No. 3 is the first patient, followed by Nos. 1, 2, 4 and 5 in that order. In this exercise five lifts should be done between each change-over. Rest easy.

**Stretcher Hurdles.**

The stretchers are put out in two rows, standing on their sides as hurdles. The front rank of each team goes to one end of the line and the rear rank to the other. A relay race is run.

Repeat with both teams at the same end. Runners go down the line, touch some object such as a fence and come back to the waiting member of the team. (Those who have run should move down the line of stretchers, ready to prop up any which are knocked over.)

The above complete schedule of exercises should be carried through in forty-five minutes by a well-trained squad.

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**ON THE VIABILITY AND TRANSMISSION OF DYSENTERY BACILLI BY FLIES IN NORTH AFRICA.**

**By Major W. STEWART,**

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Dysentery has now been recognized for centuries as one of the major problems of armies in the field and British Armies in Mediterranean regions have suffered considerably from this bacterial infection in the past. With the advent of the warm weather in North Africa the fly-scourge appeared and was followed soon by cases of acute bacillary dysentery. It appeared that it would be interesting to make a few observations on flies in relation to dysentery in Algeria and particularly after carriers of dysentery bacilli had been found among the native population. The outlook and gravity of bacillary dysentery has, of course, been much altered with the use of the newer sulphonamides but, nevertheless, it still remains an important problem. The few days following the successful treatment constitute a period of very considerably reduced physical efficiency although the source of the toxaemia may have been wiped out in the early stage.

Sanitation and customs generally in North Africa are conducive to the spread of disease by flies and the multitudinous other insects. It is quite a common custom for the inhabitants to defecate and urinate on any site, sheltered or otherwise. Deposits of faecal matter may...
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be seen in abundance almost anywhere. The latrines in populous areas are quite open to urine-loving flies and faeces are often littered over these same latrines.

Throughout the experimental work it was attempted to simulate as closely as possible the conditions seen in the countryside around; the faeces under the hedgerows, under bushes, in the recently abandoned slit-trench or air-raid trench. In such conditions flies were able to satisfy to the full their preference for such feeding-grounds.

Among the native population, dysentery carriers are common. These people have a stool normal in appearance and any abnormalities diagnostic of dysentery are absent in wet films. They suffer from no obvious disability from the condition and no suggestion of active ulceration is present. In the first 149 Arab personnel whom the writer was asked to pass as suitable for employment in bakeries, etc., 23 gave positive cultures; 10 were Flexner, 8 Sonne, and 5 Schmitz. An interesting point subsequently arose in that various units seemed to have an entirely different proportion of positive cases while some had none at all. It was later learned that the units with none or few had been recruited from the hills while those with the higher proportion were from villages near more densely populated regions.

Experimental.

The medium used was MacConkey's bile-salt-lactose agar. The more recent desoxycholate-citrate was not available at the beginning nor was it absolutely necessary. The writer understands that Boyd's valuable work was done with MacConkey's medium and Boyd has added very considerably to our knowledge of this bacterial infection. Good work can be done with this media. The agglutinating sera were those supplied by the R.A.M. College. Agglutinating reactions were done in the water-bath with readings taken twenty-four hours afterwards. The biochemical reactions were as those given in "Laboratory Diagnosis of Dysentery in the Middle East, Technical Instructions, 1941."

The apparatus used was a "compo" ration box which was covered over with some mosquito-proof gauze netting. At one end an inlet was left for Petri dishes—this was suitably screened. The whole could be sterilized completely. Flies were caught in the hospital kitchen and latrines with the help of a butterfly net. The specimens of faeces were those sent to the laboratory as routine culture specimens; a suitable amount was placed in a sterile half Petri dish and this was placed in the box along with the flies. This specimen and the flies were left untouched throughout the one experiment. The faecal specimen was left entirely open to the flies and also to the outside air through the mosquito netting. Another sterile half Petri dish with a little sterile distilled water was put in the box usually on the second day. Without water the flies died off in two to three days. Another small container was put in with a small amount of sugar.

At intervals, MacConkey plates in duplicate were put in the box and left open. It was hoped that the flies would transmit the bacteria from the faeces to the plates. The plates were then cultured over-night. At the beginning blood-agar plates were also used but it was found that the growths on these were so abundant and profuse that they had to be abandoned and MacConkey's plates alone appeared to give satisfactory results.

By this method the specimens of faeces dried up, as they did in the countryside around, on closet-seats and in latrines.

The number of flies in the box could be controlled and the time that the MacConkey plates were in was known.

The box throughout the experiments was kept in the laboratory out of the direct rays of the sun—natural faecal deposits are not always directly exposed to the sun's rays.

Surface contaminants were found, not in large numbers, and could be identified. The box was covered up during the dusting of the laboratory.

Some preliminary investigations had to be done first. The viability of dysentery bacilli in specimens under such conditions had to be found. Specimens of dysenteric stools were put in a similar box and cultures were made from these daily. As a rule, the specimens were completely dried up the following day but sometimes the mucus might take longer. If the
In most specimens no B. dysenteriae Flexner was found after the first or second day—but, in four different specimens, positive cultures were obtained on the 5th, 8th, 10th and 12th day. In the case of the last specimen it was passed at 12.00 hours on the 15th of the month and the last positive culture was at 11.30 hours on the 27th of the same month.

The small amount of sterile "drinking-water" had also to be considered. It was theoretically possible for the flies to transmit the bacilli from the faeces to the water and then subsequently for these same bacilli or their offspring to be transmitted to the culture plates. In order to assess this, Flexner bacilli were tested for their viability in water. Some rainwater was obtained and passed through a Seitz for sterilization (the water-supply of the area was subject to chlorination). Flexner was then washed off an agar-slope with some of this water and put in a universal container and kept in the laboratory in the daylight but out of direct sunlight. Cultures were made each day.

The Flexner bacillus survived for the long period of thirty-eight days.

The viability of Flexner in the rain-water necessitated repeated changings of the "drinking water" and of the sugar container. These precautions were duly observed.

The culture plates were left in varying times. The colonies practically always remained discrete and could be picked off for further identification.

Under the experimental conditions outlined above, the longest periods that the flies were found to transmit B. dysenteriae from one specimen of faeces were:

- B. dysenteriae Flexner — 273 hours = 11\(\frac{1}{2}\) days.
- B. dysenteriae Schmitz — 297\(\frac{1}{2}\) hours = 12\(\frac{1}{2}\) days.

In one instance B. faecalis alkaligenes was found in the culture of the MacConkey plate five days after dysentery bacilli had disappeared and fifteen days after the specimen of faeces had been put in the box; B. faecalis alkaligenes had not been found in the original culture.

It was sometimes found that abundant colonies of B. coli communis and coliforms of paracolon type were still present a considerable time after B. dysenteriae had disappeared. The longest duration of one experimental batch of flies was one of twenty-three days; on the last day B. coli communis was found fairly abundantly yet cultures made direct from the faecal remnants were completely sterile.

Culture plates exposed as controls with faeces and no flies as a rule gave only an odd colony of B. coli communis and the writer considers that aerial contamination was not a factor in the results obtained.

B. faecalis alkaligenes and coliforms of paracolon type are common in the bowel in North Africa during convalescence from bacillary dysentery.

The number of dysentery colonies produced during the first period of the culture plates in the box is an interesting figure. During this first period the specimens of faeces was still moist. The time elapsed since the specimen had been passed varied but it was always within the first twenty-four hours. The average number of colonies of B. dysenteriae was 7·6 colonies per fly per hour.

Throughout the experiments care was taken that no direct sunlight fell on the box as direct rays have a marked bactericidal effect. Cultures of Flexner exposed to the direct rays of the sun on rather a dull day were found to be sterile in one hour twenty minutes; during the much warmer days this time would be considerably lessened.

**DISCUSSION.**

Much work has been done on the dysenteries and of notable value is that of Boyd who has had vast experience of this infection under military conditions in India and more recently in the Middle East. This worker has largely incriminated the fly as the spreader of this disease and he has organized suitable means for combating this nuisance and improving stationary camp sanitation. The standard methods of laboratory technique in the investi-
gation of this disease in service laboratories mainly follow upon his work. Working in association with Hamilton Fairley, he has already described findings of this disease in the Middle East [1]. Cruickshank and Gillespie [2] found *B. dysenteriae* Flexner viable in faecal specimens for some fifteen days but these writers do not state whether the specimens were allowed to dry up or not.

Weil [3] suggests that in the States the part played by flies in the spread of the disease is probably small and that the immediate vehicle of infections is contaminated food. Dysentery infection is carried from one locality to another by man and patients with chronic dysentery are mostly incapacitated and not likely to play a great part in the spread of the disease.

Lowbury [4] reports the survival of *B. dysenteriae*. In his results the rectal swab used partially approaches the circumstances of the experiments described above and he found *B. dysenteriae* Sonne survive for seven days and Flexner for two days.

The main idea of the writer was to simulate as closely as feasible in the experimental work the promiscuous defaecation so prevalent in the neighbourhood. Faecal material so deposited gives free access to hordes of flies and is often not exposed to direct sunlight. If these flies in North Africa had been the predominant vehicle of transmission one would expect a continuous and pretty constant stream of cases all through the fly season. This was not so—the positive primary cultures obtained by the writer during the course of these experiments were March—4, April—16, May—32, June—91, July—41.

During August and September there was a marked fall in cases yet flies were still with us in considerable numbers. It is quite true that anti-fly measures were adopted but in spite of everything the flies persisted up to the end of September. At this time there was a considerable drop in temperature accompanied by marked diminution in the fly population and also the survivors seemed much less agile in flight. As an example of the prevalence of the following incident may be quoted. A colleague with one swatter was able to kill 82 flies in twelve minutes in a small mess-room. During these effective anti-dysenteric measures; this fly-conscious disciple of Boyd was entirely unaware that he was being timed nor does he yet know.

Since September there have been short spells of relatively warm weather with temporary re-appearance of flies but there has been no increase in cases of dysentery beyond the few sporadic cases. It seems to the writer that transmission from one human being to another either directly or by food is also an important factor. The cogent, agonizing and frequent urgency for evacuation of the half-teaspoonful of bloody mucus knows few masters and, once infection has broken out, spread by closet-seats, latrines, food-handling, etc., is an easy route.

The dysentery carriers among the Arab personnel were quite unexpected although not surprising. None of these people were incapacitated. All had already been medically examined and a considerable number were actually in employment—the immediate requirements of auxiliary services may temporarily wash-out bacteriological standards on active service.

Manson-Bahr demonstrated that the fly could act as carrier-in-the-bowel of dysentery bacilli for five days. In the experiments now described nothing was found to suggest that the dysentery bacilli were in the bowel of the fly as everything can be explained by direct mechanical transmission either by the feet or other part of the external surface of the body. It did seem in the course of the work that the flies might be harbouring *B. facalis alcaligenes* and other coliforms in the bowel but this point was not fully determined.

The long survival of Flexner bacilli in rain water is corroboration of the menace of uncontrolled water-supplies in the field but this matter is already effectively and adequately dealt with in the equipment available to all Service personnel.

The above experiments corroborate the great menace that flies may be in a climate where they are prevalent and in a community compelled to make shift in sanitation.

As a precautionary measure against the possibility of spread from one human being to another it has been the writer's practice to do as many specimens as possible before the discharge of patients back to their units.
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Once the aetiology of an outbreak in a unit has been determined it seems more valuable to be able to pass back to that unit personnel proven negative bacteriologically than it is to go on using the limited amount of media and time at our disposal for further primary cultures.

SUMMARY.

Dysentery bacilli in North Africa have been found viable in faeces eleven days after specimen has been passed and with the specimen being allowed to dry as under natural conditions.

Carriers of dysentery bacilli have been found in the native population of North Africa and these people may play an important part in the outbreaks of this disease. Flies have been found capable of transmitting dysentery bacilli from specimens of faeces to culture plates for the long period of eleven and twelve days. Nothing was found in the experiment which could not be explained by direct mechanical transmission of these bacilli.

I wish to express my indebtedness to Colonel L. Handy, late R.A.M.C., the Commanding Officer of the base hospital where this work was done, for his encouragement and for permission to forward these findings and to Serjeant F. Hearn, R.A.M.C., for his co-operation throughout this investigation.

This work was not quite completed owing to circumstances beyond the writer's control; perhaps in the future, in other fly-infested areas, it will be possible to carry on to the further stages.

REFERENCES.


CONGENITAL CYSTIC DISEASE OF THE LIVER.

BY MAJOR J. K. WILLSON-PEPPER,
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Below are recorded the details of a case of a West African negro child from whose liver was removed a tumour the size of a coconut which weighed 2 lb. in the fresh state and which is considered to be of congenital cystic origin.

References to the literature are given.

The patient was a three-year old female child of the Yoruba race (Southern Nigeria). The parents had noticed an unusually swollen abdomen two months before bringing the case to hospital. No other details are available concerning the child's symptoms.

On admission the child was found to be feeble, wasted and anaemic. The abdomen was grossly distended and a smooth circumscribed mass could be palpated arising from the right upper quadrant, apparently attached far back. There were no other objective signs and no abnormality was found in the urine.

Limited hospital facilities precluded further pre-operative investigation. The mass increased rapidly in size and the general condition of the child deteriorated further but there was no jaundice or vomiting and the child continued to take her food.

The case was given a short course of N.A.B. as a prophylactic against latent yaws and some intramuscular liver extract as a preliminary to operation.

Operation.—Anaesthetic—ether.

The abdomen was opened through a long right paramedian incision. There was some free fluid.

A solid tumour, filling the abdominal cavity and resting on the pelvic brim, was delivered