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PROPOSAL FOR A PRACTICAL COURSE IN MEDICAL ENTOMOLOGY AND VECTOR CONTROL (BURMA)

by

Mir S. Mulla, Ph.D.
I. A. H. Ismail

CE-006

Managed by Medical Service Consultants, Inc.
under contract to U.S. Agency for International Development

Authors

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I. A. H. Ismail is Entomologist, VBC Division, World Health Organization, Geneva, Switzerland.

Acknowledgement

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NOTE

As described in this document, a practical course in medical entomology and vector control occurred in Burma from November 1986 through March 1987. This report was published while the course was in progress. A critique and evaluation will be prepared when the course is completed and copies will be available through the VBC Project. It is hoped that the critique will facilitate use of this proposal as a model for similar training courses in other countries.

TABLE OF CONTENTS

GENERAL INFORMATION (SUMMARY)

Name of National Institution

Vector-Borne Disease Control Project (VBDC), Ministry of Health, Burma

Title of Course

Practical Course in Medical Entomology and Vector Control

Objectives of Course

To provide training in medical entomology and vector control for 10-12 staff members of the Vector-Borne Disease Control Project (VBDC) in Burma. They will form a core of current and future professional entomologists in charge of planning, supervision, execution, and evaluation of the many vector control activities in the country. Emphasis will be placed on providing students with basic and practical knowledge in medical entomology and giving practical training aimed at improving the effectiveness of the functions within the VBDC operations.

Duration of Project

November 3, 1986 to March 31, 1987

Funds Requested

For internal expenses see Annex 1. For materials and supplies, see Annex 4B. Budget for external consultants to be prepared by USAID/VBC Project, Washington, D.C.

Course Director

Dr. Nyunt Hlaing
Deputy Director - Malaria
Vector-Borne Disease Control (VBDC), Department of Health
Kaba-Aye Pagoda Road
Kaba-Aye P.O., Rangoon, Burma

Local Coordinator

Dr. J. Akiyama
WHO Entomologist, VBDC
c/o WHO Representative, P.O. Box 14, Rangoon, Burma

External Coordinator

Dr. R. W. Lennox
Director, Vector Biology and Control Project
1611 N. Kent Street, Suite 503
Arlington, Virginia 22209, U.S.A.

Institution Responsible for the Project

Name: Vector Borne Disease Control, Department of Health
Postal address: Kaba-Aye Pagoda Road, Kaba-Aye P.O., Rangoon
Telephone: 60516, 61161
Cable address: Anopheles Rangoon

Responsible Financial Officer

Dr. John J. Naponick
Health Development Officer
USAID/Burma
c/o American Embassy
Rangoon, Burma

ACKNOWLEDGEMENTS

During preparation of this proposal, we met and sought information and advice from officials, experts, and staff of a number of agencies in Burma. Medical officers, scientists, and staff of the Department of Health, Ministry of Health, Rangoon, were very cordial and helpful in providing needed data and information. Staff of the WHO office in Rangoon provided us with pertinent background and current information on the present status of vector-borne diseases in Burma. The staff and office personnel of the USAID/Mission in Rangoon provided assistance in preparing, typing, and reproducing this document. Our deep appreciation to all the officials and staff of these agencies and to VBC/USAID, Washington, D.C., for giving us the opportunity to be of service in the development of this worthwhile course.

Many officials, experts, and staff were contacted in the various agencies. Space does not permit us to mention of all who provided assistance and advice. The following officials, experts, and staff were visited and they greatly facilitated preparation of this proposal. Our neartfelt thanks and appreciation to:

Ministry of Health, Rangoon

Dr. U Tin U, Director General, Department of Health
Dr. U Kyaw Lwin, Director, Disease Control, Department of Health

Vector-Borne Disease Control (VBDC)

Dr. U Nyunt Hlaing, Deputy Director, Malaria
Dr. U Franco Tin, Malariologist
Dr. U Htain Win, Head, Filariasis Control Section

Dr. U Myint Htwe, Assistant Malariologist
Saw Marcus Win, Senior Entomologist
Saw Elmo, Entomologist, Filariasis Control
U Zin Aung, Statistical Officer

WHO - Rangoon

Dr. J. Galea, Program Coordinator and Country Representative
Dr. S.C. Chakrabarti, Consultant Malariologist, VBDC
Dr. J. Akiyama, Entomologist, VBDC

USAID/Burma

Mr. Earl J. Young, USAID Representative
Dr. John J. Naponick, Health Development Officer

CIDA

Mrs. H.A. Janssen, First Secretary, Development,
Canadian High Commission, Dhaka

SUMMARY

This proposal for initiating and offering a practical course in Medical Entomology is prepared in response to the prioritization of vector-borne diseases in the People's Health Plan III by the Ministry of Health of Burma, and the recommendations of the recent evaluation team which visited Burma in February, 1986. Full funding for this course has already been approved by USAID/Burma in Rangoon, provided that the proposal is also approved by the governmental authorities in Burma.

This proposal discusses the needs for such a course to upgrade the knowledge and training of the entomological staff currently employed by the Vector-Borne Disease Control project (VBDC). The duration of the course will be about five months, starting November 3, 1986 and ending March 31, 1987. Ten (10) participants meetings certain educational criteria have been selected. These students have received university education at the BSc. or MSc. level, and therefore will benefit greatly from the course.

The faculty of the course have been or will be selected on the basis of their expertise and knowledge in the areas of medical entomology, epidemiology, and control of vector-borne diseases. A mix of both Burmese and external faculty will be recruited. The bulk of the teaching will be geared to delivering lectures, carrying out laboratory and field exercises, and doing practical work. Field trips will be schedule on a frequent basis to study and observe local vector-borne disease problems. Training and experience gained in this course will be relevant to national problems relating to vector-borne diseases.

PROPOSAL FOR A PRACTICAL COURSE IN MEDICAL ENTOMOLOGY AND VECTOR CONTROL (BURMA)

RATIONALE

There is a serious shortage of professionally trained medical entomologists and vector-control specialists within the departments of the Ministry of Health. The shortage is particularly pronounced in the Vector-borne Disease Control Project, which is responsible for the control and management of malaria, Dengue/DHF, filariasis, and Japanese encephalitis. In Burma, vector-borne disease are the cause of a great deal of morbidity and considerable mortality. Malaria is foremost among these diseases. Dengue, dengue hemorrhagic fever (DHF), and filariasis are also of considerable importance.

Despite the repeated recommendations made by the external evaluation missions which visited the country annually for approximately the last five years, the VBDC project has been unable, until recently, to secure and fill the required posts of entomologists and assistant entomologists. The Ministry of Health has now succeeded in obtaining authorization for the recruitment of seven "Entomologists" and twenty "Assistant Entomologists," and has filled all of these posts. It must be noted, however, that despite the titles, most of the individuals recruited have little formal training in entomology beyond that obtained through participation in a three-week WHO/DANIDA course held in Rangoon a year ago. This amount of training is obviously inadequate to deal with the complexities of the vector-borne disease control program. One of the most serious shortcomings in connection with the training of these staff members, however, is that due to inadequate proficiency in foreign languages, they are unable to go abroad to enroll in a two-year M.Sc. course in medical entomology and vector control at recognized academic institutions.

JUSTIFICATION

For more than five years, until the end of the 1984-85 fiscal year, the Canadian International Development Agency (CIDA) provided funds in the amount of C$5,650,000 for the purchase of insecticides, spraying equipment, anti-malaria drugs, vehicles, and other supplies which assisted the Vector-Borne Disease Control Project to accomplish Phase I of its program activities. CIDA is considering the provision of an additional C$3,500,000

for the support of Phase II of the program, which is due to begin later in 1986. However, there is some concern that students from the VBDC project have not been sent abroad for advanced training in entomology. Delay in Canadian assistance would create very serious problems for the program, especially to the malaria component, which is totally dependent on the Canadian assistance.

To avert such an occurrence, the evaluation team which visited Burma in February 1986 strongly recommended that an intensive in-country training course be held in Burma for an appropriate period of time to be tailored to the actual and practical needs of the program and which will fit the educational background and current and future duties and responsibilities of the staff. CIDA has accepted such a proposal provided that the course is accepted by the Ministry of Health in Burma. The evaluation team consisted of the following members:

Dr. N.G. Gratz
Director, Vector Biology and Control
WHO, Geneva

Mrs. Helen A. Janssen
First Secretary, Development
Canadian High Commission
Dhaka (accredited to Burma)

Dr. A. Najera
Director, Malaria Action Program
WHO, Geneva

Dr. C.W.L. Jeanes
Chief, Health and Population
Canadian International Development
Ottawa, Ontario

Dr. Robert W. Lennox
Director, Vector Biology and Control
Washington, D.C.
(Consultant to A.I.D.)

Dr. J. Dick Maclean
Director
McGill Center/Tropical Diseases
Montreal, Quebec
(Consultant to CIDA)

Dr. Jean Lariviere
Senior Medical Officer
International and Intergovernmental Affairs
Health and Welfare Canada
Ottawa, Canada

STUDENTS

A total of ten (10) students has been selected from those who attended the WHO/DANIDA course held in Rangoon in March/April 1985. The selected students have met certain established

criteria. Names of students, their ages, qualifications, and present positions are shown in Annex 2.

LEARNING OBJECTIVES

The duration of the specially tailored course is approximately five months. The course is designed to train a selected group of ten (10) VBDC staff members with different educational backgrounds in order that they will form a core of professional entomologists capable of guiding the entomological and vector control component of the VBDC program, with particular emphasis on malaria. According to the current People's Health Plan (PHP) for 1986-1990, malaria is given the first priority in a list of 60 diseases.

To achieve this objective, the course is organized on the basis of formal lectures, laboratory and field work, discussions, and library assignments. A general plan of study has been developed accordingly.

Specific Objectives

Upon completion of the course the student should be able to:

Make taxonomic identification of vectors of major diseases, particularly malaria, in Burma.

Understand the morphological, behavioral, ecological, and physiological characteristics of arthropods which allow them to become successful vectors.

Understand the natural history and epidemiology of arthropod-borne diseases in relation to pathogenic agents, time, place, incidence, and prevalence of the disease.

Determine the most effective and efficient method/s of vector control suitable for application under different epidemiological/ecological situations.

Perform tasks related to monitoring of control activities and evaluations of results.

Objectives Specific to Malaria

Improve the planning and organization of entomological activities needed to collect base-line data and subsequent participation in planning, implementation and evaluation of

control measures adopted to fulfill the objectives of tactical variants (with vector control component) selected for each endemic stratum. For such planning, the participants should be able to select and standardize the appropriate entomological techniques to be employed in the above-mentioned activities.

Conduct entomological surveys as an integral part of epidemiological studies aiming at stratification of malarious areas and improvement of malaria control operations.

Organize relevant studies as an integral part of entomological investigations, e.g., monitoring changes in receptivity in certain areas, determining the nature of bioecological factors in gross failure of instituted control measures, and forecasting incipient epidemics.

Establish base line susceptibility of vectors to insecticides, and develop a system for monitoring the level of susceptibility or resistance. When resistance is confirmed, the student will be able to conduct field observations to determine the operational implications of resistance which can be used, together with parasitological data, for decision-making or replacement of the insecticide.

Compile, consolidate and analyze entomological data and, in collaboration with the malariologist, integrate these with parasitological data under various meteorological conditions for joint interpretation and reporting of findings.

Participate in and organize training courses for insect collectors.

Identify, understand, and expand the role of the community in vector control.

LANGUAGE OF THE COURSE

Lectures and instructions will be given in the English language. The emphasis will be on English in order to improve the knowledge of the participants in this language, and to provide a scientific basis for their future professional career in searching, reading, and utilizing scientific information.

COURSE CERTIFICATE

After successful completion of the course, students will be awarded a certificate issued by the Ministry of Health. This certificate should be recognized by the Government of Burma when the opportunity arises for the promotion of its holder. The certificate will indicate the sponsorship by VBC/AID and WHO.

REFERENCE BOOKS AND PERIODICALS

There is an adequate supply of books and periodicals available at the library of the Vector-Borne Disease Control Project in the areas of epidemiology and parasitology (Annex 3). USAID/Burma will purchase and add about one hundred books and periodicals in the field of medical entomology to the existing stock of the library.

PROJECT WORK

The course will consist of lectures, laboratory work, library reading, work assignments, questions and answers in the form of discussions, field trips, tests, and evaluation of the course. It is important that sufficient time be allowed for discussions. In addition, students will be required to spend a number of hours reading course material, including lecture notes and various references.

DESCRIPTION OF DIDACTIC METHODS AND STUDENT EVALUATION

Lecture

Lectures will be provided by the faculty in the lecture sessions; discussions will occur in the form of questions and answers during or immediately following coverage of each subject area. Students will be encouraged and stimulated to ask questions. All lectures will be accompanied by handouts, briefly and lucidly written. In addition, students also will be provided with other reading material to enhance their knowledge of each subjects.

Practical Laboratory Work

The practical laboratory work will enable students to recognize agents and arthropods of medical importance, especially vectors of malaria, Dengue/DHF, filariasis, and Japanese

encephalitis prevalent in Burma. It also will acquaint them with laboratory techniques required for handling and examining disease vectors.

Library Assignments

When appropriate, students will be given library reading assignments. The assignments will focus attention on subjects just presented, or will include materials pertaining to subsequent lectures, laboratory and field exercises.

Field Work

Field work will form an important component in this training program. Students will be trained in field techniques. After the course they should be able to use these techniques correctly and independently. In the field study on a selected vector control problem in malaria, students will have the opportunity to master various techniques, i.e., methods of mosquito collection, anopheline identification, dissection of salivary glands for sporozoites and stomach for oocysts, age grading, mosquito rearing in the field, mounting and preservation of material. Through this training process, students will also be trained to establish and run field studies.

Examination

The performance of students will be evaluated by tests at the end of each of the five sections, and by marks for laboratory exercises, library assignments, field study on a vector problem, and work assignments. Performance will be graded as follows:

A = 91-100
B = 81-90
C = 71-80
D = 61-70
E = Less than 61

In evaluating student performance, consideration will be given to improvement made, effort, and interest shown by the student.

Evaluation of the Course

Following the last test in section V, students will be asked to evaluate the course with respect to its organization, quantity and quality of the subjects taught, and facilities provided.

JOB DESCRIPTIONS

During the training program, the Course Director will review, develop and update job descriptions for the entomology posts. This exercise will help students to understand their duties, responsibilities and what they should do after successfully completing the course.

OPENING AND CLOSING CEREMONY

The course will be opened by the Director General of the Department of Health, Ministry of Health, Burma, or his designate, and both the WHO and USAID/Burma representatives. Similar arrangements also will be made for the closing ceremony and farewell dinner to be held on Tuesday, March 31, 1987.

LENGTH OF THE COURSE

The duration of the course will be about five months including some free time for official holidays and breaks between the various sections. Accordingly, a timetable for the course has been worked out as prescribed in Annex 5, which gives details of class hours for the five sections of the course.

SUPPLIES AND LABORATORY EQUIPMENT

A list of supplies and laboratory equipment which will be required during the course, including those items already available in the country and items which need to be purchased from abroad, has been prepared in consultation with the national authorities (Annex 4).

FACILITIES

The laboratory facilities (900 ft^2) at VBDC Headquarters are sufficient to accommodate the number of students participating in the course. However, since there is no air conditioning in the lab, it will be difficult to use microscopes and other equipment. Therefore, a request for two air conditioners is included in the equipment and supplies list.

FACULTY

The course has been tailored to fit the situation in Burma and the requirements of the VBDC project. It's success will depend to a large extent on the qualifications, experience and understanding of the faculty involved, and on the teaching methods and approaches applied. Annex 6 gives the names of some experienced lecturers and field workers who may be considered for the course. Here, the names of the faculty listed are only suggested. Some of these have not been contacted yet. USAID/VBC will make the contact and arrange for the commitment of external faculty members.

ORGANIZATION AND COURSE SCHEDULE

The course in practical Medical Entomology and Vector Control is divided into five distinct sections each between three weeks and five weeks in duration. The specific topics for each day of the course, along with the tentative assignment of lecturers, is listed in Annex 5 (Sections I-V).

Daily class schedules are to be flexible. Sufficient time will be allocated to lectures, laboratory, and library exercises as well as to short and extended field trips. The duration of the class period will be from 0930 to 1630 daily, with a 15-minute refreshment break in the morning and a one hour break for lunch. A typical daily class schedule could be as follows:

Class convenes	0900 - 0930 - Preparation
Lecture	0930 - 1100
Break	1100 - 1115
Lecture	1115 - 1230
Lunch	1230 - 1330
Lab, library, field trips	1330 - 1630

(Lectures may also be presented during the afternoon period)

The afternoon periods may be set aside primarily for laboratory-library exercises, short field trips, or visits. In addition, several all-day field trips are planned for collecting, studying, demonstration, and limited field studies. Timing of these trips should be flexible as dictated by weather and other conditions. Faculty members are urged to bring with them any specialized sampling or teaching equipment or supplies not shown in Annex 4.

Faculty members also are advised to bring with them or prepare instructional aids in advance of class. About fifteen copies of outlines, handouts, keys, illustrations, and other instructional materials should be provided by each instructor for each class when appropriate. There is no need to bring books or monographic materials except keys, especially to mosquitoes, as most of the reference materials will be made available in the VBDC library.

For instruction in general entomology and medical entomology, instructors are advised to bring sufficient numbers of specimens, either alcohol preserved, pinned or racker mounted. Many insect species will be active during the course period, even though this is the cool season in Rangoon, but there will be no time for collecting these prior to each class. For small arthropods, such as sand flies, fleas, lice, mites, ticks, and others, it will be necessary to bring in slide-mounted specimens.

For the section on Vector Control Technology, instructors are advised to have available and formulated samples of chemical and microbial control agents for bioassays in the laboratory and for limited field evaluation. Solvents such as ethanol and acetone are available in limited quantities. Most of these items including log paper, should be sent early to the USAID Mission in Rangoon.

Lectures should be prepared and presented in a plain and lucid manner. It is recommended that a great deal of visual material, such as diagrams, pictures, and demonstrations, be employed both in lectures and laboratory and field exercises. The tone of the instructional program should not be too rapid; all students with varied educational backgrounds should be able to comprehend and absorb the subject matter presented.

One final point in preparing and giving tests -- the instructors are advised to give simple tests and depend primarily on multiple choice or true and false types of questions. Test questions requiring essay answers should be avoided. The students should be encouraged to take part in class discussions and to contribute to the general knowledge by relating their experience in the field operations of the vector control program in Burma.

Section I (3 weeks, Annex 5)
General Entomology

Teaching and exercises in this section will focus attention on taxa and groups of arthropods which are of medical importance in Burma and surrounding areas. After an introduction to each group, the biology, ecology and behavior of some important members of the group will be discussed. Life history, duration of life cycle, breeding, and feeding habits of each group, as well as their distribution and habitat, will be elaborated upon. Salient points of the biology and ecology of each group having relevance to the selection of control methodologies will be emphasized. Reference to the potential effectiveness of natural control agents such as pathogens, fish, and macroinvertebrates will be made. Details of biological and naturalistic control agents will be presented in Section IV.

In laboratory exercises, the students will be provided with specimens (mature and immature stages) of several species of each group. Morphologic and other differentiating characters of the species observed will be studied and recorded. Insofar as possible, the students will be provided with pictorial or other easily constructed keys to determine the material provided to at least the generic level. For more important groups, such as mosquitoes and synanthropic flies, the specimens will be keyed to the specific level. Attempt should be made to observe and collect materials having local distribution.

It will be advisable to require a collection of 30 to 50 species of arthropods of medical importance. The students should be encouraged to do this on weekends and on their own after class hours.

Section II (5 weeks, Annex 5)
Medical Entomology

Teaching and exercises in this section will focus attention on taxa and groups of arthropods which are of medical importance in Burma and surrounding areas. After an introduction to each group, the biology, ecology and behavior of some important members of the group will be discussed. Life history, duration of life cycle, breeding, and feeding habits of each group, as well as their distribution and habitat, will be elaborated upon. Salient points of the biology and ecology of each group having relevance to the selection of control methodologies will be emphasized. Reference to the potential effectiveness of natural control agents such as pathogens, fish, and macroinvertebrates will be made. Details of biological and naturalistic control

agents will be presented in Section IV.

In laboratory exercises, the students will be provided with specimens (mature and immature stages) of several species of each group. Morphologic and other differentiating characters of the species observed will be studied and recorded. Insofar as possible, the students will be provided with pictorial or other easily constructed keys to determine the material provided to at least the generic level. For more important groups, such as mosquitoes and synanthropic flies, the specimens will be keyed to the specific level. Attempt should be made to observe and collect materials having local distribution.

It will be advisable to require a collection of 30 to 50 species of arthropods of medical importance. The students should be encouraged to do this on weekends and on their own after class hours.

Section III (4 weeks, Annex 5)
Epidemiology of Vector-borne Diseases in Burma

In this section the following aspects of the epidemiology of vector-borne diseases in Burma will be studied: history of the prevention and control of malaria, dengue/DHF, filariasis, Japanese encephalitis, plague, murine typhus, scrub-typhus and Kala-azar; host-parasite relationship; pathology; immunology, and clinical manifestations. The parasite-vector association and control procedures will also be included.

In the laboratory classes, participants will be trained in the preparation of material and identification of parasites of some of the vector-borne diseases, i.e., malaria, filariasis, leishmaniasis, and their relevant vectors. Participants will also visit the General Hospital in Takkyi Township and the Children's Hospital in Rangoon to observe clinical cases of malaria and DHF, respectively. Cases with filariasis manifestations also will be demonstrated.

This section will also include some sessions on the biology and control of rodents and their ectoparasites. Field visits will demonstrate the various activities. Participants will be also trained in field surveys of vectors/reservoirs of filariasis, DHF, plague and murine typhus. Students will be given an introduction to biostatistics on how to collect and interpret information as related to entomology, basic survey methodology including sampling techniques, and sample size determination.

Section IV (4 weeks, Annex 5)
Vector Control Technology

This is an important part of the course. It is geared to familiarize the students with the various vector control technologies with potential effectiveness against disease vectors in Burma. At the outset, various classes of chemical pesticides will be discussed, presenting some aspects of the chemistry, physical, and chemical properties of important insecticides and their uses, especially in vector control programs. Specific uses, prospects, and problems with each vector control agent will be elucidated.

In laboratory and field exercises, experiments on bioassaying chemical control agents against adult and larval stages will be carried out. Because malaria is the number one vector-borne disease in Burma, it will be necessary to limit bioassay experiments to mosquitoes. Test organisms will be obtained from the field (Aedes aegypti and Culex quinquefasciatus will be available) and used in tests. The students will learn to weigh minute quantities of insecticides, make solutions, prepare needed dilutions, and carry out tests. They will be taught how to tabulate and analyze data and to plot the data for obtaining lethal dosages or concentrations (50% and 90%) from log-dosage response lines. Once trained in these techniques, the students will be able to study and monitor resistance in Section V.

The students then will be introduced to the topic of "biological control of vectors." After a discussion of general principles, the students will be familiarized with the various groups of biological control agents. In laboratory and field exercises, the students will observe the action of biocontrol agents against mosquitoes. Definitive laboratory and field experiments will be carried out by students to determine the activity and efficacy of two microbial larvicides against mosquito larvae.

The instructors are advised to bring with them small quantities of technical and formulated materials. Except for technical malathion (ULV grade), DDT (WP), and fenthion (EC 50), no other insecticides are available at the VBDC. It is desirable that small quantities of ingredients going into formulations, as well as equipment for making small samples, be brought in by the instructors. Small quantities of formulated materials (EC, WP, S, G, SR, etc.) will be quite helpful.

Section V (4 weeks, Annex 5)
Operational Entomology in Malaria Control

This section will cover a number of topics of practical importance in malaria entomology, with particular reference to the situation in Burma. Participants will be informed of the organizational set-up of the VBDC program, its management, and functions of the various units. The role of the entomological staff, and their responsibilities and duties will be explained, including monitoring the response of disease vectors to the control measures being applied.

Participants will be given adequate training in those techniques which are used regularly in the program, i.e., mosquito identification; dissection of salivary glands for sporozoite infection, gut for oocysts and ovary for age grouping; susceptibility testing, and preparation of blood smears for precipitin testing.

Studies will be made on the mechanism of resistance to chemicals and development of a scheme for detecting and monitoring resistance in Burma. In laboratory sessions, mosquito adults and larvae will be tested for their susceptibility to insecticides, appropriate forms will be completed, and results will be interpreted.

Ecological factors associated with the prevalence of malaria vectors will be used in an exercise to establish criteria for the determination, mapping, and monitoring of receptivity as applicable to Burma.

Students will participate in an exercise to develop an entomological plan of work based on the objectives of the program and available resources and manpower. Participants will also learn how to compile, analyze, and interpret entomological data in correlation with the parasitological data.

Community participation in vector control is another important topic in this section. Students will learn about the approaches used in promoting community participation through health education. During a field visit to one of the villages selected for this purpose, participants will discuss with the villagers their role in vector control. They will also carry out a survey to determine the number of villagers using mosquito bed-nets as personal protection. As part of the exercise, students and villagers will be trained in the technique of impregnating mosquito bed-nets with permethrin. About ten nets will be used for this purpose and later distributed to the villagers.

ANNEX 1

LIST OF LOCAL EXPENSES
(Five Months)

	Kyats
Students' per diem: 7 students (at K1,200/month each)	42,000
5 students (at K600/month each)	15,000
Honoraria for national faculty (K80/day, 100 man-days)	8,000
Course Director (K80/day, 100 days)	8,000
Course secretary--with good typing and English language skills (K900/month)	4,500
Teaching aide (K400/month)	2,000
Stationery and office supplies locally available	2,000
Local transportation	45,000
Opening ceremony for students, faculty and invited guests	1,000
Refreshments during the course breaks	6,000
Presentation and awarding of certificates	1,000
Farewell dinner, faculty, students and invited guests	6,000
Miscellaneous expenses and contingencies	4,000
TOTAL	144,500

ANNEX 2

TENTATIVE LIST OF PARTICIPANTS*

No.	Name	Age	Qualifications	Present Assignment
1	U Htay Aung	35	B.Sc. (Zool.)	Assistant Ent. Mon State (Mal.)
2	U Thant Tun	27	B.Sc. (Zool.)	Assistant Ent. Tenasserin Division (Mal.)
3	Daw Zin Mar Phone	25	B.Sc. (Zool.)	Assistant Ent. Pegu Division (Mal.)
4	U Abraham	30	B.Sc. (Zool.)	Assistant Ent. Kaya State (Mal.)
5	Daw Mar Mar Win	29	M.Sc. (Zool.)	Assistant Ent. HQ Rangoon (DHF)
6	U Myo Thant	36	M.Sc. (Zool.)	Assistant Ent. Kachin State (Mal.)
7	U Zaw Winn	36	M.Sc. (Zool.)	Assistant Ent. Mandalay Division (Mal.)
8	U Maung Maung Win	37	M.Sc. (Zool.)	Assistant Ent. HQ Rangoon (Fil.)
9	U Maung Maung	39	B.Sc. (Zool.)	Entomologist, Mandalay Division (Mal.)
10	Daw Khin Khin Nu	38	B.Sc. (Zool.)	Entomologist HQ Rangoon (Mal.)

*One or two additional participants may be added to this list from the staff of Rodent Control Demonstration Unit (RCDU) or VBDC.

ANNEX 3

LIST OF SUGGESTED READING AND TRAINING MATERIAL*

1. Brooks, J.E. & Row, F.P. Commensal Rodent Control. WHO published document WHO/VBC/79.726, 1979, 109 pp.

2. Bruce-Chwatt, L.J. Essential Malariology. William Heinemann Medical Books Ltd., London, 1985, 2nd edn.

3. Fontaine, R.E. House Spraying with Residual Insecticides with Special Reference to Malaria Control. WHO published document WHO/VBC/78.704, WHO/MAL/78.904, 1978, 28 pp.

4. Harrison, B.A. & Scanlon, J.E. Medical entomology studies-II. The subgenus Anopheles in Thailand (Diptera: Culicidae). Contributions of the American Entomological Institute (1975), 12 (1), 1-307.

5. Ismail, I.A.H., Notananda, V. & Schepens, J. Studies on Malaria and Responses of Anopheles balabacensis balabacensis and Anopheles minimus to DDT residual spraying in Thailand. I. Pre-spraying observations - Acta trop. (1974), 31, 129-164.

6. Ismail, I.A.H., Notananda, V. & Schepens, J. Studies on Malaria and Responses of Anopheles balabacensis balabacensis and Anopheles minimus to DDT residual spraying in Thailand. II. Post-spraying observations - Acta trop. (1975) 32, 206-231.

7. MacDonald, G. The Epidemiology and Control of Malaria. London, Oxford University Press, 1957, 201 pp. + Appendices.

8. Mount, G.A. Ultra-low Volume Application of Insecticides: A Guide for Vector Control Programmes. WHO unpublished document WHO/VBC/79.734, 1979, 15 pp.

9. Palestina, R. Prevention, Diagnosis and Treatment of Insecticide Poisoning. WHO unpublished document, WHO/VBC/84.889, 1984.

10. Reid, J.A. Anopheline Mosquitoes of Malaya and Borneo. Studies from the Institute for Medical Research, Malaysia, 1968, 520 pp.

11. Rao, T.R. The Anophelines of India, (revised edn). Malaria Research Centre, Indian Council of Medical Research, New Delhi, 1984, 518 pp.

12. Service, M.W. Mosquito Ecology. Field sampling methods. Applied Science Publishers, London 1976, 583 pp.

13. World Health Organization. Manual on Environmental Management for Mosquito Control, with Special Emphasis on Malaria Vectors, WHO offset publication No. 66, 1982.

14. World Health Organization. Manual on Practical Entomology in Malaria. Part I, 160 pp. and Part II, 191 pp. (1975).

15. World Health Organization. Chemical Methods for the Control of Arthropod Vectors and Pests of Public Health Importance, Geneva, WHO, 1984.

16. World Health Organization. The WHO-Recommended Classification of Pesticides by Hazard and Guidelines to Classification 1986-87. Unpublished document VBC/86.1.

17. World Health Organization Technical Report Series No. 649, 1980. (Environmental Management for Vector Control. Fourth report of the Expert Committee on Vector Biology and Control).

18. World Health Organization Technical Report Series No. 679, 1982. (Biological Control of Vectors of Disease. Sixth report of the WHO Expert Committee on Vector Biology and Control).

19. World Health Organization Technical Report Series No. 688, 1983. (Integrated Vector Control. Seventh report of the Expert Committee on Vector Biology and Control).

20. World Health Organization Technical Report Series No. 720, 1985. (Safe Use of Pesticides. Ninth report of the Expert Committee on Vector Biology and Control).

21. World Health Organization Technical Report Series No. 702, 1984. (Lymphatic filariasis. Fourth report of the Expert Committee on Filariasis).

22. World Health Organization Technical Report Series No. 701, 1984. (The Leishmaniasis. Report of an Expert Committee).

23. World Health Organization Technical Report Series No. 721, 1985. (Viral Hemorrhagic Fevers. Report of an Expert Committee).

24. World Health Organization Technical Report Series No. 719, 1985. (Arthropod-borne and Rodent-borne Viral Diseases. Report of a Scientific Group).

25. World Health Organization Technical Report Series, 1985. (Resistance of Vectors of Disease to Pesticides. Report of an Expert Committee on Vector Biology and Control).

26. World Health Organization. Vector Control Series, Training and Information Guide, Fleas. Unpublished document VBC/TS/85.1, 1985, 55 pp.

27. World Health Organization. Vector Control Series, Training and Information Guide, Bed-bugs. Unpublished document VBC/TS/85.2, 1985, 26 pp.

28. World Health Organization. Vector Control Series, Training and Information Guide, Lice. Unpublished document VBC/TS/85.3, 1985, 35 pp.

29. World Health Organization. Vector Control Series, Training and Information guide, Cockroaches. Unpublished document VBC/TS/85.4, 1985, 37 pp.

30. World Health Organization. Vector Control Series, Training and Information Guide, The Housefly. WHO unpublished document WHO/VBC.

*This list of books and technical documents will be expanded by the addition of books and periodicals in Entomology and Medical Entomology.

ANNEX 4

LIST OF EQUIPMENT AND SUPPLIES

A. Items Available at VBDC

A fairly good amount of equipment and supplies is available at VBDC. Those supplies and equipment not available locally are listed under B in this Annex. The following items were noted to be present at VBDC and in working condition (equipment works on 220 volts only):

Item	Quantity
Overhead projectors (3M)	2
Movie projector - 16MM	1
Auxiliary power generator	1
ULV truck mounted generators (London Air)	3
Malathion ULV grade (96% tech)	200 gal
Fenthion EC 50 for larviciding	200 gal
Heating ovens	2
Desiccators	2
Mosquito body anatomical models	10
Books and periodicals on epidemiology (approx.)	50
Books and periodicals on entomology	Scarce
Stencil cutter Gestetner 1573	1
Dissecting microscope stage	26
Compound microscopes	3
Stereo microscopes - including zoom	12
Hygrometers	6
Petri dishes	12
Larval dippers	10
Larval bowls (6 1/2 cm diam)	17
Tally counters	10
Dropping bottles	20
Pipettes (various capacities)	24
Hand sprayers	20
Insect boxes	12
Snap cap bottles	50
Eth alcohol (can get more)	1/2 bottle
Enamel trays (19 x 14 x 5 cm)	5
Enamel trays (40 x 23 x 5 cm)	9
Enamel trays (21 x 9 x 4 cm)	5
Vials	10

B. Items Needed from Abroad

The following equipment, supplies and materials are deemed essential for the proper conduct of a course in medical entomology in Rangoon, Burma. Most of the items listed will also be usable and necessary for future courses, training workshops and technical meetings. The quantities indicated below are the minimum required. Cost breakdown and specifications of supplies will be identified later.

Item	Quantity	Make
Transparencies for overhead projector (sheets)	500	
Transparencies for overhead projector (roll)	5	
Color pens for above transparencies	4 sets	
Carousel 35mm slide projector (zoom lens) 220 volt, 50 Hz	1	Kodak
Spare lamps for 35mm carousel projector, 220 volt, 50 Hz	2	Kodak
Magazines 80 slides each	5	Any
Air conditioners (12000-13000 BTU ea) 220 volt, 50 Hz	2*	Any
Hand lenses 10-15X	15	Any
Dissecting needles	20	Bioquip
Insect pins #2	10,000	Bioquip
Forceps - several kinds	20	Bioquip
Wax pencils for writing on glass	10	
Flashlights - 2 battery capacity	10	
Alkaline rechargeable batteries - doz.	5	
Charger for batteries - 220 volt	2	
Paper cups - 4 oz treated - cartons	2	Dixie-Marathon
Pencil sharpeners, crank	2	
Mosquito bed-nets	10	
Screw cap glass vials 3 dr doz	5	
Petri dishes 10 cm	12	
Nylon plastic screen - roll	1	
Graduate cylinders, 50 and 100 ml plastic glass	5 ea	
Volumetric flasks, 50 and 100 ml	5 ea	
Filter paper 10 cm diam - boxes	6	
Adult mosquito susceptibility test kit	2	WHO
Impregnated papers for above		
DDT 4% in boxes	5	WHO
Malathion 5% in boxes	4	WHO
Control in boxes	5	WHO

Item	Quantity	Make
Larval mosquito susceptibility test kit	2	WHO
Insect nets - short handle	15	
Stapler with staples	2	
3-hole paper punch	2	
Pinning blocks	10	
Propipettes	5	
Stationery, 3-ring folders	15	
Min-max thermometer	5	Taylor
Cover slips for slides - boxes	5	
Mounting medium - 2 oz bottle	2	
Insecticides - tech & formulated	Consultants	
Schmidt boxes	15	
Point punch	2	
Index cards (4x6) lined (packet)	6	
Stencils for Gestetner 1573 and fluid (pack and qts)	2	
Sieves (set)	1	
Dip nets	5	
Fish nets	2	
Lens paper (packet)	5	
Films (16mm) on Medical Entomology	4	

*There is urgent need for two air conditioners to allow efficient use of laboratory equipment especially microscopes during this course as well as future courses and training programs.

ANNEX 5

COURSE IN MEDICAL ENTOMOLOGY AND VECTOR CONTROL
NOVEMBER 3, 1986 - MARCH 31, 1987

DAILY SCHEDULE OF CLASSES

SECTION I - GENERAL ENTOMOLOGY (3 weeks)

Date	Subject/Type of Learning Experience	Hours of Class		
		Lecture,	Lab,	Library, Discussions
Nov. 3	Opening Ceremony - Director of Course	morning		
	Address by Director General - Dept. of Health	morning		
	Address by A.I.D. and WHO reps	morning		
	Refreshments	morning		
	Introduction to course	morning		1
Nov. 4	Purpose of course: Importance of vector-borne diseases to Min. of Health, Government and relation of course to control	1		
	Use and care of optical equipment	1		1
	Use, maintenance, and upkeep of library and lab	2		2
Nov. 5	Arthropods; classification, nomenclature, classes, orders, families, genera, etc.	3		3
Nov. 6	External morphology - mature and immature	2		4
Nov. 7	Internal morphology - mature and immature	3		4
	Circulatory and excretory systems			
Nov. 10	Nervous and respiratory systems	2		4
Nov. 11	Reproductive and digestive systems	2		4
Nov. 12	Review and test		All day	
Nov. 13	Insect ecology	3		3
Nov. 14	Aquatic ecology	3		3

ANNEX 5 (cont.)

SECTION I - GENERAL ENTOMOLOGY (3 weeks)

Date	Subject/Type of Learning Experience	Hours of Class	
		Lecture,	Lab, Library, Discussions
Nov. 17	Larval habitats	2	4
Nov. 18	Predator, parasite, prey interaction	3	3
Nov. 19	Population dynamics - adult and larval	3	3
Nov. 20	Review and test	All day	

ANNEX 5 (cont.)

SECTION II - MEDICAL ENTOMOLOGY (3 weeks)

Date	Subject/Type of Learning Experience	Hours of Class		
		Lecture, Lab, Library, Discussions		
Nov. 21	Medical entomology - history, definitions, mechanisms of transmission	6		0
Nov. 24	Cockroaches - Blattaria	2		4
Nov. 25	Bed bugs - Cimicidae and kissing bugs - Reduviidae	3		4
Nov. 26	Holiday	-		-
Nov. 27	Biting flies - Psychodidae	2		4
Nov. 28	Biting flies, cont'd. Ceratopogonidae and Simuliidae	3		4
Dec. 1	Biting flies, cont'd. Tabanidae (short field trip)	2		4
Dec. 2	Field trip		All day	
Dec. 3	Review and test		All day	
Dec. 4	Mosquitoes - introduction and biology	3		3
Dec. 5	Mosquitoes - ecology	3		3
Dec. 8	Mosquitoes - behavior	3		3
Dec. 9	Mosquitoes - Aedes, Anopheles, Culex	3		3
Dec. 10	Field trip - mosquitoes' breeding sites, resting sites, sampling		All day	
Dec. 11	Synanthropic flies - Calliphoridae and Sarcophagidae	2		4
Dec. 12	Synanthropic flies - Muscidae and Myiasis	3		4
Dec. 15	Field trip		All day	
Dec. 16	Ticks and tick-borne diseases	2		4
Dec. 17	Mites and mite-borne diseases	4		4

ANNEX 5 (cont.)

SECTION II - MEDICAL ENTOMOLOGY (3 weeks)

Date	Subject/Type of Learning Experience	Hours of Class	
		Lecture, Discussions	Lab, Library,
Dec. 18	Venomous insects and arthropod allergy	4	4
Dec. 19	Fleas - Siphonaptera and diseases it transmits	4	4
Dec. 22	Lice - Anoplura and diseases it transmits	2	4
Dec. 23	Field trip	All day	
Dec. 24	Review and test	All day	
Dec. 25	Holiday	-	-

ANNEX 5 (cont.)

SECTION III - EPIDEMIOLOGY (4 weeks)

Date	Subject/Type of Learning Experience	Hours of Class Lecture, Lab, Libra Discussions	
Dec. 26	Organization, management and evaluation of the VBDC program in the Ministry of Health	3	3
Dec. 29	History of malaria and malaria control in Burma	3	3
Dec. 30	Malaria control and malaria eradication programs	3	3
Dec. 31- Jan. 4	Holidays	-	-
Jan. 5	Life cycle of malaria parasite, preparation of blood smears, staining, and examination	2	4
Jan. 6	Chemotherapy, examination of blood slides, cont'd.	2	4
Jan. 7	Malariometric surveys, geographical reconnaissance, investigation of malaria cases	2	3
Jan. 8	Visit to Taikkyi Township Hospital to observe clinical cases of malaria and primary health care in malaria control	All day	
Jan. 9	Review and test	All day	
Jan. 12	Ecology and distribution of malaria vectors in Burma	2	1
Jan. 13	Identification of malaria vectors - adults and larvae	1	5
Jan. 14	Identification of malaria vectors - adults and larvae	1	5
Jan. 15	Human ecology and malaria transmission in the different topographical areas of Burma	2	-
	Host preference, preparation of blood smears for precipitin testing	1	3
Jan. 16	Age grouping, dissection of ovary, and identification	2	4

ANNEX 5 (cont.)

SECTION III - EPIDEMIOLOGY (4 weeks)

Date	Subject/Type of Learning Experience	Hours of Class Lecture, Discussions	Lab, Library
Jan. 19	Dissection of salivary glands and mid-gut	1	5
Jan. 20	Methods of mosquito collection, resting habits	2	4
Jan. 21	Field trip		All day
Jan. 22	Review and test		All day
Jan. 23	Filariasis - distribution worldwide, prevalence in Burma, transmission cycle, manifestations, survey, and chemotherapy	3	3
Jan. 26	Filariasis, cont'd.	2	1
	Dissection of Cx. quinquefasciatus and identification of different stages of filaria larvae	1	2
Jan. 27	Cx. quinquefasciatus - breeding habits and field survey	2	4
Jan. 28	Dengue/DHF - distribution worldwide, prevalence in Burma, clinical aspects, diagnosis (including visit to the children's hospital)	3	3
Jan. 29	Vectors of DHF in urban and rural areas of Burma - breeding habits and surveys	2	4
Jan. 30	Japanese encephalitis -- distribution, prevalence, diagnosis, control, and vector identification	3	3
Feb. 2	Plague and murine typhus - prevalence, transmission cycles, surveys, and diagnosis	4	4
Feb. 3	Biology of rodents, fleas -- identification, and control	3	4
Feb. 4	Biology of rodents, cont'd.	2	4
Feb. 5	Scrub typhus - prevalence, transmission, control, and vector identification	3	1

ANNEX 5 (cont.)

SECTION III - EPIDEMIOLOGY (4 weeks)

Date	Subject/Type of Learning Experience	Hours of Class		
		Lecture	Lab, Library, Discussions	
Feb. 6	Kala-azar - prevalence, parasite, vectors, transmission cycle, diagnosis, and control	2		1
Feb. 9	Review and test		All day	
Feb. 10	General statistics	2		4
Feb. 11	Statistics used in malariology	2		4
Feb. 12	Holiday	2		4
Feb. 13	Statistics used in malariology, cont'd.		All day	

ANNEX 5 (cont.)

SECTION IV - VECTOR CONTROL TECHNOLOGY (4 weeks)

Date	Subject/Type of Learning Experience	Hours of Class Lecture, Lab, Library, Discussions	
Feb. 16	Pesticides - use and evaluation in vector programs - WHO scheme	3	3
Feb. 17	Organic insecticides - toxicity, safe use, and environmental concerns	3	3
Feb. 18	Equipment used in pesticide application	2	6
Feb. 19	Formulations of pesticides and microbials - EC, FC, WP, S, AS	2	4
Feb. 20	Adulticides in vector control, residual sprays, ULV, and others	2	4
Feb. 23	Formulations - slow release and granules (testing for release in lab)	2	4
Feb. 24	Larvicides in vector control (bioassay principles, dosage response lines)	2	4
Feb. 25	Larvicides in vector control (bioassays, dosage response lines)	2	4
Feb. 26	Review and test	All day	
Feb. 27	Monolayer films, petroleum oils, and synthetic pyrethroids - joint action	2	4
Feb. 28	Insect growth regulators (IGRs) - properties, uses, environmental concerns	3	4
March 2	Biological control of vectors - larvirorous fish, fungi, and nematodes	2	4
March 3	Biological control of vectors - microbial larvicides (bioassay - dosage response lines)	2	4
March 4	Biological control of vectors - microbial larvicides (bioassay - dosage response lines)	2	4
March 5	Biological control of vectors - natural control, macroinvertebrate predators	2	4

ANNEX 5 (cont.)

SECTION IV - VECTOR CONTROL TECHNOLOGY (4 weeks)

Date	Subject/Type of Learning Experience	Hours of Class Lecture, Lab, Library, Discussions	
March 6	Larvicides in vector control (field tests/ Culex, Aedes)	-	6
March 9	Larvicides in vector control (field tests/ Culex, Aedes)	-	6
March 10	Environmental impact of pesticides and biocontrol agents	2	4
March 11	Environmental management in vector control programs - water	3	3
March 12	Environmental management in vector control - habitat	3	3
March 13	Principles of insecticide resistance	2	-
	Detection and monitoring of resistance	2	2
March 16	Insecticide susceptibility tests - adults and larvae	2	4
March 17	Insecticide susceptibility tests, cont'd.	1	5
March 18	Parasitological and entomological investigations to determine the impact of insecticide resistance on malaria transmission	2	1
March 19	Malaria receptivity - determination and application in Burma	2	4
March 20	Planning of entomological activities in malaria control	2	4
March 23 - 24	Community participation and primary health care - field visit to a village in Taikkyi Township	2 days	
March 25	Holiday	-	-
March 26	Compilation, analysis, and interpretation of entomological data	2	4
March 27	Holiday	-	-

ANNEX 5 (cont.)

SECTION IV - VECTOR CONTROL TECHNOLOGY (4 weeks)

Date	Subject/Type of Learning Experience	Hours of Class Lecture, Lab, Library, Discussions
March 30	Review and test	All day
March 31	Evaluation of course by participants Closing ceremony and presentation of certificates	2

ANNEX 6

LIST OF PROPOSED FACULTY

A. Nationals

	Name	Position
1.	Dr. Nyunt Hlaing	Deputy Director Malaria
2.	Dr. Franco Tin	Malariologist, VBDC
3.	Dr. Htain Win	Head Filariasis Control Section VBDC
4.	Dr. Myint Thein	Head Arbovirus Section, VBDC
5.	Saw Marcus Winn	Senior Entomologist, VBDC
6.	Dr. Myint Htwe	Assistant Malariologist, VBDC
7.	U Kyaw Zaw	Entomologist, VBDC
8.	Dr. Hla Naing	Chief Rodent Control Demonstration Unit (RCDU)
9.	U Pe Than Htun	Zoologist, RCDU
10.	U Maung Maung Tun	Entomologist, RCDU
11.	Lt. Col. Kyaw Win	
12.	U A. Sebastian	Senior Research Officer, Department of Medical Research

B. External Consultants

1.	Dr. Jay Graham	Director, South Salt Lake County Mosquito Abatement District
2.	Dr. Norman Gratz	Former Director, World Health Organization
3.	Dr. Adel Ismail	Scientist/Entomologist, Division of Vector Biology & Control, World Health Organization
4.	Dr. Robert Lennox	Project Director, Vector Biology & Control Project
5.	Mr. Michael MacDonald	Graduate Student, Johns Hopkins University
6.	Dr. David Muir	Entomologist, Malaria Action Programme, World Health Organization
7.	Dr. Mir Mulla	Professor, University of California
8.	Dr. Charles Schaefer	Laboratory Director, University of California
9.	Dr. Rudi Slooff	Director, Vector Biology & Control Division, World Health Organization