A MOBILE FIELD LABORATORY

A DESCRIPTION OF TWO MOBILE LABORATORIES ORGANIZED FOR THE SOUTH AFRICAN MEDICAL CORPS

BY

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With the outbreak of war the construction of a mobile bacteriological and pathological laboratory—one that could perform almost all the routine investigations carried out by a well-equipped civilian institution and yet capable of being moved *in toto* at an hour's notice—was considered necessary. The desiderata were free mobility and efficiency. With these objects in view an attempt was made to design and construct locally a laboratory on wheels.

Owing to the geographical and climatic conditions under which the laboratory was expected to work—namely, long distances, bad roads, deep drifts, and a hot rainy tropical climate—we decided that the caravan type of laboratory would be entirely unsuitable, because any mechanical breakdown in the vehicle, such as a broken axle, would cause great damage to the contents and the laboratory would be unworkable until the defect was remedied. There were various other considerations which also led us to the design of the vehicle finally constructed. These will be mentioned later.

Equipment of Laboratory

The chassis supplied by the Defence Department was a three-ton Ford truck, 1940 model. On to this chassis was fixed a platform 12 by 7 feet, allowance being made for the rear wheels to protrude above the platform. In front of and behind each of the rear wheels the four equipment boxes were clamped. These boxes measured 35 inches in width, 25½ inches in height, and 28½ inches in depth. Two of them were fitted with three sliding drawers, the total drawer capacity occupying the whole capacity of the box. The other two were divided into compartments varying in size with the kinds of large apparatus they were to contain. Each drawer of the first two boxes was similarly divided up into compartments of different shape and size, and to the front of each was affixed a plan of that particular drawer, drawn accurately to scale, with each compartment lettered; and in addition to this plan of the drawer a list of the contents was tabulated according to compartments. This greatly facilitated the finding of any particular piece of apparatus and also expedited the packing away of material not in immediate use. With the exception of the incubator and refrigerator, both of which are fixtures to the lorry and work on paraffin, all the equipment of the laboratory is contained in the four boxes. These are not fixed permanently to the platform of the lorry, but are held in place by means of iron bands, and can be completely released by means of four butterfly nuts for each box. Thus, should it be necessary at any time to unload the lorry the whole equipment can be removed, complete in the boxes, in a few minutes, and as quickly replaced. The value of this will be found when deep drifts have to be negotiated or rivers crossed by the

aid of a pontoon bridge. Should the laboratory be required at a certain spot for some months at a time where a suitable building is available the boxes can be removed into the building and the work carried out with the maximum facilities.

Method of Tentage

The greatest use of the lorry, however, will be made in places far removed from human habitation; and to work in comfort under such conditions a method of tentage has been arranged whereby within a period of fifteen to twenty minutes the laboratory is converted into a tent, rectangular in outline and extending for a distance of six feet from the lorry all round, the lorry itself acting as the centre of the tent. The framework to carry the canvas is made of steel tubing, is collapsible, and is a fixture. When travelling the canvas tent is folded on to the roof of the vehicle and strapped down, and the steel framework folds up and is held in steel brackets along the side and back of the roof.

The lower portions of the sides of the lorry are made to hinge outwards to form work benches of teak, 2 feet 6

inches from the ground, and when so folded out they expose the equipment boxes, whose lids are on the outer aspect. These lids have folded steel legs attached on their inner aspects and form additional tables, also 2 feet 6 inches in height. The removal of the box lid exposes the drawers. The equipment and apparatus are therefore situated immediately above the work benches,

Mobile laboratories; with part of tentage open in one and stowed for travelling in the other.

thereby greatly facilitating the work. The upper portion of the side and back of the lorry is a fixture, built of half-inch wire mesh on the outside; this acts as a protecting barrier to the mono-metal mosquito gauze which covers the whole of the upper portion. When travelling, canvas flaps enclose the exposed portions of the vehicle to prevent the entry of dust.

Above the wheel-housing and therefore between the two equipment boxes on each side is a rectangular tank containing 25 gallons of water, making a total of 50 gallons. The portion of the side of the lorry adjacent to the water tank folds outwards, in a similar manner to the work benches, to expose a sink which receives water from the tank through rubber tubing. The interior of the vehicle is lighted electrically by means of two six-volt batteries, which also supply current for artificial lights for the microscopes and for lighting the tent. The batteries are charged by means of a Delco petrol motor. Between the steel roof and the wooden ceiling of the lorry is an insulating layer of asbestos for coolness. A cupboard, which is a fixture, is placed between the fixed incubator and refrigerator, and the camp stools are clamped against the ceiling. A fire extinguisher completes the equipment.

Slung below the chassis and situated between the front and rear wheels are four tanks, each of 20 gallons capacity and guarded by wire mesh from rocks and stones. These constitute the fuel supply—petrol, methylated spirits, and paraffin—and each has a guarded lockable tap.

Inventory of Apparatus

A complete inventory of the apparatus and material used in the laboratory is given below. The autoclave is an ordinary domestic pressure cooker, but has an exhaust tap fitted in addition, and the bakelite thumb-screws are replaced by metal ones. The hot-air sterilizer attains a

temperature of 180° C. within half an hour, and, like the autoclave, is heated by means of a primus stove. The autoclave can be heated by the petrol stove. The apparatus for distilling water is all metal and is tinned. The filing cabinet contains approximately 3,000 cards, and, in addition, day register books are kept. A small reference library is also carried.

S.A.I.M.R. FIELD LABORATORY

Case No. 1. Top Drawer

Compartment A

1 urinometer
1 set cork borers
1 tin opener and corkscrew
2 thermometers (clinical)
2 grease pencils
1 spatula
4 thermometers (100° C.)
2 " (360° C.)
2 dozen books litmus paper
1 pr. forceps (large)
1 " (small)
1 " scissors (medium)
1 " (small)
1 dozen rubber teats
6 pinch cocks (small)
2 platinum loops in holders
2 camel-hair brushes
2 haemocytometers
2 incubator capsules (37° C.)
2 " (49° C.)
2 gross threadbands No. 8
3 bottles cedar-wood oil

Compartment B

12 ft. gas tubing
6 ft. I.R. tubing (narrow)
6 ft. I.R. tubing (extra narrow)
1 hand torch

Compartment C

1×20-cm. Record syringe in case
1×10-cm. " " "
2×5-cm. " syringes "
2×2-cm. " " "
2×1-cm. " " "

Compartment D

2 glass staining troughs
1 lb. mercury
2 spare torch batteries
3 spare globes for torch

Compartment E

2 glass staining troughs
1 hand centrifuge
1 Zeiss A haemocytometer
250 swab tubes, 6 in. × 1 4 in.

Compartment F

1 post-mortem set
1 lb. Difco dried nutrient broth
1 lb. " MacConkey's agar
1 lb. " nutrient agar
1 lb. " MacConkey's broth

Compartment G

1 box Whatman's filter paper, No. 1;
12.5 cm.
1 box Whatman's filter paper, No. 4;
18.5 cm.
1 balance with set of weights (50 gm.)
1,000 swab wires

Compartment H

1 pH capillator outfit, B.D.H.
1 bottle damar
1 bottle petroleum jelly
1 Trenner pipette (white)
1 " (red)
20 boxes coverslips, 3 4 in., No. 1;
square

Compartment I

1 porcelain tile (12 depressions)
1 dissecting set
1 aluminium billy-can (Army pattern)
2 gauze mats with asbestos centre

Compartment J

1 spirit burner (metal)
1 " (glass)

Compartment K

8×50-cm. drop-bottles

Compartment L

1 set (3) enamel measuring mugs

Compartment M

1 enamel sterilizing dish

Compartment N

4 dozen small pill-boxes
5×50-cm. conical flasks
100 capillary tubes (10 cm.)

Case No. 1. Middle Drawer

Compartment A

24 sheets filter paper, 18 in.
2×50-cm. burettes
2 1/2 lb. glass tubing
1 burette stand upright

Compartment B

1 lb. cotton-wool, absorbent
2 lb. cotton-wool, non-absorbent
2 collapsible test-tube racks
1 burette stand base
2 dozen Dreyer tubes

Compartment C

2×50-cm. glass measuring cylinders
2×100-cm. glass measuring cylinders

Compartment D

100 throat swabs—labelled
6 ft. gas tubing

Compartment E

1 nest enamel billy-cans
1 enamel reservoir

Compartment F

12×1-cm. pipettes, graduated
12×10-cm. " "
6×5-cm. " "
6×20-cm. " "
3×25-cm. " "
3 copper pipette containers

Compartment G

4 dozen Petri dishes
4 copper Petri dish containers

Case No. 1. Bottom Drawer

Compartment A

Bottle No. 1: 1 lb. R.B.C. fluid
" 2: 1 lb.
" 3: 1 lb. white cell fluid
" 4: 1 lb. Giemsa stain
" 5: 1 lb. buffer soln.
" 6: 1 lb.
" 7: 1 lb. Leishman's stain
" 8: 1 lb.
" 9: 1 lb. carbol fuchsin
" 10: 1 lb. Lugol's iodine
" 11: 1 lb. Pugh stain
" 12: 1 lb. methyl violet,
0.5%
" 13: 1 lb. methylene blue,
1%
" 14: 1 lb. Fehling's sol. A
" 15: 1 lb. " B
" 16: 1 lb. Ehrlich's reagent
" 17: 1 lb. vaseline oil
" 18: 1 lb. xylol
" 19: 1 lb. acetone
" 20: 1 lb. formalin 40%
" 21: 1 lb. lysol

Compartment A (cont.)

Bottle No. 22: 1 lb. phenol
" 23: 1 lb. methyl alcohol
" 24: 1 lb. glycerin
" 25: 1 lb. pot. bichromate
" 26: 1 lb. sod. hydroxide
" 27: 1 lb. sod. chloride
" 28: 1 lb. mag. sulphate
" 29: 1 lb. pot. oxalate
" 30: 1 lb. pot. iodide
" 31: 1 lb. sod. citrate
" 32: 1 only wash-bottle

Compartment B

4 gross test-tubes, 6 in. × 5 8 in.
8 wire crates
1 box Whatman filter paper, 18.5 cm.

Compartment C

500 Wassermann tubes
500 agglutination tubes, 3 in. × 3 8 in.

Compartment D

600 microscope glass slides

Case No. 2. Top Drawer

Compartment A

1×8 oz. nitric acid, conc.
1×4 oz. " " dil.
1×4 oz. " " dil.
1×8 oz. sulphuric acid, conc.
1×4 oz. " " dil.
1×4 oz. " " dil.
1×8 oz. hydrochloric acid, conc.
1×4 oz. " " dil.
1×4 oz. " " dil.
1×4 oz. caustic soda, conc.
4×60-cm. drop-bottles

Compartment B

4 bottles, porcelain swing top

Compartment C

1×2 oz. caustic soda
2×2 oz. ammonium chloride
1×2 oz. ammonium carbonate
1×2 oz. ferric chloride
1×2 oz. barium chloride
1×2 oz. guaiac resin
1×2 oz. pot. ferrocyanide
1×2 oz. ferrous sulphate
1×2 oz. calcium sulphate
1×2 oz. silver nitrate
1×2 oz. ammonium molybdate
1×2 oz. pot. dichromate
1×2 oz. pot. nitrate
1×2 oz. pot. cyanide
1×2 oz. stannous chloride
1×2 oz. pot. hydroxide
1×2 oz. sod. phosphate
1×2 oz. copper sulphate
1×2 oz. sod. carbonate
1×2 oz. ammonium chloride
1×2 oz. pot. chromate
1×2 oz. zinc
2×2 oz. pot. permanganate
1×2 oz. copper foil
1×2 oz. mercuric iodide
1×2 oz. ferrous sulphide
1×2 oz. porcelain chips
1×2 oz. tartaric acid
1×2 oz. petroleum jelly

Compartment D

100×2 c.cm. Hiss's serum sugars—
glucose

Compartment E

100×2 c.cm. Hiss's serum sugars—
lactose

Compartment F

1×8 oz. pot. hydroxide, conc.
1×8 oz. glacial acetic acid
1×8 oz. ammonium chloride, satd.
soln.
2×8 oz. ammonium hydroxide
1×8 oz. sodium carbonate, satd.
soln.
1×8 oz. ammonium carbonate, satd.
soln.

Compartment F (cont.)

1×4 oz. pot. iodide, satd. soln.
1×4 oz. bottle chloroform
2×4 oz. ferric chloride, satd. soln.
1×4 oz. barium chloride, satd. soln.
1×4 oz. mercuric chloride, satd. soln.
1×4 oz. tincture guaiacum
1×4 oz. lead acetate, satd. soln.
1×4 oz. bottle ether
1×4 oz. pot. ferrocyanide, satd. soln.
1×4 oz. ferrous sulphate, satd. soln.
1×4 oz. calcium sulphate, satd. soln.
1×4 oz. ammonium carbonate, satd. soln.
1×4 oz. silver nitrate, satd. soln.
1×4 oz. bromine water, dil. soln.
1×4 oz. ammonium molybdate, satd. soln.
1×4 oz. pot. dichromate, satd. soln.
1×4 oz. pot. nitrate, satd. soln.
1×4 oz. pot. cyanide, satd. soln.
1×4 oz. stannous chloride, satd. soln.
1×8 oz. sod. hypochlorite soln.
1×4 oz. pot. hydroxide, satd. soln.
1×4 oz. sod. phosphate, satd. soln.
1×4 oz. copper sulphate, satd. soln.
1×4 oz. sod. carbonate, satd. soln.
1×4 oz. ammonium chloride, satd. soln.
1×4 oz. pot. chromate, satd. soln.
1×4 oz. alcohol
1×4 oz. ammonium sulphide, satd. soln.
1×4 oz. Nessler's soln.
1×8 oz. ammonium sulphide, satd. soln.
1×8 oz. ferrous sulphate, satd. soln.
4×60-cm. drop-bottles

Compartment G

1 Government water-testing outfit

Compartment H

1 Government poison-testing outfit

Compartment I

100 Hiss's serum sugars—saccharose

Compartment J

100 Hiss's serum sugars—mannite

Compartment K

1 nest glass beakers
3 glass funnels, 3 in.

Compartment L

4 books litmus paper
22×2-oz. green poison bottles
1×2-oz. bottle filter paper strips
1 spatula
6 in. platinum wire (thick)
3 test tubes, 1 in. diameter
1 box labels (white, square)
1×4-oz. bottle ammonium vanadate

Case No. 2. Middle Drawer

Compartment A

1 copper staining bath
5 copper wire slide supports
1 wooden rack for drop-bottles
12×50-cm. drop-bottles

Compartment B

200×25-cm. bile bottles, rubber-
capped

Compartment C

2×4 oz. hydrogen peroxide

Compartment C (cont.)

2 oz. salicyl-sulphonic acid (20%)
10 grammes cholesterol
60 c.cm. Kahn antigen

Compartment D

450×1-oz. specimen bottles (screw
cap)

Compartment E

1 lb. Difco dried testicular medium
1 lb. Difco dried brain veal medium

Case No. 2. Bottom Drawer

Compartment A

100 oxalated tubes (blood counts)
1 box assorted corks
1 microscope lamp

Compartment B

1 spirit Bunsen burner
1,000 capillary tubes (0.02 c.cm.)

Compartment C

1 nest enamel basins (3)
1 nest enamel funnels (3)

Compartment D

10×8-oz. med. flat bottles, screw cap

Compartment E

6 watch glasses
1 porcelain crucible
1 porcelain mortar and pestle (4 in.)
1 Bunsen burner (large)
12 centrifuge tubes

Compartment F (cont.)

1 box assorted labels
3 microscope lamp globes

Compartment G

1 metal tripod (double ring, large)
1 metal tripod (triangular)
1 lb. parowax
1 ball string
200 Durham tubes
1 microscope lamp base and upright
1 lb. plasticine
1 Bunsen burner spirit reservoir
1 length metal flexible tubing

Compartment H

2 metal agglutination racks

Compartment I

3×1-pint milk bottles
3 rubber stoppers

Compartment J

4 glass towels
1 duster
1 nail-brush
1 set sewing needles
4 test-tube brushes
1 bottle brush
1 agglutination bath
2 pairs rubber gloves, No. 7 1/2

Case No. 3

Compartment A	Shelf C
1 auto cook kit—petrol stove	2 foolscap record books
Compartment B	Drawer 1
2 primus stoves (silent single burner)	Spares for primus burners (prickers, etc.)
1 primus stove (double burner)	1 spare valve for autoclave
1 Fillery cooker autoclave	6 cakes toilet soap
Compartment C	3 boxes matches
1 galvanized iron bucket	Drawer 2
1 Gem water still	1,000 report forms (blue, small)
Shelf B	500 white envelopes
1 paraffin burner (for incubator)	Drawer 3
1 " " (for agglutination bath)	1,000 laboratory filing cards
2 chimneys	
1 nest billy-cans	

Case No. 4

1 hot-air sterilizer	1 vol. Stitt's <i>Practical Bacteriology, Haematology and Animal Parasitology</i>
1 collapsible stand for sterilizer	
1 Winkel-Zeiss microscope	1 vol. Mackie and McCartney's <i>Handbook of Practical Bacteriology</i>
1 agglutination board	
3 white coats	
2 hand towels	
1 vol. Manson-Bahr's <i>Tropical Diseases</i>	

Fixtures to Lorry

- 1 incubator
1 refrigerator, containing:

Agglutinating Sera:

20×0.1-c.cm. in ampoules	<i>B. typhosus</i>
" "	<i>B. paratyphosus</i> A
" "	<i>B. paratyphosus</i> B
" "	<i>B. paratyphosus</i> C
" "	<i>B. aertrycke</i>
" "	<i>B. enteritidis</i> (Gaertner)
" "	<i>B. dysenteriae</i> Shiga
" "	<i>B. dysenteriae</i> Schmitz
" "	<i>B. dysenteriae</i> Flexner
" "	<i>B. dysenteriae</i> Sonne
" "	Meningococcus
" "	<i>Br. melitensis</i>
" "	<i>Br. abortus</i>
" "	Group A serum
" "	Group B serum

Agglutinating Antigens:

2×100-c.cm. bottles	<i>B. typhosus</i> H
" "	<i>B. typhosus</i> O
" "	<i>B. paratyphosus</i> A
" "	<i>B. paratyphosus</i> B
" "	<i>B. paratyphosus</i> C
1×50-c.cm. bottle	<i>B. dysenteriae</i> Shiga
" "	<i>B. dysenteriae</i> Flexner
" "	<i>B. dysenteriae</i> Schmitz
" "	<i>B. dysenteriae</i> Sonne
" "	<i>B. aertrycke</i>
" "	<i>B. enteritidis</i> (Gaertner)
" "	<i>Br. melitensis</i>
" "	<i>Br. abortus</i>
2×100-c.cm. bottles	<i>B. proteus</i> OX2
" "	<i>B. proteus</i> OX19
" "	<i>B. proteus</i> OXK

Investigations for the diagnosis of the following conditions can be carried out by the laboratory: malaria, trypanosomiasis, kala-azar, oriental sore and cutaneous leishmaniasis, relapsing fever, infectious jaundice, rat-bite fever, typhus group of fevers (epidemic, endemic, typhus-like), plague, melioidosis, undulant fever, enteric fevers, cholera, bacillary and amoebic dysentery, balantidial dysentery, bilharzial dysentery, flagellate dysenteries, leprosy, yaws, mycetoma and blastomycosis, tropical ulcer, veld sore, fungous skin diseases, bilharziasis, filariasis, onchocerciasis, intestinal parasitic infections, myiasis, anthrax, diphtheria, gonorrhoea, meningitis, tetanus, tuberculosis. General bacteriological and pathological investigations can be undertaken, such as pus and exudates for cultural examination, blood counts, blood grouping, bleeding and coagulation times, sedimentation rate, urine analysis, the Kahn test, bacteriological examination of water supplies, examination of water for the commoner poisons, testing of water for chlorination.

In order to facilitate the taking of specimens by medical officers the following tabulated list of all conditions likely to be met with has been drawn up, together with the corresponding investigation which the laboratory can carry out and the nature of the specimen required. The medical officer has thus to make his differential diagnosis and then consult his tabulated list to find out which specimens he has to send to the laboratory and what investigations to ask for.

Specimens required for Investigations carried out by the Mobile Laboratories, S.A.M.C.

Disease	Investigation	Nature of Specimen
Malaria	Microscopical of blood	Thin and thick smears
Trypanosomiasis	Microscopical of blood	Smear
	Microscopical of gland fluid	Smear
	Serum-formalin reaction	Blood (serum 1 c.cm.)
Kala-azar	Microscopical of blood	Smear (thin and thick)
	Splenic or liver puncture	Smear
	Serum-formalin reaction	Blood (serum 1 c.cm.)
Oriental sore and cutaneous leishmaniasis	Microscopical of smear from base of ulcer	Smear
Relapsing fever	Microscopical of blood	Smear (thin and thick)
Infectious jaundice	Acetic acid test on urine	Urine
	Microscopical of urine	
Rat-bite fever	Microscopical of exudate from bite or serous fluid from papule	Smear
Typhus group of fevers: epidemic; endemic; typhus-like — tick-bite; etc.	Weil-Felix agglutination	Serum (1 c.cm.) or whole blood (3 c.cm.)
Plague	Blood culture	Blood in broth with 1% sodium citrate
	Microscopical of sputum; gland puncture	Sputum, gland fluid (or smear)
	Discharges	Discharges (or smear)
Melioidosis	Microscopical of pus	Smear of pus
	Culture of pus	Pus
	Culture of blood	Blood in broth
Undulant fever	Agglutination test	Serum (1 c.cm.) or whole blood (3 c.cm.)
Enteric fevers	Culture of blood or clot	Blood in broth
	Blood culture	Blood in bile
	Agglutination tests (Widal)	Serum (1 c.cm.) or whole blood (3 c.cm.)
Cholera	Faeces and urine culture	Faeces and urine
	Microscopical of faeces	Faeces
Bacillary dysentery	Culture of faeces	Faeces (our distance, sent in equal vol. of N/33 NaOH or twice vol. of 30% glycerin in 0.6% saline)
	Microscopical of faeces	Faeces
	Isolation of organism from faeces	Faeces
Amoebic dysentery and amoebiasis	Microscopical of faeces	Faeces
Balantidial dysentery	Microscopical of faeces	Faeces
Bilharzial dysentery	Leucocyte and differential count	Blood in oxalate tubes (provided)
Flagellate dysenteries	Microscopical of faeces	Faeces
Syphilis	Kahn test	Serum or blood (4 c.cm.)
Leprosy	Microscopical of nasal scrapings and nodule puncture	Smears
Yaws	Microscopical of smear from lesion	Smear
Mycetoma and blastomycosis	Microscopical of pus (granules) and smear	Smear
Tropical ulcer	Smear from ulcer	Smear
Veld sore	Culture of swab from sore	Swab
	Microscopical of smear	Smear
Fungous skin diseases	Microscopical of hair, scales, etc.	Hair, scales, etc.
Bilharziasis	Microscopical of urine and faeces	Urine, faeces
	Leucocyte and differential count	Blood in oxalate tubes (provided)
Filariasis	Microscopical of blood	Thick smears
Onchocerciasis	Microscopical of extract from portion of skin near nodule	Portion of skin near nodule
Intestinal parasites: ankylostomiasis, cestodiasis, etc.	Microscopical of faeces	Faeces
Myiasis	Blood count	Blood in oxalate tubes (provided)
	Microscopical of larvae	Larvae (and adults if possible)
Anthrax	Microscopical of exudate	Smear
	Culture of exudate	Swab
Diphtheria	Culture	Swab
Gonorrhoea	Microscopical of pus	Smear
Meningitis	Microscopical of pus	Smear
	Culture of cerebrospinal fluid	Cerebrospinal fluid
Tetanus	Culture of tissue	Tissue
Tuberculosis	Microscopical of sputum	Sputum
General	Pus, exudates, etc., for bacteriological exam.	Pus, etc.
	Blood counts	Blood in oxalate tubes (provided)
	Blood grouping	Whole blood (not treated)
	Bleeding and coagulation time	Patient
	Sedimentation rate	Blood in oxalate
	Urine analysis	Urine
	Bacteriological examination of water	Water in sterile bottle
	Testing for poisons in water	Water
	Water testing for purification	Water

The personnel consists of medical officers, technical assistants, drivers, and batmen. The medical officers possess postgraduate diplomas in public health, tropical medicine, and bacteriology, and have had laboratory experience. The technical assistants have undergone training in a pathological and bacteriological laboratory. By having medical officers with public health and tropical

medicine and hygiene diplomas the use of the laboratory is extended. They are qualified to advise in the investigation and control of an outbreak of disease and can advise on matters of hygiene.

If full use is made of the laboratories and their personnel the work of the Army medical and hygiene officers should be considerably easier and the morbidity and mortality rates of the Forces in the field be considerably reduced.

Two of these mobile laboratories have been organized and staffed by the South African Institute for Medical Research and handed over to the South African Medical Corps for service in the field.

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ANTISEPTICS IN WARTIME SURGERY

In a lecture to the Pharmaceutical Society on November 14 Prof. ALEXANDER FLEMING, whose subject was "Antiseptics in Wartime Surgery," defined an antiseptic as an agent that would interfere with the growth of bacteria without of necessity killing them, though most of the tests for the potency of antiseptics took account only of their bactericidal properties. The specificity of some modern antiseptics was considerable. The effect of a given chemical upon two different kinds of streptococci differed markedly, and in the case of organisms less closely related the differences in inhibitory power were still more evident. The medium in which the antiseptics were tested also made a difference. In the case of merthiolate tested in nutrient broth a dilution of 1 in 1,000,000 inhibited the growth of the staphylococcus, but in blood a strength of 1 in 1,000 was needed to inhibit. The best medium for testing antiseptics for surgical purposes was blood.

The fate of the antiseptic in a septic wound had to be considered. In the last war a popular type of antiseptic was represented by the hypochlorites. Dakin's fluid, chloramine-T, was much used, and by Carrel's method was applied for two hours with a special series of tubes. But it was necessary to discover for how long the hypochlorites remained active in the wound. A test showed the time to be only ten minutes, so that for one hour and fifty minutes, in Carrel's treatment, there was no antiseptic in the wound at all. Some of the violet and green dyes had been much used in surgery. A point to bear in mind in connexion with dyes was their affinity for the dressings placed on a wound. Prof. Fleming conducted an experiment with gentian violet in which he showed that on pouring some of this violet dye into a test tube it was completely absorbed by the cotton-wool plug. The affinity of some dyes for cotton-wool was greater than their affinity for bacteria.

The Sulphonamide Group

Prof. Fleming went on to discuss the newer antiseptics as represented by the members of the sulphonamide group—sulphanilamide, sulphapyridine, and sulphathiazole. These were not general antiseptics. They acted specially on certain micro-organisms and had little or no action on some others. Moreover, their action was not so much a killing one on the bacteria as a stopping of their growth. The bacteria were not killed by the drugs except in high concentrations, but their growth was stopped, and the killing was done by the leucocytes in the blood.

Certain conditions influenced the action of these drugs both in the test tube and in the body. They were

influenced by the state of immunity of the body. The number of bacteria present and the introduction of a number of dead bacteria with the living ones had an enormous influence on the effect of these drugs. The presence of peptones, again, hindered their action, and pus fluid had been shown completely to neutralize them. Recently he took some pus from a wound in the chest, centrifuged it so as to obtain the clear fluid, heated and diluted it, and then added a mixture of sulphapyridine and blood, the sulphapyridine being of the strength that would just inhibit bacteria—namely, 1 in 40,000. When there was no pus fluid no growth of bacteria was obtained, but with pus fluid even diluted more than one hundred times good growth was obtained and the action of the sulphapyridine on the streptococci completely inhibited. On theoretical grounds the sulphonamides should not be very good antiseptics for wounds that were really septic.

It was apt to be supposed that the drug of choice for streptococcal infections was sulphanilamide, for pneumococcal infections sulphapyridine, and for staphylococcal infections sulphathiazole. Actually sulphathiazole was the most potent of the three, acting more strongly on all micro-organisms, and sulphapyridine was better than sulphanilamide. From diagrams which he showed to illustrate the comparative potency of these drugs it appeared that sulphapyridine was ten times more potent than sulphanilamide against the haemolytic streptococcus, and that sulphathiazole was more potent still. Sulphanilamide did not affect staphylococcal infections to any great extent in the body, but there was every reason to suppose that sulphathiazole affected them; a considerable inhibition was obtained with 1 in 60,000 sulphathiazole. In using these drugs in war surgery, however, the question of solubility came in. The usual method of application was to powder them on a wound, and one then obtained in the wound a saturated solution of the drug. With sulphanilamide the saturated solution was obtained at about 1 in 100; with sulphapyridine at about 1 in 1,000; and with sulphathiazole at over 1 in 2,000. Therefore, although the last two drugs were more potent than sulphanilamide, a higher concentration of sulphanilamide was obtained in the wound, so that the ultimate result might not, after all, be very different.

Penicillin

Recently another chemical had come under discussion. This was not a new chemical, but it was something of unknown composition made in the growth of a mould and named "penicillin." It had been used in the laboratory for over ten years as a method of differential culture and in a few cases as a local antiseptic. The drug had recently come to the fore again, workers at the Sir William Dunn School of Pathology at Oxford having got a method of extracting the active principle, not in a pure state, but as a solid mixed with some coloured body. He had obtained some of this material from Oxford and tested it against the sulphonamides. Weight for weight penicillin in the impure state was a very strong antiseptic, inhibiting some bacteria over a wide area. In estimating the comparative bacteriostatic effect against haemolytic streptococci complete inhibition was obtained with penicillin in a strength of 1 in 800,000, as compared with 1 in 200,000 with sulphathiazole. Against the staphylococcus also penicillin acted in dilutions much weaker than sulphathiazole and sulphapyridine. It was not influenced, as sulphonamide was, by large numbers of bacteria, by peptones, and by other conditions so as to nullify its effect.

Penicillin had not yet been tried in war surgery with contaminated wounds, nor would it be tried until some chemist came along and found out exactly what it was and manufactured it. Probably it was quite a simple chemical, and if it could be made in the same way as sulphanilamide was made it was likely that the popularity of the sulphonamides would diminish and their place be taken by penicillin.

Prof. Fleming concluded with a reference to the dusting-on process for applying sulphanilamide powder to wounds