to move. It formed the A.I.F. Building Detachment; the work was heavy, but health was good. There was no A.I.F. medical officer until October 1942 when a party of 1,000 A.I.F. from Changi replaced British at Havelock Road. Combined parties here formed a camp hospital of 150 beds, and the medical personnel worked together. The men were worked very hard and allowed little rest, and towards the end of 1942 medical supplies became very scarce. The medical services in Changi were able to send a good supply of drugs, but the sick wastage was considerable, owing to dietetic deficiency states, and chemical burns from lime and caustic. There was a daily sick rate of 15 per cent. The camp was closed on 21st December 1942 and the whole party returned to Changi.

This covers most of the movements and experiences of working parties during 1942; by 1943 the majority of the A.I.F. troops in working camps had returned to the Changi area, or left for destinations up-country or overseas. There were still parties of Australians in Pulau Blakang Mati and Woodlands. More will be said later about these and other working parties sent out during the last year of captivity.

OVERSEA AND UP-COUNTRY WORKING FORCES

Other most significant episodes during the early period were the constitution and despatch of the working forces sent to up-country and oversea

destinations. Medical detachments were sent with these parties, and as it was impossible to foresee the conditions under which they would work, there was difficulty in deciding on the amount and type of medical assistance likely to be required. This difficulty was intensified as time went on, for the troops in Changi included a steadily growing proportion of unfit, and more medical personnel were needed for their care. At first the A.I.F. headquarters in Changi decided and selected the medical section of each party according to estimated needs, but later it was necessary to restrict the numbers. Later still the Japanese detailed the number of medical officers and other ranks to accompany each force. Some forces consisted entirely of medical personnel. The question of medical equipment for these forces was fraught with great difficulty. Not only large parties required certain basic equipment but small parties too, and those passing through from Java to distant destinations also needed medical and surgical kits, as they usually possessed nothing of this sort. The Japanese Army would not supply or replace such equipment, nor would they give any information about the medical facilities, if any, provided for each force. Sometimes an assurance was given that such parties did not need medical equipment: experience showed that no reliance whatever could be placed on these assurances. The "Forces" which left Changi were as follows:

"A" Force. Three thousand A.I.F. left on 14th May 1942 under Brigadier A. L. Varley, with Lieut-Colonel T. Hamilton as S.M.O. The medical section consisted of 15 officers, and 127 other ranks, and by order of the Japanese only an emergency surgical kit was taken, a microscope, and a good supply of drugs, including atebirin, quinine, sulphapyridine and compressed yeast.

"B" Force. After issuing conflicting orders the Japanese required a force to be formed including 1,500 A.I.F. for an oversea destination. A detachment of three unit medical officers and members of the 2/10th Field Ambulance under Lieut-Colonel E. M. Sheppard was sent with the minimum equipment for a hospital of 100 beds, including a pathological diagnostic outfit, with necessary drugs, including cholera vaccine. There were 13 medical officers and 145 other ranks.

Japan Party. Two parties "A" and "B" were formed, but the former was not sent. The "B" section comprised all officers over and including the rank of colonel. Medical officers were Colonel A. P. Derham, Colonel E. R. White, Colonel D. C. Pigdon, Captain D. J. Brennan and Captain P. N. O'Donnell, and there were eight other ranks. This party left for Japan on 16th August 1942.

"C" Force. This party of 552 A.I.F. left Adam Park on 28th November 1942 ostensibly for Japan or Korea, accompanied by Captain A. K. Barrett and fourteen medical other ranks. Medical and surgical supplies were sent from Changi.

"D" Force. This large force for Thailand consisted of 2,780 British and 2,200 A.I.F. troops. The A.I.F. component left on 14th to 18th March 1943. Major A. R. Hazelton was S.M.O. of the combined force; there were seven A.I.F. medical officers and thirty other ranks. Though the Japanese stated that only enough supplies need be taken for the voyage, Malaya Command decided that, as the destination was highly malarious, six months' supply of quinine, plasmoquine, and sulphapyridine should be taken. The Japanese arranged for tests for malaria and dysentery on all men, and stated that no man who had suffered from malaria in the last eight months or dysentery in the last three months would be allowed to leave. All men were vaccinated and inoculated against cholera and plague. The party carried copies of recipes for production of yeast and grass soup and extract, and notes on treatment of eye conditions.

"E" Force. On 28th March 1943, on eight hours' notice a force of 500 British and 500 A.I.F. troops left for an oversea destination. Major H. H. Eddey acted as S.M.O. for the whole party: there were two A.I.F. and one British medical officers, and eight Australian and two British other ranks. Equipment for a twenty bed hospital was taken with adequate quantities of drugs. This party included a number of men not fully fit, but only those fit to undertake a journey were sent, and none with a history of amoebic dysentery or eye disturbance.

"F" Force. This force of 7,000 men was ordered to leave by train on 18th to 26th April 1943 for an up-country destination. The A.I.F. supplied 125 officers and 3,300 other ranks, with 12 A.A.M.C. officers and 224 other ranks a total of 3,661. The Japanese stated that there would be seven camps each under a major of the Japanese Army. It was further stated that men only fit for light duty could be taken, but in spite of a review of all the light duty men by the A.D.M.S. and D.A.D.M.S. some 100 men had to be sent who were not then fit for any duty. Equipment for a 250 bed hospital was taken: many items including essential drugs comprised 40 per cent of the remaining stocks. Medical tests of the force were carried out. Drugs were issued by the Japanese for malaria prophylaxis, including quinine, one tablet for ten days, and plasmoquine one tablet on the tenth day, but these were taken as stock and not used prophylactically. Lieut-Colonel J. Huston, R.A.M.C. was S.M.O. of the combined party and Major R. H. Stevens, S.M.O., A.I.F.

"G" Force. This force was called for by the Japanese as a reinforcement of "E" Force but was sent to Japan. They stated that any medical personnel accompanying the force would be regarded as members of a working party. Accordingly two medical companions were taken, and a sergeant pharmacist from the N.E.I. went with the N.E.I. component of 1,000 men. Three hundred British and 200 A.I.F. made up the party.

"H" Force. This party of 3,000 included 600 A.I.F. over half of whom were from Java. Equipment was taken for a hospital of 150 beds

Medical tests were applied to the members of the force, and great difficulty was found in filling the A.I.F. quota. Three A.I.F. medical officers and eighteen other ranks went with "H" Force on 8th May 1943 with Major E. A. Marsden A.I.F., as S.M.O.

"H" Force (Officers' Party). The A.I.F. provided 68 out of 320 officers making up part of "H" Force and provided one medical orderly. The British sent two medical officers. The fitness of officers was determined by medical boards.

"J" Force. This force left on 15th May 1943: it included 300 A.I.F. with Captain C. R. Boyce as R.M.O., and ten medical other ranks. The Japanese knew that many of these men would be unfit for work, and about eighty men from the A.G.H. and convalescent depot were included. Most of these men had amblyopia due to nutritional defects.

"K" Force. The A.I.F. provided five medical officers and fifty other ranks in this party of thirty medical officers and two hundred medical other ranks. The party was intended for reinforcements. Major B. H. Anderson the D.A.D.M.S. of 8th Division commanded the force.

"L" Force. This force was another purely medical party, which left on 23rd August 1943. It included fifteen medical officers and one hundred medical other ranks, three officers and seventy other ranks being supplied by the A.I.F. Lieut-Colonel Benson, R.A.M.C., commanded the force and Major H. L. Andrews was in charge of the A.I.F. party.

Reference has been made to parties passing through Singapore from Java on their way to join other forces. There were six such Java parties which came through. The first included Major Stevens of the 2/12th Field Ambulance, with nine other officers and fifteen other ranks. Most of this party remained in Changi. The other Java parties contained varying numbers of A.I.F. troops, and in most instances some A.A.M.C. personnel also. Lieut-Colonel N. Eadie, S.M.O., A.I.F. Java arrived with a fourth party and was equipped at Changi with a much needed medical kit for the party before he moved on two days later. Some field ambulance men and also sick berth attendants from the H.M.A.S. *Perth* accompanied the fifth party and stayed a while in the area. The commander of the sixth Java party was Lieut-Colonel E. E. Dunlop of the 2/2nd C.C.S. Some of the party were quartered in the 18th British Division area, and being without a medical officer were looked after while there by Stevens, who reported that 90 per cent of them were suffering from diet deficiency diseases. Arrangements were made for the whole party to be treated with rice polishings.

Two other Java parties arrived late in 1942. These consisted of N.E.I. troops with a high percentage of Eurasians. Medically they were cared for by the A.I.F. and Gunther reported that their condition was alarming following a shocking trip. A severe epidemic of dysentery flared up in three waves; fortunately British and Australian troops were not affected. Of 598 of these troops admitted to hospital 527 had dysentery.

It is interesting to note at this stage the persistent recurrence of malnutrition in the story of forces in the hands of the Japanese. Practically all the events so far related took place within some ten months after capitulation and in that period clinical dietetic deficiencies had affected large numbers of men in widely sundered areas, and made them the readier a prey to infectious disease. We must now follow the story as it is unfolded in the later years on Singapore Island, and then trace the journeyings of the forces which left Changi for destinations unknown.