Establishing a Refugee Camp Laboratory: A Practical Guide

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A PRACTICAL GUIDE

BY WARREN JOHNS, ANZIMLT

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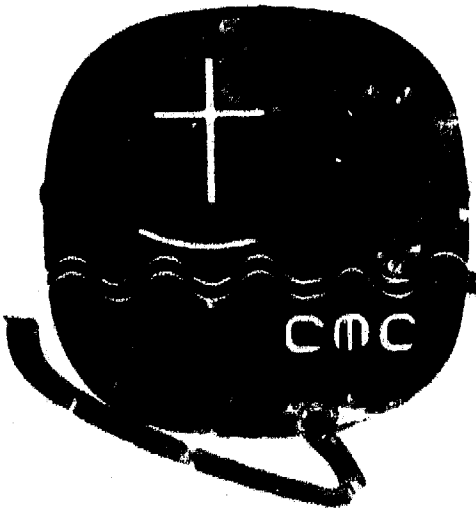

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WARREN JOHNS, ANZIMLT

January 1987

The health problems of refugees differ from those of more settled populations in two important ways. First, the initial period in most refugee camps is marked by high, and sometimes very high, levels of communicable disease, brought on by social disorganisation, food shortage, insanitary conditions and the concentration of people into a small area. Secondly, during this early period the number of skilled personnel and the level of community organisation tend to be very low. Each day, many hundreds of thousands of people may require medical assistance. The capacity to provide this, even at the most basic level, will often be limited to simple systems of symptom diagnosis and standardised treatment for a few basic diseases.

Under these conditions, a laboratory cannot possibly provide a comprehensive diagnostic service for even a small proportion of patients. The primary objective of the refugee laboratory is therefore to support and improve the services which are provided for a few common but important diseases.

Clinical diagnosis may be refined by the investigation of a small proportion of patients. For example, where many people are suffering from fevers and health workers are inexperienced the clinical diagnosis of malaria may be difficult, and it may at times be grossly overdiagnosed. The laboratory may help considerably in defining clinical judgement and the diagnosis of diseases, or by defining the importance of parasitic and other infections. On occasion, the laboratory may be able to verify the presence of relapsing fever or other diseases of epidemic importance, which are unsuspected by medical workers. It may also have a role to play in surveys of specific problems, such as anaemia. As conditions in a camp improve, the laboratory may also provide support for tuberculosis and other control programmes.

A refugee camp laboratory, therefore, does not need to be sophisticated or able to perform a large range of tests. All that is required is a small number of basic tests which are done well and which contribute medically and epidemiologically useful information.

This manual is intended chiefly for the laboratory worker who is preparing, possibly at short notice, to establish this kind of limited service in a refugee camp. It may also prove useful for laboratory workers providing similar services for non-refugee populations in rural health centres, but it is not intended to replace more comprehensive manuals, which will still be essential for detailed information.

1. PROFESSIONAL PREPARATION IN HOME COUNTRY

The most important period in preparing to work with refugees is the time spent BEFORE departing for a developing country.

A refugee camp in a remote area will not have a local laboratory supplier nor a medical book shop. Following your arrival, a few days visiting local suppliers may prove to be disappointing. Materials which were easily available at home may not be available even in the capital city. To ensure that frustration is kept to a minimum, you must prepare yourself professionally.

1.1 Planning Arrangements

- Arrange with your organisation's supplies office for the Refugee Laboratory Kit (Appendix 4) to be assembled and air-freighted to the country concerned.
- Write (or telex) to the Medical Officer in charge of the place where you will be working to request information about the diseases being found or suspected and what tests are going to be most needed.
- Prepare a list of laboratory suppliers, including telephone number, telex number, and the name of a contact person for each company. Leave a copy of this list with the supplies officer for your organisation.
- Visit or telephone local suppliers, e.g. Appendix 1, references 1, 2, 3 and 4. Collect from each supplier two product catalogues complete with ordering information, prices, and air-freight delivery arrangements.
- Spend some time in a laboratory specialising in parasitology. Become familiar with the microscopic appearance of various parasites and techniques for staining.
- Ask the supplies officer for your organisation to give you written instructions on how to order laboratory supplies. Enquire about the possibility of new staff bringing urgently needed supplies at a later date.
- Send (by airmail or telex) to the administrator of your organisation in the country concerned the list at Appendix 5, Materials for Establishing the Laboratory. Ask them to identify items that are not available locally.

- Teaching charts showing parasites, etc. should be taken to assist in training (or photocopy relevant pages from Appendix 3, references 3 and 4).
- A system should be set up for referring specimens to established REFERENCE laboratories for important investigations, e.g. a faecal specimen for Vibrio cholera.
- Enquire about the availability of blood grouping antisera and donor bags.
- Ethanol (ethyl alcohol) is often difficult if not impossible to obtain in Islamic countries; it should not be included in any refugee laboratory kit. Methanol (methyl alcohol) is a suitable replacement in most cases. Absolute pure grade (e.g. Analar) methanol is essential for the fixation of thin blood films. Technical grade methanol is adequate for all other purposes, e.g. preparing acid alcohol, 70% v/v alcohol, etc. If methanol is not available locally, you may need to make arrangements to airfreight.
- Discuss with your organisation's supplies office about the possible use of solar panels (used with vaccine refrigerators). The same solar energy powered battery may be used for the microscope. Provide information about daily load. State amps or watts drawn by load and hours of usage per day.

1.2 Purchases

Before leaving you should purchase:

- The essential text books (see Appendix 2) and pack as hand luggage. Enquire if the organisation will provide a book allowance and excess baggage allowance on the outward journey. Photocopy (for later teaching purposes) illustrations of parasite life cycles and clear illustrations of cysts etc. (See Appendix 3, references 3 and 4).
- A students' note book or memo book, A4 size, wire spine 297 x 210 mm, 45 lines per page and one plastic ring binder for holding the note book. Also five or ten clear plastic, multipunch pockets, open at top. These can be used for the laboratory technician's log book.
- Tools: 1 pair of long nose pliers, 1 junior hack saw and spare blade, 1 set of jeweller's screwdrivers and 1 screwdriver with interchangeable bits.
- Two foolscap cardboard pocket folders, both the same colour. Label each folder "Laboratory Equipment Suppliers". Make up two sets of all the suppliers' catalogues and place one set in each folder. Give one labelled folder to the supplies officer for your employing organisation and pack the other as hand luggage.

- A diamond marker (with an aluminium handle) may be useful to permanently mark slides or transport tubes (in case the labels come off).
- One tape measure, made of fibreglass, giving both inches and centimetres, analogical, 60 inches or 150 cm long, 20 mm wide.
- One box of spring type wooden clothes pegs to hang wall charts.
- A small collection of slides showing parasites will form the basis of a teaching slide set. Buy a plastic slide box to hold 50 or 100 slides for the teaching set. As an additional training aid, obtain several large prints of a mosquito (electron microscope photographs).
- Order stain pack sets for: gram stain set, 250 ml pack size RAPI - DIFF I, 500 ml pack size. Field's stain A 500 ml and Field's stain B 500 ml. (See Appendix 1, reference 4). These bottles can be placed in a well sealed tin or PVC tube with plastic base and lid. These "Emergency supply" stains can be carried as hand luggage.

2. PREPARATION ON ARRIVAL IN CAPITAL CITY

2.1 Materials for Establishing Laboratory

Ask the resident administrator of your organisation about the availability on site of the items listed in Appendix 5. Purchase items not available on site.

2.2 Local Laboratory Suppliers

Once the laboratory is established, further supplies will be needed. It is important before the refugee camp laboratory is established that a visit be made to several local laboratory suppliers in the capital city. Ask to see their store rooms and for a price list. Have doubts about a company which says that it keeps its stock in another part of town. If a price list is not available, get the price of several basic items, e.g. microscope slides, methanol, Field's or Giemsa stain, and lancets. It will take longer to get things done than at home!

Ask the local laboratory suppliers about sources of equipment, chemicals and glassware. The following may serve as a guide during your enquiry:-

Microscope glass slides
Microscope glass cover slips, 20 x 20 mm
Microscope oil
Lancets
Methanol

Visit a local blood bank and enquire about grouping antisera and donor bags.

2.3 National Reference Laboratories

The staff of the refugee camp laboratory may be asked to investigate cholera, sexually transmitted or other communicable diseases. You should therefore arrange to visit national reference laboratories in the

capital city. During a tour of these labs, your enquiries could be along the following lines.

For cholera: Where are supplies of alkaline peptone water and Cary Blair Medium? By what route should the specimens be transported? To whom should specimens be sent—name, address, telephone number? What tests are used to identify V cholera? Ask to look at V cholerae O group 1 Antiserum (Polyvalent). Is it in date? Where will serological testing be done? Which reference laboratories do they send samples to, e.g. Bangladesh? What quality control procedures are in operation?

For sexually transmitted diseases for example gonorrhoea: Can they supply Amies Transport Medium? Is a selective medium being used to isolate N. gonorrhoea? Can specimens be sent for serological testing to investigate syphilis? What tests are used and how often are they carried out? The following reference laboratories may be able to provide additional assistance:

Gonococcal Reference Laboratory
Public Health Laboratory
Myrtle Road
Kingsdown
Bristol BS2 8EL
UK
Telephone (0272) 291326

Statens Seruminstitut
Neisseria Department
80 Arnager Boulevard
DK 2300 - Copenhagen S
Denmark
Telephone (01) 952817 ext 2475
Telex 31316 SERUM DK

2.4 The Clinical Chemistry Laboratory

Visit the national clinical chemistry laboratory. Ask what tests are performed and whether or not specimens can be referred. Obtain details of the type and amount of specimen required for different tests e.g. total protein, albumin, glucose, urea and liver function tests. The clinical chemistry laboratory will also be able to advise regarding sources of chemicals and controls, and may be willing to supply you with some reagents, controls and specimen containers.

For laboratory diagnosis of viral infections

Visit the national virology laboratory. Can they handle specimens in risk group IV: maximum containment laboratory? Recommended reading

Medical Laboratory Manual for Tropical Countries, Vol 2: Microbiology by Monica Cheesbrough. (Appendix 2. reference 2). In particular: pages 17-18, pages 345-349. Laboratories with biocontainment facilities for the safe handling of risk group IV pathogens include:

Director Special Pathogens Reference Laboratory Centre
for Applied Microbiology and Research
Porton Down
Salisbury
Wiltshire
SP4 0JG
UK

Chief Special Pathogens Branch
Virology Division
Center for Disease Control
Atlanta
Georgia 30333
USA

NOTE: specimens for the Center for Disease Control should be addressed to:
Officer in Charge
United States Public Health Service
Room 2339 International Arrivals Building
Kennedy International Airport
Jamaica
NY 11430
USA

3. ESTABLISHING THE REFUGEE CAMP LABORATORY

The hardest work for the laboratory technician will be establishing the laboratory and training the staff. In some cases a site will have to be identified and a structure built. Then, once the furniture is in position, an adequate system for safe disposal of specimens decided, stains prepared and record books ruled up, new local staff can start training.

3.1 Preparing the Laboratory

The laboratory should be close to the pharmacy and injection room, and a short distance from the outpatients clinic and hospital. Construction materials will depend on what is available locally, e.g. straw mats, poles and bamboo. For the roof use a sandwich technique of black plastic sheeting between straw mats sewn together. Spend the first day observing the movement of the sun—then make windows using a sharp knife or remove walls to give the best all round lighting.

To obtain maximum sunlight (for microscope use) the laboratory should run East to West. Direct sunlight for the microscopists is to be avoided. The microscope table can be kept just out of the direct sunlight, and indirect illumination can be achieved by facing the microscope mirror towards a large white surface, e.g. white card or white sack placed over a piece of thick cardboard. Some microscopists find a cloth covering the head and part of the eyepiece gives less external light and more restful viewing.

By now you should have on site the emergency 'Lab Kit' boxes that have been airfreighted. The contents of each box should be checked off with the packing list and inspected for damage. Items that will be used regularly can be kept in the cupboard. The top shelf should be used for urine test strips, lancets, etc.; the second shelf for record books, text books and specimen collecting boxes; the third shelf for glassware, etc., and the bottom shelf for microscope slides, stains, etc. The cupboard should be locked when not in use and each trained staff member given a key.

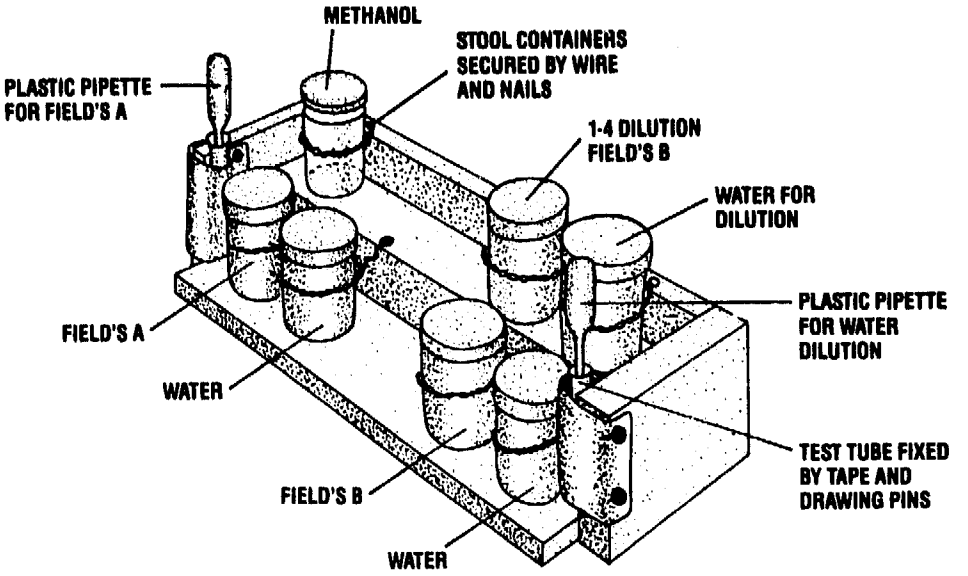
The two steel trunks should be kept in the far corner of the laboratory. One trunk should be placed 25 cm into the ground and used to store inflammable liquids. The other trunk can be used for security—two Zenith microscopes easily fit into one trunk. A length of chain can be

passed through the trunk handles and secured by padlocking onto a thick steel rod in the ground. Staff should keep a key to each trunk padlock.

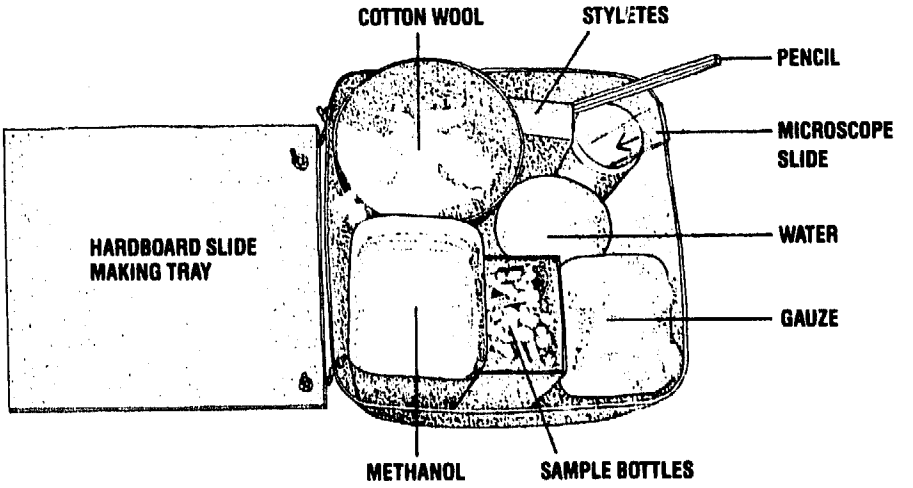
Make staining sets, e.g. Gram, Zn by cutting up Oxfam biscuit boxes (plastic) or cartons.

Don't leave cartons directly on the ground for long periods; termites may decide to make a home there and you may find the test tubes filled with soil.

FIELD'S STAIN — STAINING RACK



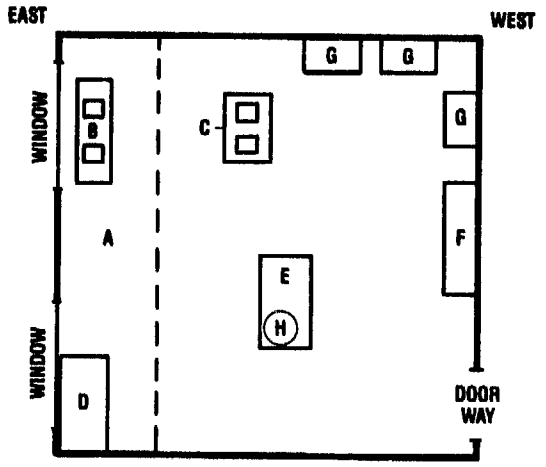
BLOOD COLLECTING BOX

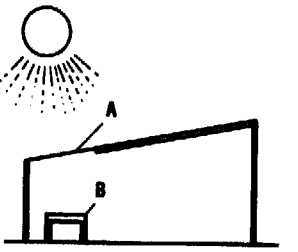


Blood collecting box made from plastic biscuit box. The hardboard slide making tray folds away under the box.

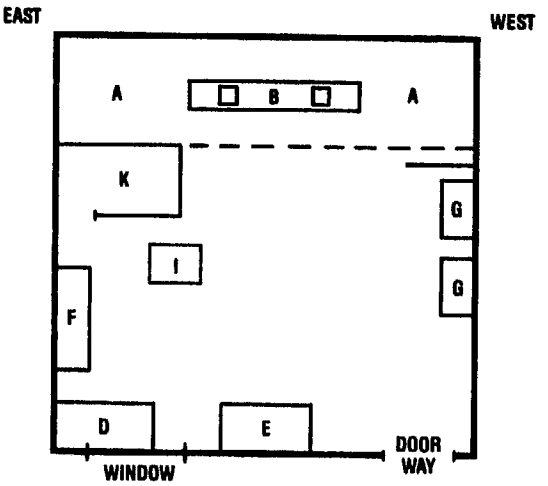
THREE REFUGEE CAMP LABORATORY LAYOUTS

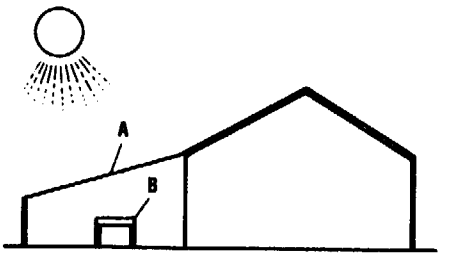
WAD KOWLI LAB



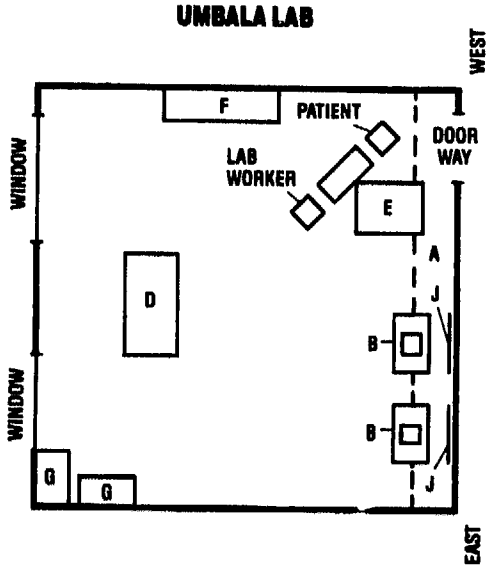


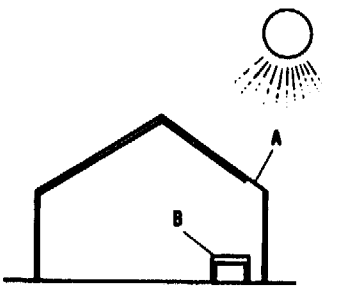
SAFAWA LAB





UMBALA LAB





A. ROOF AREA COVERED IN CLEAR PLASTIC

B. MICROSCOPE BENCH FOR SUN USE

C. TABLE FOR 2 MICROSCOPES USING ELECTRICITY (GENERATED)

D. MAIN WORK BENCH

E. TABLE FOR BLOOD COLLECTION

F. CUPBOARD

G. STEEL TRUNKS

H. WATER FILTER

I. TABLE FOR T.B. WORK

J. WHITE CARD TO REFLECT LIGHT

K. STORE ROOM

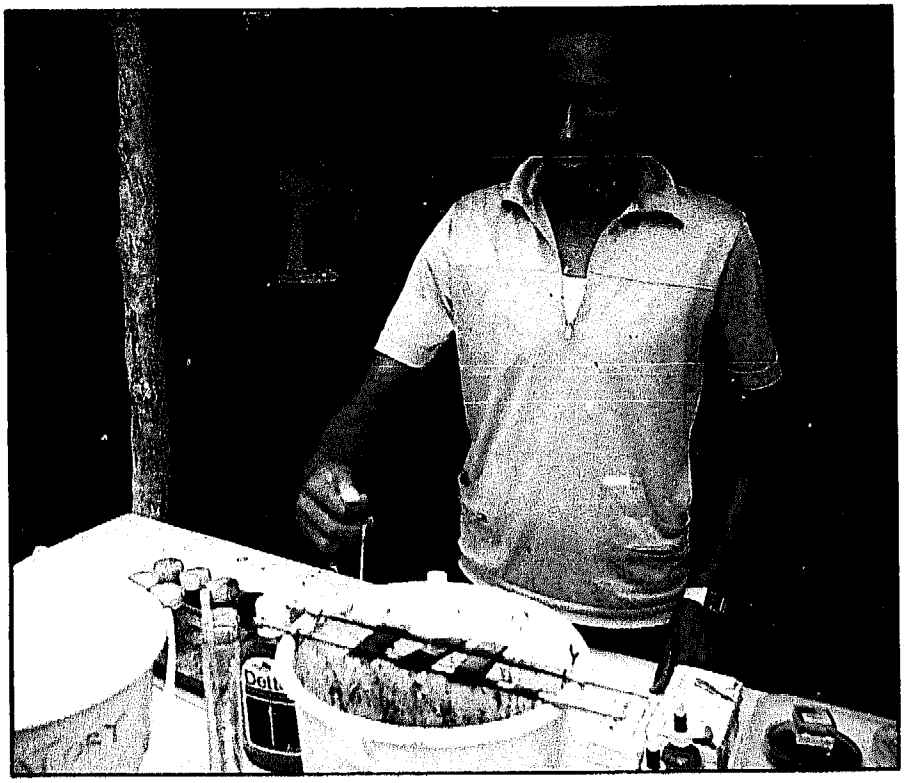
3.2 Staff Training

Hold regular teaching sessions each day for new staff. A good time is after lunch. Use the blackboard and give students ample time to make notes in their exercise books. Remember they are being taught a completely new subject in a second language—be patient. Make sure your students understand the meaning of the words—then continue. Make a point of stopping and asking your students questions to see if they understand the points being made.

Together with the students, hang on the walls (use wooden spring type clothes pegs) large charts showing malaria, stool and other parasites. Enclosed in protective plastic folders, they should be located near the microscope table.

The mai ı job during these first weeks is to train the new staff. Give as much time as possible throughout each day to work with each student. In the evening, malaria slides can be examined back in your living compound (assuming there is a generator to produce electricity). Test sets of malaria slides can be prepared from these slides and a malaria test given to the students next day. Four students at one time is a maximum for teaching. Allow a minimum of three weeks for basic skills. By working with staff on the bench you will know the needs of the staff and how the lab is working. After several weeks prepare a written examination (multiple choice).

If staff are doing something wrong how will you correct the mistake in such a way that staff will understand? On visiting a lab in a refugee camp



An Ethiopian lab worker doing a Zn stain.

in Thailand, I found the reason they were often reporting gram negative intra-cellular diplococci gonococci was because instead of using acetone-alcohol as a decolourizer, they had been using acid-alcohol as in the Zn stain method. Rather than susbstitute the correct decolourizer and leave it at that, I made use of a teaching opportunity.

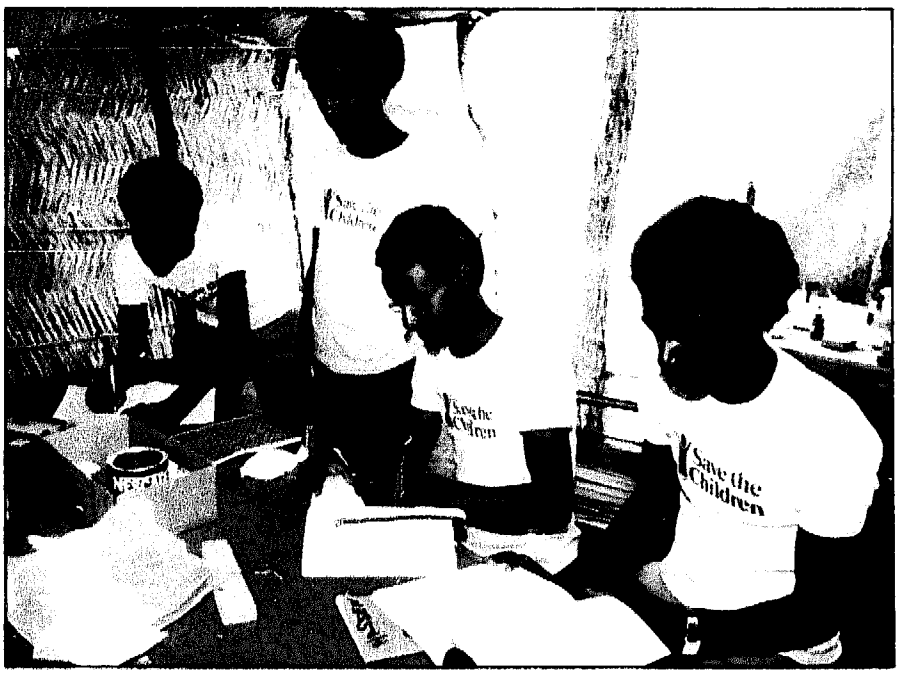
I asked someone to make two slides from three different stool samples. Each duplicate set of slides was labelled "A" and "B". I asked them to stain all the "A" slides using the gram method used in their lab. Using a gram stain pack (with the correct decolourizer) I stained the "B" set. Then we examined each pair of slides. It was soon observed that their set looked all red, and my set looked red and dark purple. This led to a discussion on different decolourizers used for gram stain and Zn stains. Together we prepared acetone-alcohol decolourizer and they learned how to prepare the decolourizer for future use.

In an informal but practical way, they had discovered their mistake and made the correction.

3.3 Laboratory Technician's Log Book

Starting with the back page, record each day the main events, staff days off and any other significant information. This will be invaluable when you are preparing monthly reports. The front of the book can be used for teaching plans, carbon copies of orders for supplies, dates when supplies arrived, copies of examinations and all reports.

A page for quantities and rate of use of supplies is useful. This invaluable book should go with you at all times and may prove to be the key to a well run laboratory.



Filling in log books at Wad Kowli.

3.4 Laboratory Tests

The range of laboratory tests required to be done will be determined in consultation with the camp's medical team. Efforts should be made to identify disease prevalence and methods which will assist in control and prevention of outbreaks of communicable diseases in the camp at an early stage.

Tests should be informative, simple and appropriate to the circumstances. Think ahead. Perhaps the refugee camp/s will still be in existence in one or two years. What tests will they be doing then? What part will the laboratory play in health care? If a T.B. programme is started, can the staff manage with the increased workload and will there be adequate supplies of alcohol needed for this work?

There is a limit to the range and number of tests that can be done in a refugee camp laboratory. Establish guidelines with medical staff, e.g. with three staff and other work, 20 malaria smears a day is a reasonable number.

Usually the main tests required will be:

A. Thick and thin blood films for malaria parasites, other blood parasites and borrelia spirochaetes.

B. Faecal tests, especially microscopy for ova, larvae, cysts, and amoebae.

C. Haemoglobin estimation.

D. Gram stain of urethral smears for gonococci.

E. Urine chemical strip tests to screen for proteinuria, haematuria and urine microscopy (e.g. cells, casts, bacteria) to investigate urinary tract infection.

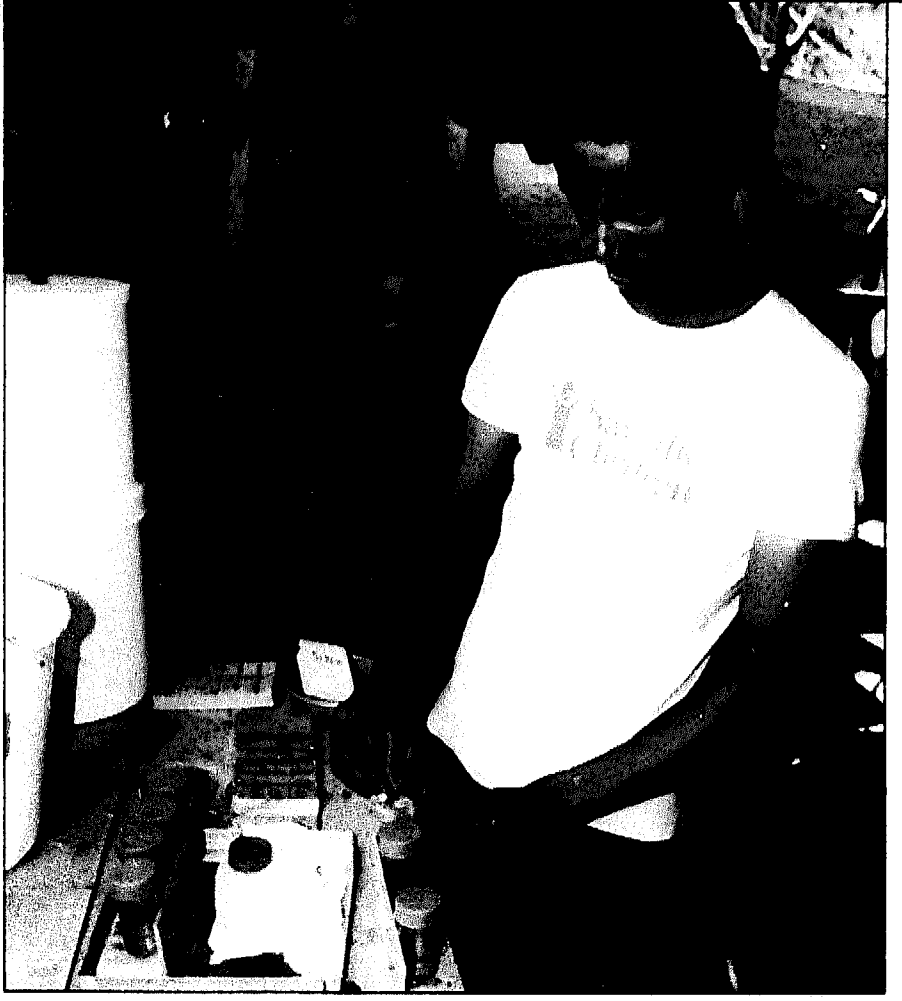
F. Zeihl-Neelsen stain for acid fast bacilli.

G. Cerebrospinal fluid tests for total protein and organisms to investigate meningitis.

H. White cell count and blood film appearances for infection and anaemia.

Depending on geographical location other parasite, bacterial and haematological investigations may be required, e.g. test for sickle cells, and the referral of faecal specimens to investigate cholera.

This practical guide does not give details of laboratory methods. References 1,2,5 and 6 in Appendix 2 provide full technical details. However, it is worth considering aspects of laboratory tests that apply particularly to refugee health care.



Lab worker at Wad Kowli doing a Field's stain.

Malaria parasites: Field's stain

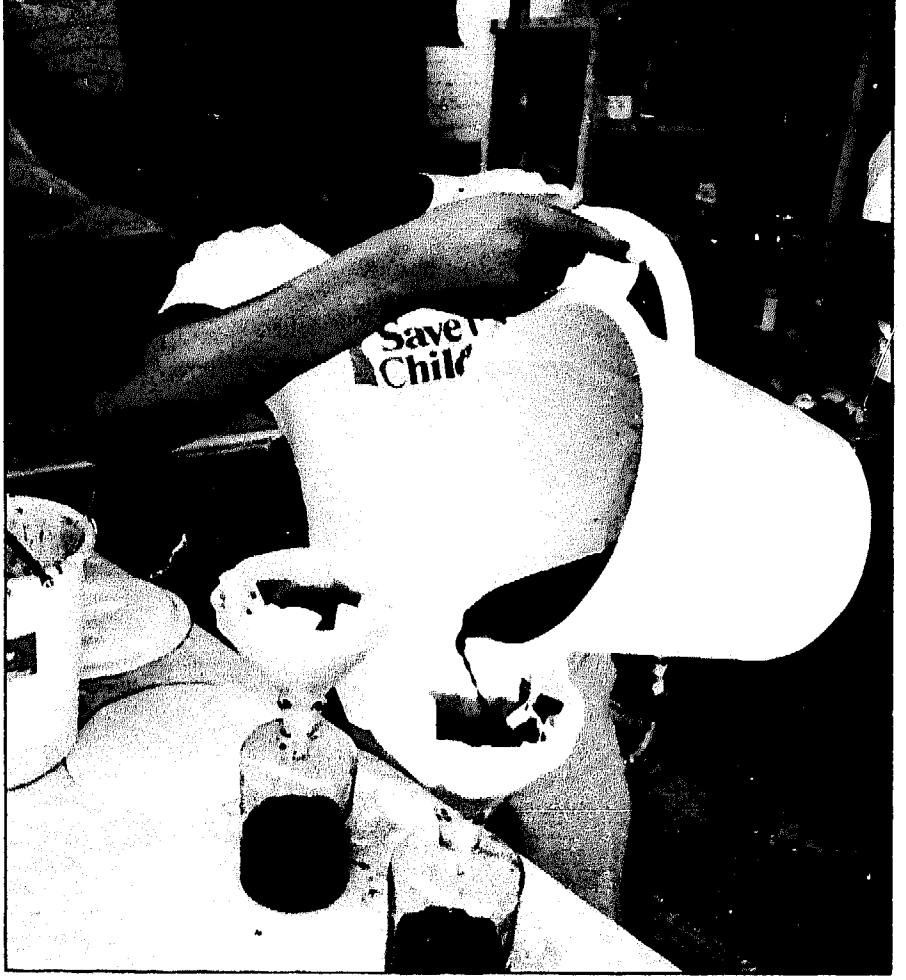
Rapid thin film technique using Field's stain

Staining of parasites can be achieved using a variation of Field's staining technique (of fixed thin blood films) from "*Practical Haematology*", by J.V. Dacie and S.M. Lewis, 6th edition, Page 54.

Method

1. Fix the thin film in methanol for 30 seconds.
2. Dilute Field's stain B, 1 part to 4 parts water.
3. Pipette 1 volume onto slide.
4. Immediately add 1 volume of Field's stain A (undiluted), mix well by blowing and stain for 1 minute.
5. Wash stain off slide with water and leave to dry.

Note: Buffered water of pH 7.0 - 7.2 has been recommended. Local water in Thailand and Sudan had a pH of 7.0 and was satisfactory for both Field's and Giemsa staining. Muddy water can be cleared by adding 1 heaped dessert spoonful of aluminium sulphate (or alum cake) to a



Field's stain is easily prepared. A lab worker filters Field's stain at Wad Kowli.

bucketful of water, mix and leave 20 minutes to settle. (The Oxfam booklet "*Safe Drinking Water*" recommends 500mg/litre.) Filtered (ceramic filter) water is an adequate substitute for distilled water (see Appendix 3, reference 17).

During refugee work in Sudan in 1985, laboratories handled 350 to 400 malaria smears each month with 1000 ml of Field's A and 1000 mls of Field's B, using both staining techniques for thick and thin films. It gives good results and in powdered form is simple to prepare.

Recommendation: Field's stain for routine use and, especially when staining freshly made dried thick films, Giemsa as an alternative. Field's stain is easy to prepare and smears can be stained quickly. The powder is simply mixed with hot clean water, allowed to cool, and then filtered.

A simple staining rack for Field's stain can be made out of wood, nails and wire. The stain is kept in clean faecal containers. Alternatively a metal rack and labelled plastic containers can be obtained from Tropical Health Technology. Your locally prepared stain can be tried out by comparing it with the old stain from the lab kit. The old stain prepared by the lab suppliers should be kept as a reference for maintaining quality control.

Make sure the staff develop the right technique for mixing the stain—by blowing. Keep the containers of stain covered when the stain is not in use. Change the water twice a day. The methanol should be

changed twice a week. The stain can be used many times. Filtering it every other day (or daily if in dusty environment) will help to keep the stain free from particles.

Rather than keeping a container of methanol in which slides are dipped, conserve methanol by applying it *to* the slide. This may be done by dropping a couple of drops of methanol onto the slide. Another method is to dip a piece of clean and soft plastic foam into methanol and gently apply this to the slide. Cotton wool has been used in this way but it can leave unwanted pieces of cotton on the slide.

Malaria parasites: Giemsa stain

Giemsa stain is particularly useful when large numbers of blood films require staining. However, remember that methanol used in preparing Giemsa stain can be difficult to obtain in Islamic countries.

Slides can be stained upside down on a glass or strong plastic tray or long plate. Two slides are glued (using PVC glue) onto a piece of glass (say 250 x 75mm); the slides should be parallel and about 70 mm apart. A plastic Pasteur pipette is used to fill the area between the slides and glass with Giemsa stain. Only a small quantity of stain need be used and any stain deposit will fall to the bottom.

Giemsa stain—a quick stain technique. This technique was used by Khmer laboratory staff in a Red Cross hospital in 1980-1981.

Preparation:

The patient's name, age, sex and location are written on a small white card. The patient's malaria smear is secured to the centre of the card by white bandage tape at the thick film end. The tape will act as a hinge during staining.

Method:

1. Fix the thin film in methanol by lifting the glass slide and dipping the thin film end in methanol. Alternatively touch the film with a piece of sponge soaked in methanol.
2. 10% concentration of Giemsa stain in a syringe, e.g. take up in a 20 ml syringe 2 ml of Giemsa stain and continue to fill up to the 20 ml mark with water. Lodge a piece of cotton wool in the needle end to act as a filter.
3. With the card and slide lying flat, drip the stain onto the smear.
4. Mix the stain by blowing and leave the film to stain for 7 minutes.
5. Rinse the film by dipping the slide in a container of filtered water. Allow the film to drain and dry.

A length of wire or strong cord can be used as a drying line. Hang each smear with its attached card over the line. A dust-free staining area should be provided by covering a table with plastic sheeting supported within a bamboo and wire frame.

Used lancets may be wiped clean then soaked overnight in 70% v/v alcohol and used again.

Plastic has been used to make a dust free staining area. Malaria smears attached to a small card are stained on the bench and later hung to dry.

Parasites in faeces

A concentration technique is not appropriate to a refugee camp situation.

Using a stick, e.g. piece of bamboo, mix a small amount of specimen with physiological saline. Cover with a coverslip. Do not make wet films too thick.

Keep two containers filled with disinfectant. In the larger one place the used slides, and in the other, the coverslips. Both slides and coverslips can be washed and reused.

Make use of a calibrated eye piece graticle to measure cyst size.

Ziehl-Neelsen method using cold carbol-fuchsin is useful for staining cryptosporidium oocysts

Should a concentration technique be necessary, modifications to the

standard formol/ether can be made: petrol can be used instead of ether. Paraformaldehyde tablets, (250 or 1000 tablets in each bottle) are available see Appendix 1, reference 19.

A concentration technique using detergent has recently been described, (see 2nd edition volume 1 Medical Laboratory Manual for Tropical Countries).

Preservation of urine

If there is any delay in examining urine specimens, add for every 100 ml of urine:

— 1 ml of Hydrochloric acid (20 drops)
— 2 ml of commercial bleach (40 drops)

(Urine processed in this way cannot be cultured. Boric acid can be used for preserving urine when culturing is required. Cells and casts are also preserved.)

3.5 A Guide to Preparing Laboratory Report Books

The fewer books and the simpler the specimen entry system the better. Use large foolscap, hard back books, one each for malaria parasites, faecal specimens and miscellaneous tests. The numbering system we used in Sudan in 1985 started with the date, followed by the specimen number. For example on the 28th the first specimen would be Lab No. 28-1, the second specimen 28-2, and so on.

The pages in the Malaria book were set out:

Malaria book

Lab No.	Patient's Name	Age	Sex	Village & Zone /House No.	Result
28-1					
28-2					
28-3					

The back page of the Malaria book was kept for recording a sample of the doctors' signatures and they were also asked to provide specimen handwriting of Blood Smear and Malaria Smear. Local health workers approved to request malaria smears did the same. This way we could check who was requesting malaria smears.

The last page in the same book was used for statistics:

Date	Total	No. Positive	Details
16.8.85	22	7	4 P fal, 2 P vivax, 1 PFPV
17.8.85	17	10	6 P fal, 4 P vivax

The Faeces book pages were set out:

Faeces book

Lab No.	Patient's Name	Age	Sex	Village & Zone /House No.	Result
28-1					
28-2					
28-3					

The same numbers system was used, so for the first faeces specimen the number would be 28-1.

Statistics for faecal specimens can be recorded daily in the back of the book, starting from the back page.

Each patient has a medical card. Alongside the test requested, write the TEST number (obtained from the laboratory report book). To avoid confusion, put a circle around all lab numbers on patients' cards. Next day the patient will return for the result—this can be found by linking the circled number on the medical card to the same number in the report book—and the result. Trained laboratory staff should write results on the patients' medical cards, especially for inpatients.

Miscellaneous book

Pages in a third hard back foolscap book can be prepared to record the results of: Haemoglobins, Urinalysis, CSF, and Gram Stains.

Method book

Before you complete your period of employment prepare a set of notes giving methods used in the lab together with addresses of local laboratory suppliers and a map showing their location.

Example of laboratory report (Kampuchea, 1980)

Monthly Report-Laboratory Aran

Date: 31.12.80 From: 29.11.80 To: 28.12.80

Bacteriology specimens

CAMP	URINE	GRAM STAIN	TB SPUTUM (Positive)	FAECES (Parasite)
Kok Tahan	7	3	4 (1)	NIL
Phnom Chat	NIL	NIL	NIL	NIL
Samet	13	25	29 (5)	48 (2)
NW 9	NIL	NIL	NIL	NIL
Nong Chan	1	8	34 (4)	28
Nong Pru	1	NIL	NIL	NIL
Taprik	7	2	1 (1)	1

Malaria monthly report

Malaria

CAMP	TOTAL	POSITIVE	P.F.	P.V.	MIXED
Kok Tahan	447	198	8	183	7
Ban Sa Ngae	346	187	34	133	20
Phnom Chat	93	37	4	32	1
NW 9	211	51	7	43	1
Samet	583	288	11	265	12
Nong Chan	538	233	18	195	20
Nong Pru	1584	1135	221	447	467
Taprik	4710	3649	1007	1927	715
Malu Kalui	917	71	96	18	7

GRAND TOTAL **8959**

Positive 5849 Negative 2110 67% Positive
P. falciparum 1326
P. vivax 3273
Mixed 1250

Example of laboratory report (Sudan, 1985)

November 1985

1. Malaria

Total number of smears	484
Number of positive	170
Number of vivax	45
Number of falciparum	101
Number of fal. + vivax	24

2. Faecal specimens

Total number of faecal specimens	67
Number of bacillary	37
Number of amoebic	7
Number of ascaris	2
Number of hookworm	4
Number of giardia	4
Number of others	5
Number of negative	15

3. Haemoglobin

Total number done	333

RESULT

Hb / AGE	2g/dl	2-4g/dl	4-8g/dl	8-10g/dl	10g/dl
0-2 yrs	—	21	72	27	10
2-5 yrs	—	12	60	33	2
5-10 yrs	1	2	26	16	15
+10 yrs	1	4	25	11	6

APPENDIX 1 LABORATORY EQUIPMENT SUPPLIERS

1 Tropical Health Technology
14 Bevills Close
Doddington
Cambridgeshire PE15 0TT
UK
Telephone: (0354) 740 825

(Non-profit supplier of equipment to developing countries and laboratory manuals).

2 Arnold Horwell Limited
73 Maygrove Road
West Hampstead
London NW6 2BP
UK
Telephone: (01) 328 1551
Telex: 28501 Horwell G

(Laboratory and clinical suppliers)

3 Astell Scientific International
172 Brownhill Road
London SE6 2DL
UK
Telephone: (01) 697 8811
Telex: 8951810

(Suppliers of laboratory equipment)

4 Paramount Reagents Limited (Laboratory Stains)
Mast House
Derby Road
Bootle
Merseyside L20 1EA
UK
Telephone: (051) 933 8350
Telex: 628178 Mast G

5 ECHO
Ullswater Crescent
Coulsdon
Surrey CR3 2HR
UK
Telephone: (01) 660 2220
Telex: 924507 ECHO G

(Supply of equipment to charity hospitals overseas)

6 Stichting I.D.A.
P.O. Box 3098
1003 AB Amsterdam
The Netherlands
Telephone: (31) (0) 2903 3051
Telex: 13566 IDA NL

I.D.A. (International Dispensary Association) was founded in 1972, and like ECHO is an independent non-profit organisation for the procurement of medical supplies.

7 Buffalo Medical Specialities Mfg. Inc.
P.O. Box 17247
14205 Myerlake Circle
Clearwater
Florida 33520
USA
Telephone: (813) 530 9991
Telex: 523405 BMS CWT

UK Distributors of BMS haemoglobinometer:

Timesco of London
22 Cleveland Street
London W1P 5FA
UK
Telephone: (01) 636 9333
Telex: 295785 TIMES G

Note: BMS Haemoglobinometer available at concessionary rate for developing countries from Tropical Health Technology. See Appendix 1, reference 1.

8 PATH (Program for Appropriate Technology in Health)
Canal Place
4 Nickerson Street
Seattle
Washington 98109
USA
Telephone: (206) 285 4599
Telex: 4740019

PATH, an international non-profit organisation, can supply pathstrips—very low cost test strips for detecting

proteinuria. Dia Tech seeks to develop appropriate diagnostic tests for use in developing countries. For further information on Dia Tech, write to:
Program Administrator/Dia Tech
c/o PATH
Canal Place
4 Nickerson Street
Seattle
Washington 98109
USA
Telephone: (206) 285 3500
Telex: 4740049 PATHUI

9 HAMLO
Secretariaat
Wilhlminapark 52
3581NM Utrecht
The Netherlands
Telephone: (030) 523 792

HAMLO (Helping Labs in Developing Countries) assists technologists in preparing themselves for overseas assignments and advises on laboratory procedures and apparatus. HAMLO provide a simple, low cost styrofoam incubator. They supply a laboratory suitcase, a small basic laboratory.

10 Milipore Corporation
11-15 Peterborough Road
Harrow
Middlesex
UK
Telephone: (01) 864 5499
Telex: 24191

Milipore Corporation
P.O. Box 255
Bedford, MA 01730
USA

11 Chief Schistosomiasis and Other Snail Borne Trematode Infections
Parasitic Diseases Programme
World Health Organisation
1211 Geneva 27
Switzerland

12 Ames Division
Miles Laboratories Limited
P.O. Box 37
Stoke Court
Stoke Poges
Slough SL2 4LY
UK
Telephone: (02814) 5151
Telex: 848337

On request, the customer service section of Ames will supply a well illustrated wall chart on urine sediments and an atlas of urine sediments.

13 Monarflex Limited
Lyon Way
St. Albans
Herts AL4 01Q
UK
Telephone: (0727) 30116
Telex: 826542

Suppliers of clear tarpaulin to cover the microscope area, manufactured from 2 layers of L D Polyethylene between which is laminated a strong polyester fibre mesh and heat bonded eyelets at a distance of 95 cm.

14 Health Unit
OXFAM
274 Banbury Road
Oxford
OX2 7DZ
UK
Telephone: (0865) 56777 Ext. 309
Telex: 83610

15 "British Berkefeld" Water Filter, available from THT and ECHO, reference 1 and reference 5. The AL Model uses ceramic elements to trap the organisms which cause bilharzia, typhoid, cholera, and dysentry. 'Sterasyl' filters are self sterilizing and last for 6-12 months. They require weekly cleaning using a brush and water (no detergent must be used).

16 Delphi Industries Limited
27 Ben Lomond Crescent
Pakuranga
Auckland
New Zealand
Telephone: 563 259
Telex: NZ21992

The Delphi Haemoglobin meter is accurate, robust and operates for extended periods on a standard 9 volt (transistor) battery. The Delphi Haemoglobin meter is also available at a non-commercial price to most developing countries from Tropical Health Technology.

17 WPA CO 7000 colorimeter, mains/battery reliable, easily maintained low cost colorimeter for absorbance readings at wavelengths from 400 - 700 nm.

Walden Precision Apparatus Limited
The Old Station
Linton
Cambridge
CB1 6NW
UK
Telephone: (0223) 892688
Telex: 817330

Note: A special low price is available for developing countries.

18 Ohaus Scale Europe Ltd.
Broad Lane
Cottenham
Cambridge
CB4 4SW
UK
Telephone: (0954) 51343
Telex: 817285 OSCALE G

Ohaus Scale Corporation
29 Hanover Road
Florham Park
NJ 07932
USA
Telephone: 201 377 9000
Telex: 136518

19 The Paraformaldehyde tablets may be ordered from:

Thompson and Capper Ltd
11 Hardwick Road
Astmoor Industrial Estate
Runcorn
Cheshire WA7
UK
Telephone: (09285) 61353

John Bell and Croyden
54 Wigmore Street
London
W1H 0AU
UK
Telephone: (01) 935 5555

Note: Each 1 gm tablet dissolved in 100 ml of water = 1% solution

20 Mix 10 ml of noditet (a shell product or nonidet P40 from BDH) and 5 ml of zaponin (Coulter Electronics, or saponin from BDH). Stand the sticks (type used for cotton wool swabs) in the solution to a depth 0.5 - 1.0 cm and leave for 30 minutes. Put the sticks into a clean container, dry for 2 hours at 50° C. Put the sticks back into the original solution in the original container and leave again for 30 minutes. Next put the sticks (whilst still in the solution container) in a 50° C incubator and leave them till completely dry.

After the initial haemolysing of the blood with the stick, haemolyse again with the same stick 15 seconds later.

21 Meddia International Slide Bank on Tropical Diseases
Royal Tropical Institute
Department Tropical Hygiene,
Section M.O.N.
Mauritskade 63
1092 AD Amsterdam
The Netherlands

Slides (unmounted) and microfiche available.

22 Foundation IMPAS
P.O. Box 596
1000 An Amsterdam
The Netherlands
Telephone: 020 656541
Telex: 10433 IMPAS NL

International Medical and Pharmaceutical Advisory Services is a non-profit foundation that advises on and mediates in buying medicines and medical equipment.

23 Medin Staal
Postbus 5026
2000 GA Haarlem
The Netherlands

Supply centrifuge requiring no mains electricity.

24 UNIPAC
UNICEF PLADS
Freeport
DK 2100 Copenhagen
Denmark
Telephone: (01) 26 24 44
Telex: 19813

This procurement and assembly centre in Copenhagen supplies medical equipment including lab items.

APPENDIX 2
TEXTBOOKS AND SLIDES

Books

The following books should be purchased prior to departure and carried out as hand luggage:

1 **Medical Laboratory Manual for Tropical Countries. Vol. 1: Clinical Chemistry and Parasitology.** by Monica Cheesbrough (Tropical Health Technology/Butterworth, 2nd Edition 1986, ELBS 1986) ELBS £2.95 plus packaging and postage. Available from Tropical Health Technology, (Appendix 1, reference 1) ISBN 0950743410.

2 **Medical Laboratory Manual for Tropical Countries. Vol. 2: Microbiology.** by Monica Cheesbrough (Tropical Health Technology/Butterworth 1st Edition 1984, ELBS 1985) ELBS £2.95 plus packaging and postage. Available from Tropical Health Technology ISBN 0407004068.

3 **Medical Parasitology.** a self-instructional text, by Ruth Leventhal and Russell F. Cheadle, 2nd Edition 1985, £25.30 available from H K Lewis & Co Ltd ISBN 0803655975.

4 **Bench Aids for the Diagnosis of Malaria.** Set No. 1 plates 1-4 and Set No. 2 plates 5-8. Illustrations by Yap Loy Fong £4.00. These teaching aids can be obtained from:

World Health Organisation
Distribution and Sales Service
1211 Geneva 27
Switzerland

or from: HMSO
P.O. Box 276
London SW8 5DT
UK

5 **ANEMIA: Fundamental Diagnostic Haematology.** by Bruce L Evatt, S M Lewis, F Lothe and James R McArthur. Published by US Dept. of Health and Human Services, Public Health Services, Center for Disease Control, Atlanta, Georgia and WHO Geneva, Published 1983. Available from:

National Technical Information Service
5285 Port Royal Road
Springfield
VA 22161
USA

6 **Manual of Basic Techniques for a Health Laboratory** World Health Organisation 1980, (Available in English, French, Spanish) ISBN 9241541458.

Notes:

A The English Language Book Society produce low-priced (between one third and a half of the price of the cheapest publishers' editions) unabridged editions of British publishers' books. Obtain a catalogue by writing to:

The English Language Book Society
The British Council
65 Davies Street
London W1Y 2AA
UK
Telephone: (01) 499 8011

B Request a copy of WHO publications catalogue. Recommended are their Technical Report Series, e.g. the Leishmaniases, Cholera.

C Medical book suppliers:
H K Lewis & Co. Ltd.
136 Gower Street
London WC15 0BS
UK
Telephone: (01) 387 4282

D It is advisable to cover the text books with clear adhesive plastic (purchased in a roll from a local stationery shop).

Slides

The Institute of Child Health produces slide sets and other teaching aids in association with TALC (Teaching Aids at Low Cost). The slide sets include texts describing each slide, usually with questions and answers. They can be viewed at the Institute of Child Health, but can only be purchased from TALC. The following slide sets are particularly useful:

Helminths: Those of importance in human disease.

Protozoa: Some of the more common protozoal diseases.

Anaemia. Reporting Blood Films A revised edition of a previous set (paediatric haematology) describing the microscopic diagnosis of common blood disorders in children.

Microscopic Diagnosis of Tropical Diseases Microscopic appearance of the agents of many tropical diseases.

Schistosomiasis and Intestinal Helminths: Microscopic Diagnosis Simple techniques for rapid quantitative diagnosis of major helminth infections.

Available from:

Teaching Aids at Low Cost (TALC)
Box 49
St. Albans
Herts AL1 4AX
UK
Telephone: (0727) 53869

or visit:

Institute of Child Health
30 Guildford Street
London WC1N 1EH
UK
Telephone: (01) 242 9789

APPENDIX 3
FURTHER READING

1 **Refugee Community Health Care** Stephanie Simmonds, ed. Oxford University Press, 1983 ISBN 019261407X

2 **Disasters.** Vol 5, No. 3, 1981 The International Journal of Disaster Studies and Practice, Relief and Development Institute, 1 Ferdinand Place, London NW1 8EE, UK.

3 **Atlas of Medical Helminthology and Protozoology** H. Jeffrey and R. Leach, Churchill Livingstone.

4 **Manual of Basic Techniques for a Health Laboratory** World Health Organisation, 1980 ISBN 9241541458.

5 **Primary Health Care in Developing Countries: A Guide to Resources in the UK** AHRTAG 1982, ISBN 0907320031. A directory for sources of information and material on all aspects of primary health care in developing countries. Available from AHRTAG, 85 Marylebone High Street, London W1M 3DE, Telephone: (01) 486 4175.

6 **A Colour Atlas of Tropical Medicine and Parasitology** W. Peters and H.M. Gilles (Wolfe Medical 2nd Edition 1981) ELBS edition ISBN 723408955. Available from 3 Conway Street, London W1P 6HE.

7 **A Medical Laboratory for Developing Countries** Maurice King. ELBS ISBN 0443035520. Available from Churchill Livingstone 1-3 Baxter's Place, Leith Walk, Edinburgh.

8 **Appropriate Technology articles** published in the British Medical Journal, ISBN 0727901575. Available from the British Medical Association, Tavistock Square, London WC1H 9JR.

9 **The Morphological Diagnosis of Human Malaria Part 1: A Morphological Study of the Erythrocytic Parasites in Thick Blood Films** John W Field, A A Sandosham, and Yap Loy Fong. Studies from the Institute of Medical Research Federation of Malaya No. 30. Printed at the Economy Printers Ltd. Kuala Lumpur, 1983.

10 **The Morphological Diagnosis of Human Malaria Part 2: A Morphological Study of the Erythrocytic Parasites** John W Field and P G Shute, Illustrated by Yap Loy Fong, Kuala Lumpur. Printed at the Government Press, by B T Fudge, Acting Government Printer. Studies from the Institute of Medical Research, Federation of Malaya No. 24. Excellent illustrations of the varying appearance of the parasite seen in red cells.

11 **Lecture Notes on Tropical Medicine,** D R Bell, 1985. Blackwell Scientific Publications Ltd, Osney Mead, Oxford OX2 0EC, UK.

12 **The Field Directors' Handbook: An Oxfam Manual for Development Workers 1985.** The Oxford University Press, ISBN 0 19 920153 6.

13 **Practical Haematology** J V Dacie and S M Lewis, 6th Edition, ISBN 0 443 019819.

14 **Introduction to Medical Laboratory Technology** F J Baker and R E Silverton, Butterworth ISBN 0 407 73252 7.

15 **Helping Health Workers Learn** David Werner and Bill Bower, Macmillan Education, 1984.

16 **Guidelines for Drinking Water Quality Vol 3: Drinking water quality control in small community supplies** WHO Geneva, 1985. ISBN 92 4 154170 9.

17 **Atlas of Infectious Diseases** J Nuegebauer, from F Hoffmann - La Roche & Co, Akitiengesellschaft, CH 4002 Basel, Switzerland.

18 **Essential Malariology** L J Bruce-Chwatt, Heinemann Medical, 2nd Edition 1985. ELBS edition ISBN 0433 045221.

19 **Laboratory Guide for Rural Health Centers in Papua New Guinea.** Write to: Laboratory Instructor, Provincial Hospital, Alotau, Milne Bay Province, Papua New Guinea.

APPENDIX 4
REFUGEE LABORATORY KIT

This kit will enable you to set up a laboratory with sufficient supplies for about one month. After this period additional supplies will need to be purchased locally or imported.

A. Microscopes

2 microscopes (monocular are adequate and cheaper than binocular models) with 10x, 40x, 100x (or 90x) objectives and 10x eyepieces. Condenser with iris diaphragm. Mechanical stage mirror. All lenses, including the sub-stage condensor should be individually wrapped and packed in the carrying case. Ask the supplier to provide one eyepiece with a calibrated eyepiece graticle (to measure cyst size). The corresponding scale should be marked on a stick-on label, placed both on the microscope body and inside the carrying case.

1 stage micrometer (specially engraved slide) for use with the eyepiece graticle micrometer-disc. 100 x 0.01 = 1 mm. If the supplier is unable to calibrate the graticle.

B. Malaria parasites

- 1000 ml Field's stain A (solution) 2 x 500 ml bottles. Cat. No. B41 (Appendix 1, reference 4).
- 5 packets of 6 grams Field's A (compound). Cat. No. D81039 (Appendix 1, reference 4).
- 1000 ml Field's stain B (solution) 2 x 500 ml bottles. Cat. No. PS42 (Appendix 1, reference 4).
- 5 packets, each of 5 grams Field's B (compound) Cat. No. D81040 (Appendix 1, reference 4).
- 250 ml Xylene.
- 1000 ml Giemsa stain, 2 x 500 ml bottles.
- 2 x 2½ litre methanol (methyl alcohol) - AR or other pure grade
- 2000 blood lancets, 8 boxes of 250 each.
- 1000 microscope slides, 10 boxes of 100 each, 76 x 26 mm, frosted end, 1 mm thick.
- 2 funnels, polypropylene, 140 mm diameter.
- 100 filter papers, 15 cm, Watman No. 1 circles.

- 2 bottles buffer tablets (phosphate), pH 6.8, (tablets to make up 1 litre).
- 2 bottles buffer tablets (phosphate), pH 7.2, (tablets to make up 1 litre).
- 6 staining jars, polypropylene, round base with screw-on lid to contain 10 slides back to back.
- 2 bottles microscope immersion oil, 100 ml bottle.
- 1 box of lens cleaning tissue, in wallets of 25 sheets, 100 x 150 mm.
- 2 steel rods (for staining) 40 cm long.
- 2 metres soft rubber tubing (to fit above steel rods and for tornique).
- 2 rolls pH indicator paper in books with several different pH ranges, (supplied by Tropical Health Technology).
- 1 measuring cylinder, polypropylene, 100 ml, graduated.
- 2 measuring cylinders, polypropylene, 25 ml, graduated.
- 1 rugged and portable Ohaus balance, sensitive to 0.01 gm (contact Tropical Health Technology) Ohaus model 505-10 (Appendix 1, reference 18).

  Note: Many of these products can be obtained at low cost from Tropical Health Technology, a non-profit organisation (see Appendix 1, reference 1).

C. Parasites in faeces

- 1000 microscope coverslips, 20 x 20 mm.
- 3 bottles each 20 grams potassium iodide.
- 3 bottles each 10 grams iodine (in brown bottle). To be used to prepare Dobell's iodine, and Lugol's iodine used in Gram stain.
- 1 centrifuge, requiring no mains electricity (contact Medin Staal, Appendix 1, reference 23).
- 2 boxes of applicator sticks, wooden, (Box of 864).
- 5 packets, each of 1 gram, eosin, Cat. No. D78029 (Appendix 1, reference 4).

D. Haemoglobins

- 1 BMS Haemoglobin meter, standard model, complete with chamber set, 100 wood haemolysis applicators, 1 calibration standard, Cat. No. 10-101 (Appendix 1, reference 7 and Appendix 1, reference 1, Tropical Health Technology for price reduction in aid organisations).

  Note: Purchase a spare chamber set, bulb and batteries.
- 1000 Saponised sticks, 10 boxes of each. (Can be made locally at one third commercial price, see Appendix 1, reference 20).
- The Delphi Haemoglobin meter. A small portable direct digital readout haemoglobin meter may be easily calibrated using the oxyhaemoglobin or cyanmethaemoglobin method. The haemoglobin meter is stable through the temperature range 0°C to 50°C and is unaffected by conditions of high

humidity. Supplier reference 18, Appendix 1. In addition purchase: 1 packet of microlitre, microcapillary pipettes, (250 each packet, with safety bulbs), ammonia, and test tubes (with lids) to hold 3 ml.

E. Gram stain

- 2 bottles crystal violet, oxalate, 500 ml.
- 1 litre acetone.
- 2 x 2½ litre methanol (methyl alcohol).
- 2 bottles neutral red, 500 ml.
- 1 Gram stain pack, in handy 250 ml dispenser bottles, Cat. No. PS47-NR (Appendix 1, reference 3). Keep for reference and backup.
- 2 Wash bottles, polyethylene, 500 ml, use integral tube spout type.

F. Zn stain for acid fast bacilli

- 2 litre carbol fuchsin
- 500 ml hydrochloric acid (some workers prefer sulphuric acid).
- 5 packets each of 1 gram malachite green (some workers prefer methylene blue).
- 2 wire loop holders.
- 10 bacteriological wire loops.
- 1 Ziehl Neelsen stain pack, Cat. No. PS153-MG (Appendix 1, reference 3).

G. Miscellaneous

- 100 swabs, sterile, individually wrapped in paper.
- 1 roll Parafilm, 50 to 80 mm wide.
- 20g EDTA (Dipotassium salt - anticoagulant). (See I below).
- 5 sachets, trisodium citrate preweighed sachets (3.8g). (See J below).
- 2 beakers, polypropylene, Tri Pour, 250 ml.
- 2000 containers: screw-capped, leakproof, polypropylene (not polystyrene), approximately 60 ml for faeces, sputum and urine (these can be washed and reused).
- 1 safety, universal pipette filler.
- 1 pi-pump 2500 model, for 10 ml (pipette filler).
- 12 reagent bottles, plastic, 500 ml, with stoppers, leakproof.

- 2 reagent bottles, brown plastic, 500 ml, with stoppers, leakproof.
- 5 stain dispensing leakproof containers (250 ml) with pouring spouts or alternatively small glass bottles (100 ml) dropping TK pattern, clear glass with ground stopper.
- 1 small brown plastic container with integral dropper (for Dobell's iodine).
- 2 small clear plastic containers with integral droppers for microscope oil and saline.
- 2 bottles Urine Reagent Strips: Ames, Hema-Combistix or equivalent, bottles of 100 Strips (Appendix 1, reference 12).
- 5 pipettes graduated, 1 ml, polystyrene.
- 5 pipettes graduated, 5 ml, polystyrene.
- 5 pipettes graduated, 10 ml, polystyrene.
- 2 measuring cylinders graduated, polypropylene, 25 ml, with stopper.
- 1 measuring cylinder graduated, polypropylene, 250 ml, with stopper.
- 1 measuring cylinder graduated, polypropylene, 500 ml, with stopper.
- 1 bottle, RAPI-DIFF 1, 500 ml, Cat. No. PS127 (Appendix 1, reference 4).
- 20 sterile screw cap glass tubes or bottles to contain 10 ml of venous clotted blood for virological specimens, e.g. blood for serological tests.
- 10 sterile screw cap tubes or bottles which contain Heparin (1 IU/IVE blood)—for culturing viruses.
- 1 Improved Neubauer Bright-Line counting chamber, 4 cover glasses.
- 1 bottle white cell diluting fluid 500 ml.
- 20 test tubes, glass, 100 x 16 mm.
- 10 centrifuge tubes, polypropylene 10 ml.
- 2 funnels, polypropylene, 95 mm diameter.
- 1 test tube holder wire, plastic coated, for above tubes.
- 2 brushes for above test tubes.
- 2 boxes of 20 ml graduated capillaries (250 each packet, with safety bulbs) for making white cell dilutions—wash and reuse.
- 20 small capped containers, plastic, suitable for white cell dilutions.
- 1 measuring jug, polypropylene, graduated to withstand high temperatures. Tall form, capacity 1000 ml.
- 5 chinagraph black pencils (glass marking).
- 1 box stick-on labels (150 approx.) 65 mm x 45 mm, removable in water.
- 1 spirit burner, all metal (non-corrosive) with spare wick.
- 500 Pasteur pipettes, plastic (for dispensing stains and TB work).
- 10 slide mailers, polythene with integral push-in lid (contact Tropical Health Technology).
- 1 spatula, polypropylene.

- 1 mechanical interval timer 60 minutes (contact Tropical Health Technology)
- 1 forceps, plastic for slides.

H. Microfilariae and schistosoma haematobium

- 4 filter holders, 13 mm diameter, at low cost from PATH and Tropical Health Technology includes silicone or rubber gasket.
- 100 filters for schistosoma eggs. Clear polycarbonate filter membranes, 12 mm pore size, 13 mm diameter (nuclepore). From PATH or Tropical Health Technology.
- 100 clear polycarbonate filter membranes, 5 mm pore size, 13 mm diameter for microfilariae. Available from Tropical Health Technology (low price) or Nuclepore Corporation.
- 1 forceps, blunt-ended stainless steel for handling filters. Available from PATH or Tropical Health Technology.
- 1 Gram methylene blue for staining microfilaria nuclei and demonstrating the presence of a sheath—use 1% solution in saline.
- 100 plastic containers for blood collection—to hold 2.5 ml of EDTA anticoagulated blood. The containers can be washed, dried, refilled with anticoagulant and used again (contact Tropical Health Technology).

I. EDTA Dipotassium salt solution 100 g/l (10%)

EDTA. 20 g
Distilled Water, 200 ml

Put 0.5 ml of the solution in each of a series of 5 ml bottles,

or

put 0.2 ml of the solution in each of a series of 2 ml bottles. Leave the open bottles to dry at room temperature overnight.

J. Trisodium citrate 38 g/l (3.8%) aqueous solution

Trisodium Citrate, 3.8 g
Distilled Water, 100 ml

Keep in a cool place. Use 1 ml of the solution per 4 ml blood. Used for filtration technique for microfilariae.

Note: When no microfilariae have been found, the filters if handled carefully may be washed and reused.

APPENDIX 5
MATERIALS FOR ESTABLISHING THE LABORATORY

- Cor mercial bleach (use as 10% solution) or 0.25% v/v Sodium hypochlorite solution containing 2500 ppm of chlorine
- 1, ½ inch paint brush (for cleaning microscopes)
- 1 blackboard
- 1 box chalk
- 5 sheets carbon paper
- 2 chains, dog chain type (to secure steel trunks)
- 3 padlocks (for cupboard and steel trunks)
- 1 door catch for cupboard padlock
- 1 water filter, (see Appendix 1, reference 15)
- 2 or 3 metres of wire (general use in lab)
- 3 foolscap hard back exercise books, 330 x 205 mm, 7 mm feints, 44 lines per page (for laboratory report books)
- 6 ball point pens, blue
- 2 ball point pens, red
- 4 pencils (with erasers)
- 1 pencil sharpener
- 6 large black (or blue) felt tip pens
- 1 tube strong glue
- 6 medium size exercise books (students' notes, etc)
- Syringes, polypropylene 5 ml and 2.5 ml needles, cotton wool gauze.
- Matches
- Hand washing soap
- Plastic basin
- 3 plastic buckets, 12 litres capacity
- 3 tables

  —1 for blood collection and writing
  —1 for microscope work
  —1 for specimen preparation and staining

  or: Sufficient wood to make three tables, saw, hammer, nails.
- Plastic sheeting to cover tables, thick.

- 4 steel straight back chairs (or 2 chairs and one microscope bench or 3 chairs and one strong stool for patients).
- 1 cupboard, steel or wood with shelves (with built-in lock if thought to be secure enough).
- 2 steel trunks with handles and catch so that each trunk can be padlocked (for microscope security and inflammable chemicals).
- Two wood slide drying racks, 200 mm x 100-130 mm. At intervals of 30 mm saw parallel grooves at approximately 60 degrees. Alternatively use stainless steel racks supplied by Tropical Health Technology.
- Scrubbing brush, large (to clean tables).
- Nail brush (to clean water filter elements).
- Clean rags (wiping slides, etc).
- 1 thermometer 0-100°C.
- Scissors
- Reagent test strips for urine testing: Hema-Combistix, Ames company; L-Combur 5 test, Boehringer company
- Scalpel blades and handle
- Adhesive tape, white