Priority Areas	Examples of Suggested Areas of Research	Justification	Types of Research Desirable
3. Inapproriate Fertility	3.1 Research to improve the assessment and adaption of more effective, safe, appropriate and acceptable technology for the control of fertility in high risk groups, and the adaption of available technology for local needs.	Inappropriate fertility has been observed to be a problem in both urban and rural areas which could be controlled or prevented through more effective and efficient application of existing methods of fertility control, and effective surveillance mechanisms on fertility patterns.	HBR HSR
	3.2 Impact on health status of inappropriate fertility in high risk groups.		
	3.3 Development of effective, feasible, appropriate and acceptable surveillance mechanisms on (i) fertility patterns and (ii) incidence of infertility including its causes, epidemiology and success rate of treatment.		
4. Immunisable Diseases	4.1 Ways to strengthen and systematise the planning, management and evaluation of immunisation programmes, at all levels of the health care delivery system through:	Immunisation against the 6 childhood diseases (diphtheria, pertussis, tetanus, polio, tuberculosis and measles) is implemented as a regular activity in the maternal and child health services. Although the immunisation programme has resulted in the considerable reduction of the incidence of these specific diseases, nevertheless, outbreaks have occured from time to time. This indicates that there are areas of inadequate coverage where children are unprotected by immunisation.	HSR HBR Biomedical
	(i) ways to strengthen management from the national level right down to the district and sub-district level, and the identification of appropriate operational targets for immunisation coverage, including the optimal mobilisation of available resources to reach target child populations at this most optimal ages.	The immunisation programme aims at immunising at least 75% of the susceptible population against the 6 diseases. While coverage for BCG is impressive at 96.4% coverage for diphtheria, tetanus and whooping cough need to be further improved.	
	(ii) the development of coordinated intersectoral strategies for community awareness, involving appropriate social mobilisation methods viz community participation, communication and motivational measures.	It is targetted by the year 2,000, immunisation for diphtheria, tetanus and whooping cough should reach 95% coverage. Morbidity from tuberculosis should not exceed 5% infection rate of school entrants. Cases of tetanus should not exceed 0.5 per 100,000 in the age group up to 10 years.	
	(iii) was to increase the efficiency of existing services, viz:		
	(a) improving accessibility (physical, social and cultural)		

Priority Areas	Examples of Suggested Areas of Research	
	(b) mobilisation of existing resources (c) localised mopping-up campaigns	
	(iv) ways to improve communications among health staff at all levels, and between health staff and the community.	This target may be achieved by steps to improve and strengthen the organisational structure with a view to enhance more efficient delivery of immunisation programmes to the community, elucidating and overcoming the causes of low coverage, increasing community awareness and optimising the immunisation schedule, and improvement of mechanisms for monitoring and evaluation of programmes.
	4.2 Development of affordable, acceptable and appropriate alternatives to ameliorate the situation of low immunisation coverage and the lack of completion of full immunisation in certain areas through: (i) elucidating the specific causes of such low coverage (ii) ways for increasing community awareness and effecting appropriate and desirable behavioural changes such as understanding the importance of immunisation and keeping to the schedule for full primary immunisation and booster doses. (iii) ways to improve health personnel performance and service delivery in the immunisation programme. 4.3 Ways to optimise the immunisation schedule, including the feasibility and effectiveness of making the current schedule more flexible. 4.4 Ways to improve mechanisms for the continual monitoring and evaluation of the effectiveness of the immunisation programme, especially among the high risk groups, *including* (i) the maintenance of the cold chain and potency of vaccines used and (ii) monitoring of vaccine side effects (iii) involvement of general practitioners and private hospitals to include them in all aspect of the surveillance mechanism	

APPENDIX II: RESEARCH IN LOCAL DISEASES FOR WHICH BASIC KNOWLEDGE REGARDING CONTROL IS STILL LACKING

Priority Areas	Examples of Suggested Areas of Research	Justification	Types of Research Desirable
1. Vector-borne	1.1 Factors contributing to the continued existence of these diseases in affected localities, in particular (i) malaria among the Orang Asli, workers in land schemes, and the armed forces and (ii) dengue in urban localities (iii) filariasis in rural areas (iv) scrub typhus in rural areas. 1.2 Development of more effective, acceptable and appropriate methods for control including: (i) new and innovative ways of community participation in case detection, treatment and prevention among the many strategies of primary health care. (ii) ways to improve interagency and intersectoral coordination in the control of vector-borne diseases. (iii) evaluation of the effectiveness of new technologies and their adaptation for control of VBD e.g vaccine, insecticide-impregnated bed nets in malaria prevention. (iv) ways to overcome the problem of insecticide resistance in the responsible vectors. (v) ways of overcoming the problem of chloroquine and other drug resistance in *P. falciparum* malaria in relation to the biological aspects of resistance. (vi) development and adaptation of new methods of biological vector control, including population genetics. (vii) population dynamics of vectors. (viii) immune responses of vectors towards agents of disease and their role in modulating disease transmission. (ix) immuno-pathology of malaria, filariasis, dengue and scrub typhus. (x) screening of new drugs in vivo and in-vitro cultures.	Vector-borne diseases are still prevalent in many areas. In 1986, a total of 42,710 cases of malaria were reported in the country. Of these 31,262 occured in Sabah. In Peninsular Malaysia, 22.3% of malaria cases occured in the Orang Asli and another 2% in workers in large land schemes. Surveillance data for dengue indicates a 4 to 5 year cycle for outbreaks. The incidence in 1986 was 0.88 per 1,000, fourtimes that in 1985. Typhus and Japanese encephalitis are endemic, but their true prevalence is unknown. It is targetted that morbidity from malaria should not exceed an annual parasite incidence rate of 10 per 10,000. Filariasis should not exceed 5% prevalence rate. This target may be achieved through, interalia, (1) elucidating factors contributing to the continued existence of these diseases in affected localities (2) more effective control through interalia improved interagency and intersectoral coordination, innovative primary health care strategies for case detection and treatment and research to overcome the problem of insecticide and drug resistance and (3) elucidation of the epidemiology of diseases like Japanese encephalitis and other group B flaviviruses, and exploitation of the knowledge gained for use in prevention and control strategies, and (4) improvement of diagnostic tools for vector-borne viral diseases in general.	Biomedical Epidemiological HBR HSR Clinical

Priority Areas	Examples of Suggested Areas of Research	Justification	Types of Research Desirable
	1.3 Epidemiology of Japanese encephalitis and other group B flaviviruses, including their extent, risk factors and population at risk.		
	1.4 Ways to improve the efficiency of diagnostic tools and development of vaccines for dengue, malaria, filariasis, scrub typhus.		
2. Viral Diseases (other than Vector-Borne)	2.1 Development of alternative affordable, effective and appropriate methods for the control and therapy of important nonvector-borne viral diseases, including: (i) new and acceptable ways to effectively monitor the potential introduction and spread of new diseases (such as AIDS). (ii) ways to effect desirable behavioural change for the prevention of such diseases. (iii) ways to contain and reduce the spread of hepatitis B, including cost-effectiveness of vaccination. (iv) ways to assess and control the outbreak of hepatitis A infection as well as Non A/Non B hepatitis.	Studies have indicated that the prevalence of hepatitis B in various populations ranged from 3-14% among groups that included pregnant women and the general public. The incidence of viral encephalities was 0.32 in 1986. Rubella is a cause for concern. It is targetted that the morbidity from hepatitis A should be less than 25% in the population (at age 20). The HBsAg carrier rate should be less than 1 per 1,000. This target may be achieved by the development of more effective methods for control and therapy of viral diseases, the monitoring of the spread of new diseases (such as AIDS), and with appropriate intervention programmes where required, effecting desirable behavioural changes for disease prevention, and containment of the spread of hepatitis B in the community. In Malaysia, HAV outbreaks occur every year and there is presently very little research into the Biomedical Clinical and Epidemiological areas. Strong support should be given to develop techniques for the isolation of HAV, its detection in water resources and sea foods, carrier status (if any), molecular probes for its detection, etc. Hepatitis Non A Non B is going to pose a bigger problem in the future now that blood donors are adequately screened for hepatitis B and research should be pursued in the importance of hepatitis Non A Non B.	
3. Bacterial Diseases	3.1 Development od new, affordable, effective, acceptable and appropriate methods for the control and therapy of important bacterial infections, including:	Bacterial respiratory infections, tuberculosis, leprosy and sexually transmitted bacterial diseases are endemic in Malaysia. In 1986, the incidences of leprosy and tuberculosis are 1.20	Biomedical Clinical Epidemiological

Priority Areas	Examples of Suggested Areas of Research	Justification	Types of Research Desirable
	(i) ways to improve and strengthen existing mechanisms for the surveillance of bacterial resistance and monitor its changing patterns, and new methods of minimising such resistance. (ii) in relation to (i), new information on patterns of antibiotic use or abuse and appropriateness of treatment.	and 58 per 100,000 respectively. A national survey in 1976 indicated an annual incidence of 25,000 tuberculosis cases. The number of reported cases have increased by 18% from 1981 to 1986. Gonorrhoea and syphilis form 83% and 14% respectively of all STDs. Penicillinase-producing Neisseria gonorrhoea (PPNG) continued to increase from 32% in 1981 to 41.7% in 1986, posing a serious problem in treatment. Incidence of syphilis, gonorrhoes, chanroid and opothalmia neonatorium were 8.9, 32.4, 0.88 and 0.77 per 100,000 respectively in 1986.	
	(iii) development of new and improved diagnostic methods for early detection of disease in high risk populations. 3.2 For diseases requiring long-term therapy, alternative methods and strategies to improve patient compliance, including: (i) new information regarding causes of defaultation. (ii) development of new drug regimens to shorten duration of therapy, preferably with minimal side effects. (iii) ways to increase case-finding at an early enough stage of disease development (eg TB and leprosy). (iv) determination of reservoirs of infection in areas of high incidence.	Its is targetted morbidity from leprosy should not exceed 0.5 per 100,000 incidence. Morbidity from tuberculosis should not exceed 5% infection rate in school entrants. These targets may be achieved by improved methods of control and therapy, surveillance of bacterial resistance and methods to minimise such resistance, improved diagnostic methods for early detection of disease, and strategies to improve patient compliance in these requiring long term therapy.	
4. Parasitic Diseases (Non-Vector Borne)	4.1 Studies in the disease dynamics leading towards the development of new and appropriate methods for the control and therapy of parasitic diseases including: (i) ways to reduce the incidence of scabies and headlice. (ii) Intestinal helminthiasis and intestinal protozoan infections in high risk populations. 4.2. Epidemiology of clinically important but little studied infections as toxoplasmosis and toxocara infections and schistosomiasis. 4.3 Other opportunistic parasites which are potentially fatal to AIDS patients. Cryptosporidiosis and *Pneumocystis carinii* pneumonia.	Worm infestations are highly prevalent as shown by a 1982 survey in 11 environmental sanitation programme areas. The crude infestation rate was 84.8%, the infestation rates for hookworm, roundworm and shipworm were 36%, 68% and 56% respectively. Information on clinically serious but lesser known infections such a toxocariasis and toxoplasmosis is lacking. It is targetted morbidity should not exceed 15% in the age group below 15 years. This target may be achieved by improved methods for control and therapy, especially for head lice, scabies and helminthiasis. The epidemiology of important but little known infections such as toxoplasmosis and toxocara infection would need further study.	Biomedical Clinical Epidemiological

Priority Areas	Examples of Suggested Areas of Research	Justification	Types of Research Desirable
5. Neuroses and Other Non-Psychotic Diseases	5.1 Methods for the integration of cost-effective and appropriate psychiatric services in primary medical care. 5.2 Extent, and the impact on mental health status of related conditions such as alcoholism and drug abuse. 5.3 Extent and impact on mental health status of disruptions in the family, the work environment, culture-shock, transmigration, child abuse, mass hysteria and other stress-related situations. 5.4 New, acceptable and appropriate methods for the control and prevention of these disorders. 5.5 Behavioural Aspects of Aids. 5.6 Early intervention programme and integrates team management of physical and mental handicapped condition in children and adolescene.	In 1986, a total of 1,758 hospital admissions were for neuroses and other non-psychotic disorders. However, the extent of mental illness and its contributory factors has not been extensively studied in the Malaysian community. Strategies for control include methods to integrate psychiatric services in primary health care and elucidating the local aetiological factors contributing to such neuroses. A new area with increased tourism For too long, the mental, social and educational aspects of these children have been neglected in our primary medical approach. Effective intervention will decrease the complications to the child, sibling, family and society.	HBR Clinical HBR
6. Neoplasms (Geographical/ Ethnic)	6.1 New information on potential risk factors and extent of the problem eg. oral cancer, nasopharyngeal carcinoma, lung cancer and cervical cancer. 6.2 Ways to implement affordable, effective, appropriate and acceptable preventive and control programme for the reduction of these diseases including among other methods: (i) ways to increase awareness of known risk factor's and symptoms for early detection. (ii) ways to effectively reduce or eliminate entirely known risk factors and (iii) ways to strengthen and improve existing screening mechanisms including cost-effective methods of integrating these into existing primary medical care services. 6.3 Development of cheap reliable means of detecting early cancers or recurrences. 6.4 Assessment of new or known methods of treatment for cost effectiveness or efficacy. 6.5 Development of new methods of treatment relevent to Malaysia — see appendix IIIB, 2.3	Neoplasms have been recognised as a major public health problem. Hospital records show that neoplasms constituted of all admissions and are the 5th cause of deaths in government hospitals over the past 10 years. Knowledge on epidemiology and magnitude of the problem is not reliably known; this situation is compounded by a lack of a National cancer registry A pilot study on cancer notification conducted in 1984 among 13 hospitals in the Federal Territory and Selangor showed that the commonest cancers were those of the lung, nasopharynx and liver among males, and cancer of the cervix and breast among females. Smoking, an established risk factor in several cancers, is highly prevalent. The National Health and Morbidity Survey showed that 40% of men above 14 years of age smoke; 36% are heavy smokers. Control of neoplasms can be achieved through the development of effective preventive programmes to create awareness and avoidance of risk factors, improvement of existing screening mechanisms and effective ways to reduce cost of treatment.	Epidemiological Clinical

APPENDIX III: RESEARCH IN NON-COMMUNICABLE DISEASES
(A) HAZARDOUS FACTORS KNOWN
(B) HAZARDOUS FACTORS UNKNOWN

Priority Areas	Examples of Suggested Areas of Research	Justification	Types of Research Desirable
(A) HARZARDOUS FACTORS KNOWN			
1. Cardiovascular Diseases	1.1 Development of new and alternative methods of early detection of CVD through, among other strategies: (i) ways of enhancing awareness of known risk factors and symtoms in high populations. (ii) development of cost-effective and appropriate screening and control measures and their intergration in primary care services. 1.2 Ways to improve follow-up treatment of diabetes, hypertension, stroke and ischaemic heart disease and reduction of the high proportion of uncontrolled hypertensives even though they have been on medication. 1.3 *Development of an affordable, effective, appropriate* and acceptable programme for the reduction of morbidity and mortality including: (i) ways to check unfavourable changing patterns especially the occurence of coronary heart disease in younger age-groups. (ii) ways to effectively reduce or counteract the effects of known risk factors such as hypercholesterolaemia, smoking, obesity, lack of exercise and life-styles conducive to the development of CVD. (iii) ways to reduce the prevalence of rheumatic heart disease, including measures to ensure appropriate antibiotic use and effective compliance.	Cardiovascular diseases are the leading cause of death in government hospitals. In 1985, 28.4% of medically certified deaths in Peninsular Malaysia were due to cardiovascular diseases. Hospital admissions for cardiovascular diseases have increased between 1973 to 1984 by 69%, Indicating the increased burden on hospital resources from CVDs. A changing pattern of coronary heart disease has been observed in which an increasing among number of cases are seen in the eary 30's. This may be an indicator of an emerging coronary epidemic. The National Health and Morbidity Survey (1986) showed that hypertension is present in 14% of the adult population, and that only 1 in 3 persons with raised blood pressure is aware of the problem. Sixty eight percent of persons receiving *medication for hypertension were not controlled by medi*cation. Among the adult population, 2% had 'chest pains' suggestive of angina, and 1.5% had a 'history of chestpain' for more than of an hour. There is an increasing tendency towards obesity and change in dietary patterns leading to a rising incidence of hypercholesterolaemia. Forty percent of Malaysian adult males smoke, of whom 36% are heavy smokers. Western countries such as U.S.A. and Australia have shown that cardiovascular diseases, in particular coronary heart disease, can be reduced through effective intervention programmes. It is targetted that there should be a significant reduction in morbidity and mortality from cardio-vascular diseases by 1990 through a combination of preventive and treatment strategies, including the development of an effective system of early detection of CVD, improvement of compliance to follow-up treatment and an effective and appropriate per ventive and control programme for the reduction of morbidity and mortality.	Clinical HSR HBR Epidemiological

Priority Areas	Examples of Suggested Areas of Research	Justification	Types of Research Desirable
2. Respiratory Diseases	2.1 (i) epidemiology of respiratory diseases, allergic and *non allergic, exposure related, occupational.* (ii) Research into factors causing respiratory ailements eg. pollution of air, toxic furnase within home/ office.		
3. Accidents	3.1 Road accidents Development of effective and appropriate methods to contain and reduce the alarming rate of disability and mortality from road accidents including: (i) ways to effect desirable behaviour change through effective safety education. (ii) ways to reduce known contributory factors such as alchoholism and poor road conditions. (iii) ways for more effective interagency and intersectoral coordination, including information sharing and improved communication. (iv) new information in support of road safety regulations and its enforcement. 3.2 Industrial Accidents 1. Development of new and appropriate methods to reduce disability from industrial accidents, including: (i) ways to induce desirable behaviour conducive to the safety and wellbeing of workers including the creation of awareness of health hazards in the workplace. (ii) new information to support and upgrade safety in the workplace, especially in the manufacturing sector.	Accidents are the major cause of admissions to government hospitals, forming 13% of all admissions in 1980, and 2% of all deaths in hospitals in 1987. Most affected are the young and *economically productive group who may require prolonged* and expensive hospital stay. A study on motor vehicle accidents indicated the main causes as human error and poor road conditions. Many of the causes are preventable, an inspite of this, annual rates are increasing. Industrial accidents averaged 60,000 — 70,000 a year (1981–86), with 30,000 deaths over a similar period. Among those with permanent disablement in the 20–24 year age group, 3% were due to eye injuries which led to blindness. Among industrial accidents, those in the manufacturing sector incurred the highest morbidity. A significant reduction in morbidity and mortality from accidents could be achieved through the development of appropriate and effective *preventive measures to reduce* known contributory factors, effect behavioural change and increase public awareness.	HBR Epidemiological

Priority Areas	Examples of Suggested Areas of Research	Justification	Types of Research Desirable
	(iii) new information in support of existing legislation and its enforcement and the development of new laws to ensure safety in workplaces. (iv) cost-benefit studies on ways to reduce working days lost due to injuries, and for the increase of productivity and minimisation of cash payment as compensation. 3.3 Home accidents 1. Extent and risk factors of home accidents in the high: 2. Development of effective, acceptable and appropriate methods in the reduction of injury and mortality from home accidents, through: (i) ways to make the home environment safer. (ii) safer designing of toys to reduce injury in children. (iii) ways to increase awareness of an reduce or eliminate known hazards at home, especially for the younger children for		
4. Substance Abuse	4.1 Drugs addition 1. Ways to strengthen and improve the existing preventive programme, including: (i) ways to further reduce the number of new recruits, especially among youths. (ii) new information regarding the changing pattern of drug abuse including substitution of psychotropic drugs and glue sniffing. 2. Ways to improve rehabilitation programmes, including: (i) ways to reduce the high relapse rate after treatment.	Drug addiction constitutes a serious social and health problem. Of those detected in 1987, 67.1% were below the age of 30 years. While the numbers detected have shown a decreasing trend, a changing pattern of addiction has been observed. The relapse rate after treatment is high and is in excess of 70% one year post-treatment. An increasing trend in glue sniffing among youths and school children has been observed. A rising trend in alcohol consumption has been observed. Statistics from the University Hospital showed that 4% of admissions to the psychiatric unit were alcoholics and 4% of general medical admissions were cirrhotics. Alcoholism is entrenched among plantation workers, who are mainly of Indian origin, and there have been frequent reports of morbidity and mortality from use of alcohol adulterated with methanol.	HBR Biomedical Clinical

Priority Areas	Examples of Suggested Areas of Research	Justification	Types of Research Desirable
	(ii) ways to strengthen supportive post-treatment facilities, including home support and counselling.	It is targetted that there should be at least a 50% reduction of the current level of drug dependence and alcohol consumption, alcohol-related accidents and dependence syndrome.	
	4.2 Alcoholism and cigarette smoking Development of effective and appropriate programmes for the reduction of tobacco and alcohol consumption, including: (i) ways to reduce smoking in high risk groups especially in the young. (ii) ways of increasing awareness of known hazards, and effecting desirable, behavioural changes.	This could be achieved by improving existing preventive and rehabilitation programmes for drug addition. Tobacco and alcohol consumption can be reduced by the development of effective and appropriate education programmes and the enforcement of appropriate legislation.	
5. Metabolic Disorders	5.1 Development of an affective, affordable, appropriate and acceptable programmes for control through among through among other strategies: (i) ways for early detection of metabolic diseases, including appropriate screening programmes. (ii) ways to ensure proper treatment and follow-up, including strengthening of mechanisms for defaulter tracing, and to reduce the rate of uncontrolled dissease among those already detected. (iii) epidemiology studies & diabetes and its related complications.	The National Morbidity Survey (1986) showed that 4.5% of the population admitted to being diabetics. Of the remainder who said they were not diabetics 8.8% were found to have elevated post-prandial blood glucose. Very little is known of the extent of other metabolic disorders such as gout and ostreoporosis. Reduction of complications and prolongation of life could be achieved through the development of an effective, affordable and acceptable control programme for the early detection, appropriate treatment and follow-up of the disorders.	Biomedical Clinical
	5.2 New information on the epidemiology of gout, obesity and osteoporopsis.	There is lack of decumentation on occupation-related diseases such as the pneumoconioses, noise-induced hearing impairment, pesticide exposures, radiation exposures, radiation exposures and occupational dermatitis. It is observed that paraquat poisoning is an increasing problem among estate populations.	HSR Clinical Epidemiological
6. Occupation Diseases	6.1 Development of effective, affordable, appropriate and acceptable methods the reduction of occupational diseases, through among other strategies: (i) ways to improve intra-agency and intersectoral coordination in the prevention of these diseases, particularly in (a) ways to reduce structural and operational barriers, (b) way to harmonise differing perceptions of issues being addressed and (c) ways to strengthen existing mechanisms for collaboration.	There control and prevention of occupational diseases will require the introduction of appropriate occupational health services to cover the needs of all workers, the implementation of technical and educational mesures to reduce work related risk factors and improvement of monitoring and surveillance mechanism to detect emergence of new hazards.	

Priority Areas	Examples of Suggested Areas of Research	Justification	Types of Research Desirable
	(ii) ways to increase awareness of known hazards in high groups. (iii) ways to ensure a safe working environment and the reduction of hazards among high risk groups. (iv) new information in support of existing legislation, as well as for the development of new legislation in the control and prevention of occupational diseases. 6.2 Ways to improve monitoring and surveillance mechanisms for (i) early detection of the emergence of new hazards. (ii) characterisation of the epidemiology of occupational disease including the determination of the extent and risk factors of specific pneumoconioses, noise-induced hearing impairment occupational dermatitis, pesticide and radiation exposure.		
(B) HAZARDOUS FACTORS UNKNOWN			
1. Psychotic Disorders	1.1 Extent of the problem and characterisation of high risk groups. 1.2 Factors contributing to these disorders. 1.3 Ways to strengthen and improve diagnostic and therapeutic methods, including methods for the integration of cost-effective and appropriate psychiatric services in primary medical care. 1.4 Psychiatric Rehabilitation.	Information on psychotic disorders have been scanty. A study on psychotic disorders have been been scanty. morbidity in a Malaysian clinic showed that 3% of cases had some form of psychiatric illness. In 1986, hospital admission figures showed that there were 2,056 cases of suicide and self-inflicted injury. (A WHO report on mental health in developing countries in 1984 revealed that the annual incidence of psychiatric emergencies and chronic psychiatric disorders was 0.5 and 5 per 1,000 respectively.) Much is unknown of the local risk factors and causes of psychotic disorders in the Malaysian community. Reduction of disability and mortality from psychoses requires knowledge of local causes and risk factors, and appropriate and acceptable methods of therapy.	HBR Clinical

Priority Areas	Examples of Suggested Areas of Research	Justification	Types of Research Desirable
2. Neoplasms (Cosmopolitan)	2.1 Epidemiology of cancers, including their distribution and determinants. 2.2 Development of an effective, acceptable and appropriate system of registration of cancer cases. 2.3 Development of an effective and coordinated cancer programme to reduce mortality and morbidity that is cost-effective and acceptable, interalia, through (i) effective methods to upgrade basic laboratory and screening facilities (ii) ways to improve and strengthen existing facilities for treatment and rehabilitation.	Information on neoplasms have been scanty and based on piece-meal data from diverse and often uncoordinated sources. Available statistics indicate that neoplasms are the 5th cause of deaths in government hospitals. The true epidemiology of neoplasms is unknown due to the lack of a cancer registry. Reduction of morbidity and mortality from cancers require effective screening programmes in conjunction with a coordinated cancer control programme including the implementation of a cancer registry.	Epidemiological Biomedical Clinical

Priority Areas	Examples of Suggested Areas of Research	Justification	Types of Research Desirable
2. Neoplasms (Cosmopolitan)	2.1 Epidemiology of cancers, including their distribution and determinants. 2.2 Development of an effective, acceptable and appropriate system of registration of cancer cases. 2.3 Development of an effective and coordinated cancer programme to reduce mortality and morbidity that is cost-effective and acceptable, interalia, through (i) effective methods to upgrade basic laboratory and screening facilities (ii) ways to improve and strengthen existing facilities for treatment and rehabilitation.	Information on neoplasms have been scanty and based on piece-meal data from diverse and often uncoordinated sources. Available statistics indicate that neoplasms are the 5th cause of deaths in government hospitals. The true epidemiology of neoplasms is unknown due to the lack of a cancer registry. Reduction of morbidity and mortality from cancers require effective screening programmes in conjunction with a coordinated cancer control programme including the implementation of a cancer registry.	Epidemiological Biomedical Clinical

APPENDIX IV: RESEARCH TO REDUCE MORBIDITY, MORTALITY AND TO LIMIT, DISABILITY FOR CONDITIONS FOR WHICH PREVENTION IS NOT KNOWN

Priority Areas	Examples of Suggested Areas of Research	Justification	Types of Research Desirable
1. Endocrine disorders 2. Congenital and genetic disorders 3. Degenerative diseases 4. Metabolic disorders	1. Problem characterisation and risk factors for these disorders viz Endocrine disorders, Congenital and genetic diseases, Degenerative diseases and metabolic disorders. 2. Socio-economic impact of diseases, including cost of health care, resource allocation and service productivity. 3. Ways to improve existing methods of diagnosis screening and treatment to these disorders, eg. screening for congenital hypothyroidism in endemic goitre areas.	There is a lack of knowledge regarding the following diseases for which prevention is not known: endocrine disorders (thyrotoxicosis, childhood hypothyroidism, pituitary and ovarian dysfunctions), congenital and genetic disorders (mongolism, thalassemias, haemophilia and other blood discracias), and degenerative diseases (multiple sclerosis and muscular dystrophies). Research is need to characterise these diseases and elucidate risk factors, and elucidate risk factors, and develop methods to treat and limit disability.	Clinical Biomedical HBR

APPENDIX V: RESEARCH TO MEET NEEDS OF POLICY MAKERS AND PLANNERS

Priority Areas	Examples of Suggested Areas of Research	Justification	Types of Research Desirable
1. Transmigration	1.1 Characterisation of the nature and extent of transmigration.	This has been recognised as an increasing problem but has not been characterised or quantified. The socioeconomic and health problems created by rural urban migration have not been studied extensively and there is no comprehensive programme to deal with this problem.	HBR HSR
	1.2 Determination of the impact of transmigration on the health of the affected population.		
	1.3 Ways to overcome the social and health problems created by transmigation.	Traditional healers continue to play significant role in the health care system of this country. There are 3,000 traditional birth attendants (TBAs) who deliver 15% of the total births. Three broad systems of traditional medicine exist locally, viz:	HBR Clinical Biomedical
2. Alternative Medicine	2.1 Determination of the extent of utilization of alternative medicine by the public, the number and types of practioners, their diagnostic and therapeutic methods, their distribution, their level of training and orientation, if any, and role in their respective communities.	• Chinese Traditional Medicine, which is practised by 1,000 urban-based Chinese practitioners (sinsehs) who see about 200,000 patients each month.	
	2.2 Determination of the pharmacological composition efficacy, safety, pharmacological and clinical properties of compounds and herbs used in alternative medicine, including the conduct of clinical trials to verify claims of treatment of diseases by traditional healers.	• Indian Traditional Medicine, which is practised by 500 Indian traditional practitioners and • Malay Traditional Medicine, in which the number of practitioners are unknown	
	2.3 The feasibility and effectiveness of integrating proven and safe alternative medicine practices into the health care system.	Traditional medicine is culturally well-accepted by the Malaysian public and are bridging deficiencies in cosmopolitan medicine.	
	2.4 Development of a surveillance mechanisms for the routine monitoring of: (i) number and type of traditional medicine practitioners (ii) traditional medicine centres or functioning services (iii) diseases known to be successfully treated by traditional healers (iv) drugs, preparations or medicaments and traditional medicine pharmacopias	Health expenditure in the country has been documented at 2.8% of the GNP. This is low compared to other nations in the same region (and much below the WHO recommendation of 5% GNP).	HER HSR
3 & 4. Resources & Management For Health Care	1. Development of methods to improve the current programme management and operations including:		

Priority Areas	Examples of Suggested Areas of Research	Justification	Types of Research Desirable
	(i) ways to achieve appropriate programme reorientation (ii) ways to achieve a more equitable resource allocation (iii) ways to achieve better organisation of programmes (iv) ways to achieve a more effective management of resources and programme activities 2. Undertake further studies in financing of health care, in particular identification of new sources of finance, methods of financing, cost-sharing and cost containment towards achieving more cost-effective health care delivery, and the monitoring and evaluation of the effectiveness of these methods. 3. Ways to improve quality of medical care. 4. Ways to encourage community participation and use of other Primary Health Care approches in engancing health system delivery.	Health manpower is still inadequate in total numbers and is inequitably distributed eg. Sarawak's doctor-population ratio is 1:6308 while that in the Federal Territory is 1:773 (1986 figures). Some of the problems identified in the management of the health services are: 1) lack of coordination between the private and public sectors, and within the respective sectors in matters relating to health 2) non-optimum use of all resources 3) lack of accurate, reliable and timely information for planning purposes 4) non-utilisation of available data and lack of feedback to ground level staff 5) inability to motivate community participation 6) inappropriate technology used due to inadequate knowledge and guidelines in selection and use of health technology. To ensure accessibility of health care to the population, at the right level of care, the procedures, equipment and drugs used should be appropriate, cost-effective and acceptable. Changing health expectations, demographic patterns and therefore patterns of diseases as well as availability of new technologies for health care management call for continued review and where necessary, a reorientation of technical application. Concomitant with this, there should be a parallel development of cost effective technology in the production of biologicals, reagents and pharmaceuticals and ways to facilitate the successful transfer of those technologies.	Biomedical HSR HER Research should be geared to: 1) introduce 2) implement 3) utilise and 4) develop

APPENDIX VI: RESEARCH FOR TECHNOLOGY DEVELOPMENT

Priority Areas	Examples of Suggested Areas of Research	Justification	Types of Research Desirable
1. Biotechnology	1.1 Biologicals and Reagents 1. Development of affordable, cost-effective and appropriate technology in the production of biologicals and diagnostic reagents such as monoclonal antibodies and gene probes for the detection of: (i) infectious parasitic, bacterial and viral diseases, and (ii) non-infectious diseases such as autoimmune disorders. Technologies used would include: (i) recombinant DNA (ii) hybridoma technology (iii) cell cloning (iv) peptide systhesis (v) Antigen purification 2. Ways to facilitate the effective and successful transfer of the above technologies 1.2 Pharmaceuticals 1. Ways to enhance the cost-effectiveness of existing production systems 2. Ways to strengthen collaborative mechanisms in the production of economical and high technology pharmaceuticals for local comsumption and export. 3. Ways to facilitate technology and capital transfer between local manufacturers and multinational organisations. 4. Ways to promote local manufacture of raw materials.	Malaysia has vast resources of materials, which can be utilised for Biotechnology in Medicine. Research will result in production of new test, regents and vaccines which will form the basis for: — new industry locally — epidemiological studies — new treatment methods — new monitoring methods Research in this field will result in increase in number of highly trained personnel. Basic science research can be encouraged. Cost of medical treatment and monitoring can be reduced. A knowledge of the antigenic determinants, both protein and non-protein, and the possible changes in mutant and variant organisms is important. The starting point in production of gene probes is frequently the purification of the gene product.	Biomedical

Priority Areas	Examples of Suggested Areas of Research	Justification	Types of Research Desirable
2. Computerisation	2.1 Feasibility and effectiveness of utilizing computers to improve health management, health care delivery system, health information system, patient care as well as medical research. 2.2 Development of appropriate software for the above functions. 2.3 Ways to optimise the usage of existing computer systems, and of ensuring their integrity and security.		
3. Medical Equipment and Instrumentation	3.1 Feasibility of developing, introducing and maintaining more effective and appropriate equipment and instruments if possible, with the use of local materials.	There is a need for quality assurance in the maintenance of medical equipments to assure optimise and most effective performance. Most quality assurance test tools are very expensive for widespread use in hospitals.	Design and development of test tools and phantoms using local materials eg. rubber, tin, timber for use in quality assurance in radiology (X-ray, CT, ultrasound etc). Manufacturing of such tools should also be considered.
4. Appropriate Technology	4.1 Evaluation of operational policies, standardization of procedures for acquisition, and appropriateness of screening, diagnostic and curative procedures at all levels of health care. 4.2 Evaluation of available health technology especially their cost effectiveness and cost benefits, availability of technical capability as well as attitudinal profiles of providers and consumers towards such technology. 4.3 Development of new technologies which are more effective and acceptable as well as more appropriate to the local situation.	Image processing techniques are used widely in cytology, pathology, radiology, physiological monitoring; however commercial image analysis systems could help in semi-automatic screening and diagnosis in areas such as pap-smear tests, chromosome typing, quantification of radiographs. Science research can be encouraged. Cost of medical treatment and monitoring can be reduced.	Development of microcomputer-based image analysis systems for use in cytology, radiology, pathology. Development of software for semi-automatic screening and quantitation.

APPENDIX VII: RESEARCH IN TOXICOLOGY

Priority Areas	Examples of Suggested Areas of Research	Justification	Types of Research Desirable
1. Poisoning by chemicals (eg. insecticides & weedicides, organic solvents) and natural toxins (eg. from plant, animal or microbial sources)	1.1 Methods of detecting natural toxins in body fluids/tissues 1.2 Correlating blood/tissue levels and toxicity 1.3 Mechanism(s) by which toxicity is produced 1.4 Developing new or more effective approaches to/methods of treatment 1.5 Epidemiological studies of poisoning (eg. toxic waste, paraquat)	Poisoning by chemicals (eg. weedicides) and natural toxins (eg. snake venoms, microbial/fungal toxins) is not an uncommon occurrence in our country. Research should be encouraged in this area so as to ensure safety to the population and the maintenance of health standards. Early detection of the toxic substance would facilitate treatment and reduce mortality. There is a lack of documentation on methods of detecting natural toxins (or their antibodies or metabolites) in body fluids/tissues. Also important are studies correlating blood/tissue levels of the toxic substance(s) and the toxic symptoms to establish definite cause of death. Research on the underlying mechanisms by which toxic substances exert their effects is needed to contribute to more effective treatment or even prevention of toxicity. Epidemiological studies are lacking. For instance, good documentation of snake envenomation in Peninsular Malaya was last published in the late 1960s.	Pharmacological Biochemical Clinical Epidemiological

Ⅶ. Institute for Medical Research:ANNUAL REPORT 1989
(第1章 第2章 第9章)

1. INTRODUCTION

The Institute for Medical Research (IMR), completed another successful year in research, diagnostic services and training of various categories of staff for the Ministry of Health (MOH). It provided consultancy services when needed and produced a number of vaccines for the Ministry.

In addition to the above, the IMR continued to function as the WHO Regional Centre for Research and Training in Tropical Diseases and Nutrition (since 1978); the National Centre for SEAMEO-TROPMED (Southeast Asian Ministers of Education Organization — Tropical Medicine Programme, since 1967); and the secretariat for the Inter-Islamic Foundation for Science, Technology and Development (IFSTAD, since 1988).

The United States Army Medical Research Unit-IMR (USAMRU-IMR), officially closed its operations in Malaysia on 4 July 1989, after completing more than 40 years of highly productive and successful collaborative research into tropical diseases with the IMR.

Two WHO Collaborative Centres are situated in the Institute, these being the WHO Collaborating Centre for Taxonomy and Immunology and Screening and Clinical Trials of Drugs against Brugian Filariasis, since 1981, and the WHO Collaborating Centre for Ecology, Taxonomy and Control of Vectors of Malaria, Filariasis and Dengue, since 1986.

RESEARCH

Research continued to be the primary function of the IMR, with emphasis being directed towards solving problems encountered in the implementation of various health programmes. Research funding for the year was again mainly from the Government's Research and Development (R&D) Fund, a special allocation under the Fifth Malaysian Plan, to encourage and intensify research in priority areas. Research grants through the R&D Fund for 1989 amounted to M$6,432,500. In addition, research grants were also obtained from the WHO, PORIM and SEAMEO-TROPMED. Research projects were mainly grouped under 14 research programmes and these resulted in 49 scientific papers and 11 reports.

The Behavioural Research Programme examined the social and cultural aspects of Orang Asli with the view to identifying those elements which could be utilized to encourage greater community participation in maternal and child health services.

The Blood Disorders Programme examined the relationship between the use of oral contraceptives and some coagulation parameters. Data for the registry of thalassaemia and haemoglobin disorders were also collected.

In the Cancer Programme, data for the hospital-based registry of leukemia and allied disorders were further collected for the creation of a database for use in patient management and research. The presence of chromosomal fragile sites in patients with leukemias and lymphomas was also studied. It was found that 65% of 20 cases studied had chromosomal aberrations, mostly involving translocations.

The Cardiovascular Diseases Programme looked at the nutritional effects of palm oil and palm vitamin E on serum lipids, prostanoid and platelet aggregability. The results of the clinical trial comparing the dietary effects of palm oil and olive oil are

being analysed. In the second trial, it was found that palm vitamin E supplementation did not bring about any significant change in the parameters monitored in normal subjects.

Results of another study suggested that the role of cigarette smoking (7 or more cigarettes per day) as a risk factor for ischaemic heart disease is not likely to be due to a direct effect on platelet aggregability but rather through an inhibition of prostacyclin production.

Two major childhood diseases were studied in the Community Health Programme, these being acute respiratory infections (ARI) and diarrhoeal diseases (DD) in Kelantan. The first was a longitudinal study to evaluate the impact of improved case management and health education of mothers in ARI in the control of the disease. The second study looked into the aetiology of DD. An interesting finding was the isolation of *Cryptosporidium* from 21% and 2.9% from hospital and community cases respectively.

In the Dengue Programme, a longitudinal study on the epidemiology of dengue/dengue haemorrhagic fever which began in 1984 was completed in 1989. Some interesting findings were that in spite of an average increase of 11% per year in sero positives in children (from an initial of 43.4% to 95.9%, there was an extremely low rate of dengue disease; *Aedes* larval indices and adult mosquitoes were also extremely low. Risk factors were identified as locality of residence, family practices in failing to prevent larval breeding, few animals in the household and low family income.

Among the projects under the Febrile Illness Programme, was one looking into the aetiology of acute hepatitis. From the study of 966 specimens, 45.8% were positive for anti-HAV IgM and 11.9% positive for both HBsAg and anti-HBc IgM. Of 147 sera tested, about 14% showed Delta co-infection. Only 1% was positive for CMV IgM and none for EBV, while about 2% were positive for leptospirosis.

Experimental chemotherapeutic studies under the Filariasis Programme showed that CGI 18041, an adduct of benzothiazol isothiocyanate N-methylpiperazine was an extremely effective filaricidal compound when given even at a single dose of 50 mg/kg body weight. This gives hope for the development of more potent and convenient antifilarial drugs.

The Human Nutrition Programme was extremely active during the year, carrying out several studies on undernutrition, three on nutritional evaluation of local foods and one on the use of glutathione reductase as an indicator of riboflavin nutriture.

It was found that adequate compliance with iron and vitamin supplementation at montly intervals from 20-24 weeks of pregnancy to birth was associated with a significant improvement in the haemoglobin (Hb) concentration in only 42% of those with initially low Hb level. There was no significant association between birth weight and compliance with the supplementation. Interestingly, the proportion of babies with birth weight < 3.0 kg was about fourfold higher in the group with normal initial Hb level than in the group with low initial Hb level.

The study on hookworm infection and protein-energy malnutrition showed that significant weight, height and haemoglobin deficits were observed in children 7–9 years old with hookworm infection, with deficits being related to the intensity of infection based on egg counts. These observations suggest that hookworm infection may be an important determinant of chronic protein-energy malnutrition and anaemia in areas where the diets are generally inadequate in protein, energy and iron.

The first comprehensive study of retinol and carotenoid concentration and nutrient composition in a number of Malaysian vegetables and fruits and foods of animal origin, using the high-pressure liquid chromatography method, was carried out. The dietary fibre, cholesterol and carbohydrate contents of a number of foods were also analysed.

In the Leprosy Programme, a seroepidemiological survey for leprosy in Peninsular Malaysia was carried out in 32 districts selected through stratified random sampling. Of the 4,566 blood samples obtained from the 21,917 clinically examined subjects, 3.8% had significantly raised antibodies to phenolic glycolipid antigens.

Projects under the Malaria Programme were mainly in epidemiological field studies and the assessment of malaria parasite sensitivity to various antimalarials. Of the 14 *Plasmodiun falciparum* isolates successfully tested using the WHO test-kits, 80%, 7.1% and 14.3% were resistant to chloroquine, mefloquine and quinine respectively.

Research under the Parasitic Diseases Programme covered a wide area, ranging from prevalence studies of *Blastocystis hominis* infection in man and monkeys to production and characterization of monoclonals against *Toxocara canis*. Prevalence studies on intestinal helminthic infections carried out among estate, Orang Asli and resettled slum inhabitants, gave some interesting results. In an estate in Serdang, Selangor, 15.3% had one or more infections while this was 78.8% in Orang Asli from Kampong Bukit Kemandul, Selangor. Resettlement of slum inhabitants into flats reduced the infection rates drastically from 63.3% at 7–10 years ago to 30.4%.

A national surveillance of antibiotic resistance amongst *Neisseria gonorrhoea* isolates in Malaysia under the Sexually Transmitted Diseases Programme, showed that the pattern was not very much different from that in 1988. The average percentage of penicillinase producing *N. gonorrhoea* (PPNG) strains was 32.2% with Kota Bharu having the lowest rate (15%) and Kuching the highest (40%).

Projects carried out under the Scrub Typhus Programme were mainly those related to production of antigens and conjugated antibodies for use in the direct immunofluorescence test for scrub typhus. Various compounds were also evaluated for their acaricidal properties.

In addition to the projects carried out under the 13 research programmes, other miscellaneous research projects were conducted by officers in the various divisions.

DIAGNOSTIC SERVICES

The IMR carried out a total of 464,840 diagnostic tests, including both specialised and routine ones. As desired, this represents a reduction of 52,982 or 10.2% less than the 517,822 tests carried out in 1988. It is still the Institute's desire that routine tests be carried out by the peripheral laboratories while it provides specialised tests, consultancies in laboratory diagnosis and participates in quality control. Specialised tests provided include those for the diagnosis of viral diseases, immunodiagnosis of parasitic diseases, epidemiological markers for bacteria of public health importance, tissue typing, immune function assays and investigations for endocrine imbalances.

The IMR will continue to function as a referral laboratory and endeavour to upgrade and develop more sensitive and specific diagnostic tests. In this connection, the IMR has recently developed and utilised tests for the detection of allergies to mites and also for toxocara infection causing visceral larval migrans.

TRAINING

The IMR continued to provide training for various categories of health personnel for the Ministry of Health. The training programmes range from the 3-year Medical Laboratory Technologist (MLT) course to post-graduate diploma courses in parasitology and microbiology. In addition, ad hoc courses and attachment training are conducted where necessary.

Eighty candidates sat for the final examination of the MLT course in 1989 and 54 passed. During the same year, 72 trainees were accepted for the 22nd MLT course. In the Advanced Level Course for MLTs, 14 out of 16 and 13 out of 15 candidates who set for the final examinations in Chemical Pathology and Medical Microbiology respectively, were successful.

The Institute continued to host the two 6-months SEAMEO-TROPMED post-graduate courses leading to the Diploma in Applied Parasitology & Entomology (DAP&E) and the Diploma in Medical Microbiology (DMM). Fifteen candidates attended and successfully completed the DAP&E course while 10 candidates attended and 9 successfully completed the DMM course.

Continuing education for staff members of the Institute was also given emphasis as this would ensure that researchers are equipped with the required skills and knowledge to meet research, diagnostic and training roles effectively. In addition to local courses and seminars on advances in laboratory science, researchers and other categories of staff are given ample opportunities to pursue courses overseas. Where appropriate officers were given the necessary encouragement and facilities to pursue post-graduate degrees or professional qualifications either locally or overseas.

CONCLUSION

The IMR has again performed satisfactorily in all its assigned activities. It fully met the diagnostic, consultative and training needs of the the Ministry of Health. Research efforts were better focused at solving problems encountered in the implementation of health programmes and were in priority areas identified for research emphasis by the National Council for Scientific Research and Development (NCSRD) of the Ministry of Science, Technology and Enviroment. As we embark into the 1990s, the Institute will endeavor to intensify research in clinical epidemiology, behavioural research, health systems research and clinical nutrition. Where appropriate it will encourage the use of molecular biology and other biotechnological tools in research. It will continue to fulfill its obligations as the WHO Regional Centre for Research and Training in Tropical Diseases and Nutrition through collaborative research and the provision of training for scientists in the region. Our regional and international links through SEAMEO-TROPMED and IFSTAD will be maintained and strenghtened for the mutual benefit of participating countries and in keeping with our image as an internationally well-known research centre of excellence.

Dr M. Jegathesan
Director

The study also showed that the use of family planning methods was low. There appeared to be specific reasons for not commonly practising them. Of importance was that they could not allow any decrease in the population as they would lose having workers to run the community's economic activities. Also, they believe that couples with no children are unlucky as they would not have anybody to look after them when they are old or sick.

Pregnant mothers need to adhere to sanctions and taboos imposed on them throughout their pregnancy. In matters concerning food they are to avoid eating canned foods such as sardine and milk. Deaths among mothers in the village had been contributed to breaking such sanctions.

Such beliefs are underlying to the attitude among pregnant mothers who prefer to deliver their babies at home and be attended by traditional midwives (67.6%). Only 20.6% of them said that they would choose to deliver at the hospitals. Although this percentage is low it nevertheless reflects a tendency of some in the population, particularly those in the age group of 18–25 years who want to try modern treatment. They are the young people in the community who have been more exposed to new ideas of change and development.

Acceptance of modern treatment is also shared by the Semai's traditional midwives, who are willing to cooperate with the clinic or hospital when their services are required. On the part of the menfolk, there had been no objections to their wives receiving hospital care when complications were encountered at delivery.

At the end of the study a model was developed to elucidate the place of health belief and practices in the cultural system of the Orang Asli. With the model it will be possible to see how and in what aspects of the community's way of life can change or modifications in behaviour be suggested to effect wider community involvement in uplifting the maternal and child health care and in malaria control.(Haliza M.R.)

BLOOD DISORDERS

Coagulation profile in women on oral contraceptive pills

This study was conducted to examine the effect of combined low-dose oral contraceptive pills on the coagulation system and to relate it to the reported incidence of thrombosis.

A total of 107 cases (65 controls, 42 pill users) aged 22–48 years were examined for various coagulation parameters. Preliminary findings showed no significant differences in the prothrombin and partial thromboplastin times between the control and pill user groups. The mean activities for coagulation factors II and VIII were similar for both groups whereas that for factor V was slightly higher in the controls compared to that of pill users, these being 113.8% and 107.3% respectively. Biochemical analyses for other variables are being carried out. (Roshidah I., Khalid H. & Abdul Halim A.J.)

Registry of thalassaemia and haemoglobin disorders in Malaysia

We visited the various general hospitals in Malaysia and discussed the protocol with the paediatricians, physicians and pathologists, so as to get them involved in the project. Formats and preliminary questionnaire forms were then prepared. Preliminary inquiries were sent to approximately 132 consultants. The returns will

enable us to obtain a feedback on difficulties faced in diagnosis and facilities and also the number of cases of thalassaemia and hemoglobin disorders seen in the country. We received replies from about 60 consultants. We have now recorded approximately 1,115 cases. With this information, we hope to produce a comprehensive database for use in the early diagnosis and treatment of these disorders. (Radha K., Rekhraj V. & Khalid H.)

Diagnosis of beta-thalassaemia using DNA technology

Southern Blot analysis and Restriction Fragment Length Polymorphism (RFLP) analysis were carried out and data are being processed.

Polymerase Chain Reaction (PCR) analysis has helped us to elucidate the various genetic mutations in thalassaemic patients. Direct detection using specific mutant probes has revealed three forms of mutations : 4 base pair deletion (codon 41/42); base substitution C-T (IVS-2,654) and base substitution A-G (-28, promoter region).

RFLP analysis using restriction endonucleases without radioactive labelling have shown some positive results (Mm II and Ava II).

We have designed several oliogonucleotide probes for detecting the following mutations : -31 (A-G); codon 17 (A-G); IVS-1 nt 5, (G-C); IVS-2 nt 654, (G-C); 4 bp deletion at codon 41,42 and -28 ATA.

We are continuing our work to elucidate all the various mutations in the beta globin gene region responsible for conferring beta-thalassaemia. (Hidayat H., Nik Mohammad M., Khalid H. & Shaharuddin A.)

Assessment of various methods for prenatal diagnosis of alpha and beta thalasaemia

Several methods were assessed for use in this project. The RP-HPLC technique gave fast results and allowed the analysis of small amounts of samples in the study of globin chain synthesis.

RFLP analysis was found not suitable as a large sample volume was needed and the method was both tedious and time consuming.

The PCR method was found to be the best as only a small sample volume was needed and gene amplification could be carried out without the tedious method of gene cloning in a bacterial host.

We are still facing some difficulties in getting fetal samples as not many families readily volunteer for such tests. (Zaik M., Sabab H. & Khalid H.)

CANCER PROGRAMME

Hospital-based registry of leukemia and allied disorders

We visited the various general hospitals in Malaysia and discussed the protocol with the paediatricians, physicians and pathologists, so as to get them involved with the project. Formats and preliminary enquiry forms were then prepared. Preliminary inquiries were sent to approximately 132 consultants, with the object of enabling us to obtain a feedback on difficulties faced in the assessment of diagnostic and treatment facilities and also the number of different cases of leukemia and allied disorders

mine the potability of drinking water in 12 villages in Pasir Mas, Machang and Pasir Puteh, and to relate this with the occurrence of diarrhoea disease in the area. Six villages were randomly selected from Pasir Mas, Macang and Pasir Puteh respectively. Information was obtained from each village on the source of water supply, type and condition of wells and latrine, proness of area to flooding, apart from relevent socio-demographic data. Information on diarrhoeal diseases in children were obtained from the on-going surveillance mechanism, which collect data on morbidity and mortality of diarrhoeal diseases as well as acute repiratory tract infections every two weeks from house-to-house surveys. Since April 1989, three cross-sectional surveys on water quality were conducted and 310 water samples were collected during each survey period from the 12 villages. Water samples were cultured and analysed, using the membrane filter technique, at the IMR field laboratory in Kelantan the same day to obtain MFC counts. For the first two surveys, the coliphage method (developed by Wang, C.W., University of Malaya) was also used to compare with MFC counts. Ninety three percent of the water samples came from well water, the remaining 7% from JKR piped water supply. The average MFC count per sample of water across all villages was 6,187, with a range of 100,000. The study is countinuing, with another survey due in 1990. (Lye M.S., Wang C.W. & Loh C.L.)

Prognostic signs and symptoms of acute peptic ulcer

This project is being carried out in collaboration with the Faculty of Medicine, University of Malaya. The primary objective is to determine the symptoms and medical history that will predict peptic ulcer disease with a high degree of probability. It is hoped that ultimately, a set of definitive criteria can be produced which can be used to screen out non-peptic ulcers and reduce the number of unnecessary endoscopy procedures.

All patients who came through the Polyclinic C at the University Hospital with complaint of dyspepsia were selected for the study. Since the beginning of 1988, a total of 444 patients entered the study. All these reponded to a structured questionnaire which captures the patients' socio-demographic data, symptoms, alcohol consumption, and smoking history. Endoscopic examination was carried out subsequently.

Of the 444 patients, 225 had complete data which were available for analysis. Of the 225 patients, 31 (14%) were confirmed peptic ulcer (gastric, duodenal, or both) with endoscopic examination. A stepwise logistic regression was performed using LOGIST (SAS) on the following independent variables : age in years, gender, race, history of smoking (at least 5 cigarrettes a week), nocturnal pain, radiation site, aggravation by spicy food, severity of pain, relief by medication. aggravation by hunger, past history of ulcer, and history of alcohol ingestion. The presence or absence of peptic ulcer was the binary dependent variable. Variables that entered the model were age, radiation site, aggravation by spicy food, and gender. It was noted however that there was multicollinearity between gender and smoking ($p = .0000$). When the regression was repeated with gender removed, smoking entered the model, together with age, radiation site and spicy food. The results are to be regarded as still preliminary; the study is on-going and data will be reanalysed as the sample size increases. (Lye M.S., Tan H.S. & Wong, D.)

DENGUE

The project "Epidemiology of Dengue/Dengue Haemorrhagic Fever" which com-

menced in 1984, was completed in 1989 by the Virology Division in collaboration with the Department of Medical Microbiology, University Malaya and the Kuala Lumpur General Hospital.

A second project, "Potential use of the micro-inoculation technique in *Toxorhynchitis* larvae for the rapid diagnosis of Dengue", was aimed at identifying species and strains of *Tx. splendens* that can be used in the above test. (Programme Co-ordinator: Sinniah M.)

Epidemiology of dengue/dengue haemorrhagic fever

This project concluded with the following findings:-

The percentage of children sero positive for dengue increased by an average of 11% a year. By the 6th year the percent positive reached 95.9% compared with 43.4% six years ago.

In spite of the high dengue infection rate and in spite of acontinous and reliable surveillance mechanism, there was a very low rate of dengue disease among the cohort of children. Of the 16 children picked up by the surveillance mechanism for suspected dengue infection, only 1 was sero positive. Dengue virus was not isolated from any of these children.

Although the percentage of sero positive children increased by 11% annually, the larval indices remained low. In addition, the extrememly low number of adult *Aedes* trapped was disproportionate to the level of transmission present.

Risk factors for dengue infection were locality of residence, family practices in failing to prevent larval breeding, few animals in the household, and a low family income. (Lye M.S., Lim T.W., Lee H.L., Sinniah M., Vijayamalar B., Deavi M., Lam S.K., Pang T., Haliza Mohd Raji, Gunasegaram, & Devi S.)

FEBRILE ILLNESS

This programme covering viral diseases other than dengue, includes a number of projects. A new project was started in 1989 to evaluate the safety and effectiveness of an interferon preparation following prednisolone withdrawal, in the treatment of patients with chronic hepatitis-B (CHB).

Various other projects are on-going research from previous years. The first commenced in 1987 and aims to determine the etiological agents of acute viral hepatitis. The second is to study the prevalance of HSV-Type II antibodies in normal females compared with women with cervical carcinoma. The third project is a collaborative effort with the Department of Genetics and Cellular Biology, University of Malaya and aims to evaluate the sandwich hybridization technique for detecting human CMV in crude urine samples instead of purified urine. The fourth is on Congenital TORCHES infections and the fifth is on CMV infections in relation to kidney transplants. (Programme Co-ordinator: Sinniah M.)

Clinical trial of interferon in chronic hepatitis-B patients

An estimated 80% of the world's 200 million Hepatitis-B virus (HBV) carriers live in the Asian-Pacific region, where HBV is endemic; an estimated 15% of these carriers may eventually die from chronic liver disease and/or liver cancer. Although

leprosy patients and the other to clone pure subset populations of T cells from leprosy patients.

In addition, work is also being carried out in two other areas, one to evaluate some of the diagnostic tests based on the newer antigens and the other to establish an animal model for leprosy research. (Programme Co-ordinator: Sukumaran K.D.).

Characterization of *Mycobacterium leprae* proteins purified from lysates of recombinant DNA clones

Recombinant DNA expression technology offers an effective strategy for the thorough and systematic examination of antigens coded in linear segments of a pathogen's genome when antibodies are available for use as probes. A recombinant genomic library of DNA from *M. leprae* cells isolated directly from human patients (in contrast to the existing gene libraries which were constructed from *M. leprae* organisms grown experimentally in the armadillo) may well result in the identification of antigenic determinants that have not yet been detected.

A gene library was successfully constructed from *M. leprae* cells isolated directly from human biopsies. It is now being expanded and the protein lysates will be characterized. (Gan S.C.)

Seroepidemiology of Leprosy

A seroepidemiology study of loprosy in Peninsular Malaysia was completed. By stratified sampling from 32 districts selected at random, a total of 21,917 individuals were examined clinically and 4,566 blood samples were tested for antibodies to phenolic glycolipid antigens. The percentage with significant antibody levels was 3.8% (Gan S.C.)

Nude mice : An animal model for leprosy research

The objectives of the project are (i) to make available nude mice for leprosy research and (ii) to test the susceptibility of the locally bred nude mice to *Mycobacterium leprae*. A total of 30 SPF Swiss outbred nude mice, 20 heterozygous nude (nu/$^+$) female mice and 10 homozygous nude (nu/nu) male mice were purchased from Australia. Heterozygous females are used for breeders as homozygous females have underdeveloped nipples and do not produce any milk to feed their pups. About 30% of the litter from these matings were homozygous nudes. These mice were placed in isolators for breeding. Isolators are needed to maintain a clean environment as it has been reported that nude mice survive for only 8–10 weeks in conventional rooms. To date a total of 185 nude mice have been obtained.

Two samples of *Mycobacterium leprae*, one armadillo-derived and the other patient derived, were inoculated into the footpads of these mice. 20 mice received graded doses of armadillo-derived *Mycobacterium leprae*, while 12 mice received a fixed dose of human *Mycobacterium leprae*. These mice will be observed for 9 months, after which they will be sacrificed and studied. (Fuzina N.H. and Gan S.C.)

MALARIA RESEARCH PROGRAMME

Projects under the malaria research programme were mainly in epidemiological field studies and in the monitoring of malaria parasite sensitivity to known antimalarials in use in Malaysia.

Malariometric surveys were conducted in areas of different endemicities with a view to correlate results of various serological assays for antibodies with parasite, spleen and sporozoite rates and to determine whether such assays can be used for seroepidemiological purposes in Malaysia and the region.

The monitoring of parasite sensitivity to common antimalarials continue to be an important activity as this would provide health practitioners with early warning of the changing pattern of parasite response and the emergence of resistance to such drugs.

Genetic and host preference studies were carried out on some important vectors of malaria from Peninsular Malaysia and Sabah. (Programme Co-ordinator: Mak J.W.).

Monitoring the *in vitro* drug sensitivity of *Plasmodium falciparum*

In 1989, 44 specimens were received for *in vitro* drug sensitivity testing of *P. falciparum* against 3 antimalarial drugs (chloroquine, mefloquine and quinine) using the WHO microtest kits. Of the 14 successful tests against chloroquine, 80% of the isolates showed resistance i.e. schizont growth in wells with 8 pmol or more of drug. For mefloquine, 7.1% of the isolates were resistant, showing schizont growth in wells with 64 pmol or more. For quinine, 14.3% of the isolates were resistant, schizont growth occuring in wells with 256 pmol or more. (Mak J.W. & Noor Rain).

Local isolates of *Plasmodium falciparum*

A total of 46 isolates were obtained from patients infected with *Plasmodium falciparum*. Of these, 33 were from Orang Asli patients at the Gombak Hospital while the other 13 were from patients at the General Hospital, Kuala Lumpur. *In vitro* cultures of these isolates were performed using the candle-jar method of Trager & Jensen (1975). Thirteen of these isolates (28%) were successfully cultured. Two of these were subcultured for 10 generations while the other 11 had undergone 4-6 generations of subculture before being cryopreserved in liquid nitrogen.

One established isolate (Gombak A) was grown *in vitro* as an antigen source for use in the indirect fluorescent antibody test (IFAT) and the enzyme-linked immunosorbent assay (ELISA) for routine diagnosis and seroepidemiological studies in malaria. Also genomic DNA was extracted from the Gombak A isolate for the production of a *P. falciparum* DNA probe. (Lim P.K.C. & Noor Rain A.).

Seroepidemiological studies in malaria

The objectives of this multicentre study involving investigators from Thailand, Indonesia, Philippines and Malaysia are:

(a) To determine the suitability of various serological techniques in the assessment of malaria endemicities;

(b) To determine the correlation of results between these various tests;

(c) To make recommendations on the standardization of these tests in the region for seroepidemiological purposes.

Studies were carried out in an non-endemic area (Pondok Tanjong, Perak), a nypoendemic area (Ulu Langat,Gombak and Petaling, Selangor) and a mesoendemic area (Betau, Pahang). During the malariometric surveys, spleen and parasite rates were determined. Sera were collected for measurement of antibodies and entomological studies carried out to determine vector densities.

At Pondok Tanjong, all 893 people examined were negative for malaria parasites but 15(1.7%) had subperiodic *Brugia malayi* microfilaraemia. In the survey of five hypoendemic villages in Selangor, 9 out of 698 (1.3%) were found positive for malaria (33.3% *Plasmodium falciparum*, 66.7% *P. vivax*). Of the 596 persons examined in the mesoendemic area in Betau, 162 (27.2%) were positive for malaria. Of these positives, 79 (48.8%), 71 (43.8%), 3 (1.8%) and 9 (5.6%) were due to *P. falciparum*, *P. vivax*, *P. malariae* and mixed infections respectively.

The sera collected are being tested for malaria antibodies against schizont and ring-infected cell antigens, using the indirect fluorescent antibody (IFA) assay; against soluble schizont antigens and cell-ELISA antigens using the enzyme-linked immunosorbent assay (ELISA). The antigen source is from *in vitro* cultured *P. falciparum* Gombak A isolate. (Mak J.W., Normaznah Y., Lam P.L.W., Suresh K., Lim P.K.C., Noor Rain A., Ambu S. & Choong M.F.).

Genetic variability in the tendency of *Anopheles maculatus* to bite indoor/outdoor and to bite man

At the beginning of the year, two experiments were carried out in Post Betau, Pahang on *An. maculatus* using the mark-release-recapture technique. The experiments investigated the possible existence of a distinct man-biting (anthropophilic) variety and of genetic variation in the tendency of the species biting indoor and outdoor. Recovery rates of marked mosquitoes were high (11.5–12.6%). Results showed that there was no association between the choice of host of *An. maculatus* at successive feed and no heterogenicity between indoor and outdoor biters.

In the same studies, the oviposition cycle estimated for *An. maculatus* was 2.4 ± 0.45 days (1.98–3.12 days). The horizontal survivorship estimate of 0.761 from the log-regression of recaptures against time agreed fairly well with the survivorship estimated vertically ($p = 0.710$) obtained from log-regression of the number of mosquitoes in each age group against time. The maximum flight distance was 1.6km. The information obtained from these studies are important for future intervention measures in the study site. (Loong K.P. & Chiang G.L.)

Precipitin bloodmeal tests of *Anopheles maculatus*

An important aspect of vector behaviour essential in the understanding of the epidemiology of malaria transmission is the mosquito host preference. Thus it is invaluable for us to know the proportion of vectors feeding on man and other animals.

Different methods of collecting outdoor resting materials were attempted. These included sweep nets, drop nets and wooden boxes smeared with mud and half-buried in potential resting areas of *An. maculatus* besides using battery operated aspirator searching amongst vegetation around houses and along the river banks in the early morning between 0600–1000 hours in Post Betau and Ulu Lui.

Despite all the methods described above, we failed to collect outdoor resting blood-fed specimens. Hence almost all blood-meal tests were carried out with specimens collected from CDC light-traps placed indoor and outdoor of houses. To date 172 specimens have been tested and results revealed high human blood index (HBI) of 0.932. The high HBI could be due to the constant depletion of wild animals as a result of hunting by the orang asli and the opening up of land for marginal farming in which wild animals are driven away. Besides that, the only domestic animal kept by the villages are dogs and chickens but they are not the preferred host of *An. maculatus*. Very few villages had cows and our survey indicated that out of the 18 villages in Post Betau, only 4 had cows. There were no cows in the orang asli village

in Ulu Lui. As man is the only source of blood, and because of the exophilic nature of the vector, DDT spraying had not been effective in bringing down the malaria cases. (Loong K.P. & Chiang G.L.)

Electrophoresis studies

Samples of the F1 generation of *Anopheles donaldi* and *An. barbirostris* from Malacca, F1 *An. donaldi* from Sabah and F6 *An. donaldi* originally from Malacca, were studied by means of horizontal starch-gel electrophoresis. A total of 10 gene-enzyme systems, representing 15 presumptive gene loci, was assayed. Ten loci (alpha-GPD, Fumarase, PGM, MDH-1, MDH-2, HK-1, HK-2, HK-3, IDH-2, 6GPD-2) were monomorphic and common in both *An. barbirostris* and *An. donaldi*. Five of the 10 gene-enzyme systems which were represented by distinctive electromorphs, coded as IDH-1, 6PGD-1, ME, GPI and G6PD, could be used to separate the two species. The level of polymorphism in the F1 Malacca sample of *An. donaldi* was higher than that of the laboratory colonized F6 materials. All the enzymes assays for F1 *An. donaldi* of Sabah were monomorphic. (Chiang, G.L., Dakorn, L. & Kamariah)

OTHER PARASITIC DISEASES

Research in parasitic diseases covered a wide area of interest, stretching from toxoplasmosis to toxocariasis. Techniques used in investigations were also as varied. They ranged from simple coprological examinations to the sophisticated monoclonal antibody production. (Programme Co-ordinator: Ow-Yang C.K.)

Soil-tranmitted helminthiasis in an estate community

A survey on soil-transmitted helminthiasis (STH) was carried out in Prang Besar Estate, Serdang, Selangor. Of the 1,300 individuals liviing in 310 quarters supplied by the estate, 414 submitted a stool sample each. Of these, 15.3% had one or more worm infections:*Ascaris* (13.1%), *Trichuris* (4.9%), hookworm (1.7%) and *Strongyloides* (0.2%). Children below six years had the highest rates of STH (26.5%). Worm infestation was examined in relation to the villagers' habits and their environment. Risk of helminth infections was higher among those living in the older quarters as compared to those in the newer ones, the Relative Risk (RR) being 2.1 ($p<0.01$). Higher rates were found among those living in homes with toilet which were choked ($RR = 4.2$, $p<0.001$) or dirty ($RR = 2.9$, $p<0.001$) as well as among those with collapsed or stagnant drains ($RR = 2.6$, $p<0.001$). Persons who were reported as seldom or sometimes washed their hands before meals also had higher infection rates than those who always did so ($p<0.05$). (Lai P.F. & Lim T.S.)

Medico-ecological survey in Bakun Area, Seventh Division, Sarawak

A reconnaissance trip was carried out in August at the Bakun area, Sarawak in August at the request of the Sarawak Electric Supply Company. Fifteen long houses were visited and finger-prick blood samples were obtained from 154 persons to check for any evidence of schistosomiasis in the area. Other information was also collected from the Heads (Ketua Rumah) of the long houses for planning of the survey proper.

The survey proper was conducted in November-December. The Division of Parasitology, IMR was responsible for the studies on schistosomiasis, intestinal parasites and public health problems while the Medical Headquarters, Kuching carried out the survey on malaria and filariasis, and vector mosquitoes. Eight long houses

Fifteen leaf monkeys were bought from an animal dealer. Each of the monkeys were put in an individual cage for better observation and easy intervenion. Their behavior and eating habits were monitored daily. On arrival, the animals were given long acting antibiotics and vitamins. Faecal and blood samples were also taken. During the first two weeks of the quarantine, the mortality rate was observed to be 30%. Deaths were due to dehydration, septicaemia and pneumonia. Individually housed monkeys were depressed, with a tendency to crouch in one corner. However these animals were observed to be eating.

Faecal examination showed heavy infections with strongyloides, trichuris and *Ancylostoma*. These animals were also found to be anaemic and with high eosinophillia.

After a period of 3 weeks, the animals were released into an open cage. On release,it was observed that these animals tended to huddle together. They were also observed to prefer the sunny part of the cage in the morning. All animals were found to be Mantoux negative when tested. Only one monkey died after it was transferred to the open cage.

A second batch of monkeys has been ordered. A different management approach will be taken so as to reduce the mortality rate in this new batch of monkeys. (Fuzina N.H. & Mutalib A.R).

DIVISION OF MALARIA AND FILARIASIS

Production of monoclonal antibodies against *naja-naja kauthia* venom (cobra venom)

A total of about 30 fusions were carried out and of these only two monoclonal antibody producing hybrids were obtained. The two positive hybrids (CV2D8, CVIE9) were cloned by limiting dilution. Both clones were IgGl secretors. In cross-reactivity studies, the monoclonal antibodies against the Cobra venom reacted well with its antigen but did not cross-react with the other venom antigens, *Bungarus fasciatus* (Banded krait), *Callaselasma rhodostoma* (Malaysian Pit Viper), *Trimeresurus purpurseomalatus* (Shore pit Viper) and *Trimeresurus wangleri* (Temple Pit Viper). (Noor Rain A., Ambu S. & Mak J.W.).

Development of ELISA for bloodmeal identification

Antisera produced in laboratory-bred rabbits against seven hosts' sera namely avian, cat, cow, man, pig, rodent and reptile were cross-absorbed with heterologous sera until no precipitin band was observed in the counter-immunoelectrophoresis test (CIE). The absorbed antisera were then partially purified by three ammonium sulphate precipitations followed by dialysis in normal saline; then checked in CIE to confirm their reactivity. Antisera of each animal host was reacted in the ELISA against homologous and heterologous sera (diluted 1:2500) to determine the specificity and sensitivity of the test compared to CIE. Optimal dilutions of antisera, sera and peroxidase-conjugated goat anti-rabbit IgG were determined by a chequerboard titration.Results obtained showed that antisera raised against avian, pig and reptile were highly specific and no cross-reactions were seen with any of the heterologous sera tested. However, anti-cat antiserum was found to cross-react with pig serum, anti-man antiserum with monkey serum, anti-cow antisera with goat serum and anti-rodent antiserum cross-reacted with both pig and horse sera.

In the second part of this study, known bloodmeals of laboratory-fed mosquitoes (diluted 1 in 2500) reacted in the ELISA with the various antisera showing that antisera raised against avian, cat, reptile and pig were highly specific. The three other antisera however, showed similar cross-reactions as reported above.

These findings indicated that while ELISA was more sensitive than CIE as bloodmeals could be diluted higher (1:2500) compared to CIE (1:150), specificity of the ELISA was not so good for some of the antisera. Further cross-absorption would be performed on these antisera to improve their specificity in ELISA. (Lim P.K.C.).

DIVISION OF MEDICAL ECOLOGY

Field and laboratory studies on parasitic infection in feral and wild animals were carried out during the year. A total of 3,031 feral and wild animals consisting of 24 species were collected mainly by trapping and of these, 20 were mammals, 3 reptiles and 1 bird. All the animals were examined for helminth infections and blood parasites. Ectoparatises were also collected from the animals.

Vectors of plague

Surveys to monitor the vectors and the animal reservoirs of plague were carried out at the refugee camp, Pulau Bidong, Terengganu. In the first survey carried out in May 1989 a total of 391 rats belonging to four species, namely, *Rattus rattus diardii, Rattus norvegicus, Rattus exulans* and *Rattus tiomanicus* were trapped. A total of 638 rat fleas, *Xenopsylla cheopis* were collected from 116 rats thus giving a flea index of 1.6.

In the second survey carried out in October 1989 a total of 187 rats were caught. These were *R.r. diardii, R. norvegicus* and *R. exulans.* A total of 579 rat fleas were recovered from 125 rats and the flea index was 3.1.

The dominant species of rat was *R.r. diardii* followed by *R. norvegicus*. Both hosts and parasites were in abundance on the island. The abundance of the rat flea, *Xenopsylla cheopis* is of considerable public health importance as the flea indices were rather high during the surveys. (Inder Singh K.)

Environmental impact assessment at the proposed Bakun Hydroelectric Project, Sarawak

A medico-ecological survey was conducted at the proposed Bakun Hydroelectric Project in Sarawak, so as to study the different species of wild animals that may serve as reservoir hosts in relation to diseases of public health importance, particularly with respect to the presence of zoonotic infections.

Small mammals were trapped at the proposed dam site and areas adjoining the future catchment area. A total of 100 traps were used and trapping was carried out for 11 days. Captured animals were examined for ecto- and endoparasites. Thick and thin blood films were made for blood parasites. A total of 22 animals were trapped, consisting of 2 species of rats, 1 bird, and 2 species of reptiles. Endoparasites recovered from *Sundamys muelleri* were *Capillaria hepatica, Hepatojarkus malayae, Protospirura muris, Physaloptera* spp., *Heterakis spumosa, Nippostrongylus braziliensis, Paragonimus* sp. and *Armillifer moniliformis. H. malayae* was recovered from *Rattus whiteheadii* and *Echinostoma* sp. from birds. Of these parasites *C. hepatica, Paragonimus* sp. and *A. monoliformis* have been reported in man. (Inder Singh K.)

Examination of blood parasites

Of the 762 smears taken from animals and examined for blood parasites, *Trypanosomes, Grahamella, Hepatozoon, Plasmodium* and microfilaria were found in 76, 56, 19, 14 and 5 animals, respectively. (Inder Singh K).

DIVISION OF MEDICAL ENTOMOLOGY

Screening and isolation of indigenous microbial control agents

A total of 20 isolates of *Bacillus thuringiensis* and 6 isolates of *B. sphaericus* were isolated from soil and water samples collected throughout Malaysia. The *B. thuringiensis* isolates comprised 17 strains of serotype H-14, 1 strain each of H8a8b and H-7 and a new serotype individualised as *Bacillus thuringiensis* serovar *malaysianensis* (Btm). This new serotype was shown to be more effective against mosquitoes than the standard strain of *B. thuringiensis* serovar *israelensis*. No B-exotoxin production was detected from Btm which makes it safe to be used as a microbial control agent. An anaerobic bacterium isolated from coastal mangrove swamp in Malacca was found to be highly larvicidal to several mosquito larvae. This isolate was identified and studied in detail by Pasteur Institute and subsequently named as *Clostridium bifermentans* serovar *malaysia*, a new anaerobic bacterium. This is the first time an anaerobe is reported to exhibit mosquitocidal activity. Toxicological studies conducted by PI indicated that this agent was not toxic to the test animals. (Lee H.L. & Seleena P.)

Field evaluation of indigenous *Bacillus thuringiensis*

Wettable powder of an indigenous isolate of *Bacillus thuringiensis* serotype H-14, IMR-BT-8 was evaluated in the field in Grik, Perak against *Culex pseudovishnui*, a suspected vector of Japanese encephalitis. The larval population was markedly reduced by about 90%, 24 hours post-treatment, thereby demonstrating the potential of this agent in the control of vectors of Japanese B encephalitis.

Preliminary field evaluations of *B. thuringiensis* serovar *malaysianensis* was conducted in earthen pots and tyres for the control of *Aedes albopictus*. Comparative trials with IMR-BT-8 (serotype H-14) and Vectobac (commercial *B. thuringiensis* H-14) indicated that Btm was the most effective exhibiting long residual activity in water containers. (Lee H.L. & Seleena P.)

Plasmid analysis of indigenous *Bacillus thuringiensis*

The plasmid profile of two indigenous isolates of *B. thuringiensis* H-14 was analysed after the plasmid DNAs were extracted with alkaline lysis technique and electrophoresed on agarose gel. Both isolates were shown to contain a total of 9 plasmids inclusive of the 72 MD plasmid which harboured the endotoxin genes similar to the standard strain of *B. thuringiensis* serovar *israelensis*. (Lee H.L.)

Nationwide *Aedes* larval survey in Peninsular Malaysia

This survey which was initiated in 1988 was concluded this year. A total of 7,855 premises in 171 towns/localities (11 states and 1 Federal Territory) were surveyed. For *Aedes aegypti*, the House Index (HI) and the Breteau Index (BI) ranged from 0.89–7.72% and 0.89–9.19 respectively, averaging 4.15% and 4.54 respectively for Peninsular Malaysia. The survey also determined that for *Ae. albopictus*, the HI and BI ranged from 0–2.75% and 0–3.00 averaging 0.98% and 1.03 respectively. The ubiquitous presence of *Ae. aegypti* in Peninsular Malaysia is confirmed. In general, anti-*Aedes* measures are effective in suppressing the larval population in urban towns. (Lee H.L. & Hishamudin M.)

Insecticide studies

Laboratory screening

Permethrin, a synthetic pyrethroid was bioassayed in the laboratory against lab-bred larvae of *Anopheles maculatus, Aedes aegypti, Mansonia uniformis* and *Culex quinquefaciatus* using the standard WHO method. The results indicated the high toxicity of this chemical against these larvae.

A new chitin synthesis inhibitor (CSI) known as flufenoxuron (Cascade) was evaluated against larvae of *Ae. aegypti*. The results indicated an EC50 (Effective Concentration of 50% mortality) value of 0.000042 mg/l. Gross morphological, histological and ultrastructural studies were conducted on both exposed and control batches of larvae, larviform pupae, pupae and adult stages to determine the exact effects. These studies revealed deformities mainly on the cuticle, specifically the chitin-containing layers. (Lee H.L., Yap A. & Salleh H.)

An insect growth regulator (IGR), pyriproxyfen was evaluated in the laboratory against several *Culex* species. The results showed that this compound was more active in tap than field water. The LC90 values indicated that *Cx. quinquefasciatus* was the most susceptible while *Cx. gelidus* the least in field water. It was also effective against *Mansonia uniformis*.

As a follow-up to the above laboratory investigation, an area in Serdang was selected for evaluating the IGR under natural field conditions. Preliminary adult and larval survey in this area over a period of five months showed that the predominant species are *Cx. tritaeniorhynchus* (64.2%), *Ma. uniformis* (32.1%) and *Cx. gelidus* (1.5%). Control operation using the IGR is scheduled to start early next year. (Chiang G.L.)

Field evaluation

Based on results of laboratory bioassays, permethrin was also evaluated in the field for the control of *Anopheles* larvae. At a dosage of 0.5 kg/ha, permethrin was shown to be able to eliminate completely the larval population for the trial duration of 1 week. (Lee H.L. & Salleh H.)

Resistance studies

The susceptibility status of *Aedes aegypti* to temephos (Abate) is being monitored continously since the detection of a low level of resistance. Field-collected larvae from Selangor, Kuala Trengganu, Alor Star and Kangar showed increased tolerance to temephos, but this larvicide is still effective at the operational dosage of 1 mg/l. (Lee H.L. & Salleh H.)

An attempt to select a temephos-resistant strain of *Aedes aegypti* is being conducted in the laboratory. Preliminary results indicated the progressive acquirement of tolerance to this larvicide after 8 generations of selection. (Lee H.L. & Salleh H.)

A simple and rapid biochemical test to detect insecticide resistance due to elevated esterase has been developed and a simple test kit has been produced for field evaluation. Initial feedback from state entomologists showed that this technique of resistance detection is very useful. (Lee H.L.)

Susceptibility tests were conducted on larvae of *Culex gelidus, Cx. tritaeniorhynchus, Cx. vishnui* and *Cx. pseudovishnui* from several localities in Peninsular Malaysia to temephos (Abate). Blood-fed females were collected from the field using cattle-bait-traps. Larvae hatched from eggs laid by the wild females were used for bioassays. No resistance was detected. Temephos is still an effective larvicide against the *Culex* species. F1 adults of the above four species were also tested for susceptibility to malathion at a WHO diagnostic dosage of 5% malathion. The results showed that *Cx. vishnui* from Lubuk Pusing, Tebong and Teluk Intan were resistant to malathion. No resistance was detected in the other species. (Chiang G.L. & Tay S.L.)

Repellent

Lately there has been renewed interest in the use of fabrics impregnated with repellent and/or insecticide. The repelling effect of varying concentrations of ethanol-based DEET impregnated headbands, wristbands and anklets was assessed against some mosquito species in Selangor. In Kuang, a malaria endemic area, the average reductions of *Anopheles maculatus* collected from protected team with 5%, 10% and 30% DEET were found to be 71.96%, 82.34% and 95.77% respectively. However, in Batang Berjuntai, 30% DEET provided 82.45% protection against *Mansonia uniformis*. Impregnated headbands, wristbands and anklets therefore provide a high degree of protection. In tests conducted over 2 months, impregnation with DEET showed no decline in effectiveness. (Chiang G.L. & Soejitno)

Other studies

A case of urogenital myiasis caused by the maggot of *Eristalis* species was identified in a female patient. This form of myiasis is reported for the first time in a human and this indicates the medical importance of *Eristalis* which is commonly found breeding in polluted drains or pools in Malaysia. (Lee H.L.)

DIVISION OF PATHOLOGY

Further studies on the effects of palm oil on chemically induced mammary carcinogenesis in rats

This is a collaborative project carried out with researchers from PORIM. All the 139 mammary tumours induced in the test and control animals in this project were examined and typed histologically. The results of this study are being analysed for publication. (Nesaratnam K., Khor H.T., Ganesan J. & Chong Y.H.)

DIVISION OF RADIOCHEMISTRY

The research programme in the Division is aimed at (1) producing our own immunoassay reagents for hormones (2) developing and validating assay procedures (3) collaborative studies with clinicians on hormonal changes in health and disease. The outcome of the research projects is intended to facilitate the diagnosis and management of disorders or diseases affecting the hypothalamic/pituitary/thyroid/adrenal/gonadal axes as well as other endocrine and non-endocrine organs.

Development and clinical applications of an in-house radioimmunoassay for human growth hormone

A radioimmunoassay for human growth hormone (hGH) was established during the previous year and the test was used in several studies. Serum hGH levels were

9.2 BUDGET FOR 1989

In the year under review, IMR's total budget can be summarized as follows:

i)	From the Malaysian Government: For personal emoluments and operating expenditure.	$10,399,675.00
ii)	Training and Scholarship Allowances: For trainees attending the IMR's Senior and Junior courses in Medical Laboratory Technology.	1,286,595.00
iii)	Trust Accounts: USAMRU/SEAMEO-TROPMED/WHO/PORIM	1,320,218.23
iv)	Research and Development Fund:	6,432,500.00
	TOTAL	$19,438,988.23.

CHAPTER 1

HEALTH STATUS

POPULATION

In 1988 an estimated 16 941 780 persons were living in Malaysia. This was an increase of 416 183 persons or 2.5% over the preceding year. The annual rate of growth in population in Peninsular Malaysia was 2.4%, in Sabah was 3.8% and in Sarawak was 2.6%. Currently, 83% of Malaysia's population lives in Peninsular Malaysia, while only 8% and 9% live in Sabah and Sarawak respectively.

The more densely populated states in Peninsular Malaysia are still Johor, Perak, Kedah, Penang, Selangor, Federal Territory and Kelantan, each having more than a million people. Table 1.1 shows the population distribution and density in 1988. Sarawak and Wilayah Persekutuan displayed contrasting densities per square kilometre of 13 and 4 862 persons in a backdrop of 124 000 square kilometre and 243 square kilometre.

Up to the end of 1988, the age structure of the population in Malaysia was still showing a situation predominantly youths. With infants and toddlers comprising 14% of the population, children 5 – 14 years old constituting another 23% and the entire population under 20 accounting for 48% of total population, health problems among the younger generation will continue to be of prime consideration in health planning. See Table 1.2.

Mortality rates of perinatals, neonates, infants and toddlers have fallen progressively over the years. The health of mothers too was becoming evident in the gradually declining mortality rate. See Table 1.3.

TABLE 1.1 – Population and Population Density, Malaysia, 1988

State	Population			Area in Km2	Density in Km2
	Male	Female	Total		
Perlis	89 837	89 986	179 823	795	226
Kedah	671 256	683 940	1 355 196	9 426	144
Penang	548 344	557 347	1 105 691	1 031	1 072
Perak	1 064 679	1 081 757	2 146 436	21 005	102
Selangor	950 568	930 233	1 880 801	7 956	236
W. Persekutuan	609 476	572 014	1 181 490	243	4 862
N. Sembilan	347 164	346 675	693 839	6 643	104
Malacca	274 159	286 969	561 128	1 650	340
Johor	1 012 258	999 859	2 012 117	18 986	106
Pahang	519 803	483 258	1 003 061	35 965	28
Terengganu	355 319	351 446	706 765	12 955	55
Kelantan	572 938	579 206	1 152 144	14 943	77
PENINSULAR MALAYSIA	7 015 801	6 962 690	13 978 491	131 598	106
SABAH	716 021	654 168	1 370 189	73 711	19
SARAWAK	804 828	788 272	1 593 100	124 449	13
MALAYSIA	8 536 650	8 405 130	16 941 780	329 758	51

Source: Department of Statistics.

TABLE 1.2 – Population by Age-Group, Malaysia, 1988.

	AGE GROUP (YEARS)	PENINSULAR MALAYSIA		SABAH		SARAWAK		MALAYSIA	
		Population	% to Total	Population	% to Total	Population	% to Total	Population	% to Total
Infants and Children	0 – 4	1 933 141	13.8	255 618	18.7	208 186	13.1	2 396 945	14.1
	5 – 9	1 666 492	11.9	192 599	14.0	182 843	11.5	2 041 934	12.1
	10 – 14	1 532 240	11.0	160 577	11.7	187 320	11.7	1 880 137	1.1
	0 – 14	5 131 873	36.7	608 794	44.4	578 349	36.3	6 319 016	37.3
Adolescents	15 – 19	1 447 454	10.4	136 159	9.9	189 447	11.9	1 773 060	10.5
Young Adults	20 – 29	2 611 757	18.7	230 912	16.9	295 614	18.6	3 138 483	18.5
Matured Adults	30 – 59	3 960 982	28.3	339 096	24.8	428 759	26.9	4 728 837	27.9
Aged	60 & over	826 425	5.9	55 228	4.0	100 731	6.3	982 384	5.8
	TOTAL	13 978 491	100.0	1 370 189	100.0	1 593 100	100.0	16 941 780	100.0

Source: Department of Statistics

GENERAL HEALTH INDICATORS

Vital Rates

Table 1.3 shows a comparison of the vital rates in 1981 and 1988. The crude birth rate throughout Malaysia has shown a marginal drop. Mortality rates of newborns, infants, toddlers and mothers continue to decline each year consequent upon improvements in health services from year to year.

TABLE 1.3 – Vital Rates for Malaysia, 1981 and 1988

	Peninsular Malaysia		Sabah		Sarawak	
	1981	1988	1981	1988	1981	1988
Crude Birth Rate	30.8	29.2	42.3	38.7	28.7	29.3
Crude Death Rate	5.2	4.9	4.6	3.8	3.7	3.5
MORTALITY RATE						
Perinatal	23.75	16.01	N.A.	16.1	N.A.	8.7
Neonatal	12.27	8.94	15.3	13.5	8.9	6.2
Infant	19.71	14.05	26.3	19.6	15.1	9.8
Toddler	1.80	1.11	2.6	1.6	1.4	0.6
Maternal	0.59	0.26	0.22	0.19	0.3	0.15

N.A. = Not Available

Source: Department of Statistics.

Life Expectancy

The average life expectancy at birth has remained stable at around 70 for both sexes. However, as shown in Table 1.4 female life span exceeded the male and the Chinese is still reporting the highest expectancy among the various races in Peninsular Malaysia.

TABLE 1.4 – Expectation of Life at Birth (Age in Years), Peninsular Malaysia, 1981 and 1988.

RACE	1981		1988	
	Male	Female	Male	Female
Malays	68.4	71.7	68.7	71.9
Chinese	69.6	75.7	70.4	76.0
Indians	63.3	68.9	64.6	69.5
ALL RACES	68.0	72.9	68.6	73.0

Source: Department of Statistics.

Age-Specific Proportional Mortality

Table 1.5 gives the age-specific proportional mortality in Malaysia in 1988. As reflected in the declining infant and toddler mortality rates between the years from 1981 to 1988, the proportional mortality in the age group 0-4 years have fallen from 5.9 per 1000 population to 4.9 deaths in Peninsular Malaysia.

MORTALITY BY CAUSE

Cause-specific mortality in Peninsular Malaysia in 1988 is shown in Table 1.6 (Medically

TABLE 1.5 – Age-Specific Proportional Mortality, Malaysia, 1988.

AGE GROUP (YEARS)	PENINSULAR MALAYSIA			SABAH			SARAWAK			MALAYSIA		
	No. of Deaths	% to Total Deaths	Deaths Per 1000 Pop.	No. of Deaths	% to Total Deaths	Deaths Per 1000 Pop.	No. of Deaths	% to Total Deaths	Deaths Per 1000 Pop.	No. of Deaths	% to Total Deaths	Deaths Per 1000 Pop.
0 – 4	7 442	10.8	3.85	1 356	26.0	5.30	559	10.2	2.68	9 357	11.7	3.90
5 – 14	1 657	2.4	0.52	187	3.6	0.53	105	1.9	0.28	1 949	2.4	0.50
15 – 44	9 243	13.4	1.40	966	18.6	1.63	777	14.1	1.02	10 986	13.8	1.38
45 – 64	16 941	24.6	9.99	1 233	23.7	9.26	1 390	25.3	7.48	19 564	24.6	9.71
65 & Over	33 647	48.8	62.41	1 466	28.1	41.45	2 669	48.5	38.94	37 782	47.5	58.76
TOTAL	68 930	100.0	4.93	5 208	100.0	3.80	5 500	100.0	3.45	79 638	100.0	4.83

Source: Department of Statistics

Certified and Inspected Deaths) and in Table 1.7 (Non-Medically Certified Deaths). Total deaths for the year was 68 930, 38.8% of these being medically certified and 62% non-medically certified.

Among the medically certified deaths, Heart Disease and Cardiovascular Disorders was the major cause of mortality, continuing its hold into 1988 where it accounted for 30% of total medically certified deaths. The other secondary but nonetheless important causes included Neoplasms 11%, Birth Injuries and Other Causes of Perinatal Mortality 9% and Accidents 6% (3% were motor vehicle accidents).

Appendices 1 and 2 show respectively the number of medically certified deaths due to Malignant Neoplasms and to Diseases of the Circulatory System by detail cause groups in Malaysia in 1988.

TABLE 1.6 – Medically Certified and Inspected Deaths by Specific Cause, Peninsular Malaysia, 1988.

CAUSES	No. of Deaths	% to Total Medically Certified and Inspected Deaths
Enteritits and Other Diarrhoeal Diseases (ICD 001, 002 & Remainder of 001 – 009)	117	0.5
Tuberculosis (ICD 010 – 018)	399	1.5
Septicaemia (ICD 038)	847	3.3
Neoplasms (ICD 151, 153, 154, 162, 174, 180, 204 – 208, Remainder of 140 – 208, 210 – 239)	2 951	11.4
Diabetes Mellitus (ICD 250)	448	1.7
Nutritional Deficiency (ICD 261, 262, 263, 280 – 285)	118	0.5
Heart Disease and Cardiovascular Disorders (ICD 390 – 392, 393 – 398, 401 – 405, 410, 411 – 414, 430 – 438, 440, Remainder 390 – 459)	7 741	29.9
Pneumonia (ICD 480 – 486)	762	2.9
Chronic Liver Diseases and Cirrhosis (ICD 571)	237	0.9
Nephritis, nephrotic syndrome and nephrosis (ICD 580 – 589)	760	2.9
Congenital Anomalies (ICD 740 – 759)	812	3.1
Birth Injuries and Other Causes of Perinatal Mortality (ICD 767, 760 – 766, 768 – 779)	2 272	8.8
Motor Vehicle Traffic Accidents (E810 – E819)	863	3.3
All Other Accidents (E880 – E888, Remainder of E800 – E949)	1 505	5.8
ALL CAUSES	25 917	100.0

Source: Vital Statistics, Peninsular Malaysia, Department of Statistic.

TABLE 1.7 – Non-Medically Certified Deaths by Cause, Peninsular Malaysia, 1988.

CAUSES	No. of Deaths	% to Total Non-Medically Certified Deaths
1. Road Transport Accidents	973	2.3
2. All Other Accidents	755	1.8
3. Injury by Other Persons/Homicide	60	0.1
4. Suicide	150	0.3
5. Dying of Childbirth or Pregnancy	42	0.1
6. Malaria or Repeated Fever	126	0.3
7. Fever and Cough	181	0.4
8. Other Fevers	3 217	7.5
9. Chickenpox	1	0.002
10. Diarrhoea	115	0.3
11. Lockjaw	7	0.01
12. Measles	35	0.08
13. Tuberculosis or Dry Cough	152	0.4
14. Yellowness of Eyes or Skin	149	0.3
15. Abdominal Pain	605	1.4
16. Diabetes	331	0.8
17. Fits and Convulsions	501	1.2
18. Cancer	2 023	4.7
19. Heart Attack	1 519	3.5
20. Shortness of Breath and Swelling of Legs	39	0.09
21. Old Age (65 years and above) and does not include other causes	21 404	49.8
22. Other known causes of deaths	4 954	11.5
23. Unknown Causes	5 674	13.2
ALL CAUSES	43 013	100.0

Source: Vital Statistics, Peninsular Malaysia, Department of Statistics.

In the non-medically certified deaths for 1988, 50% were reported to be caused by old age and 8% other fevers.

Accurate analysis of mortality trends in Sabah and Sarawak was however not possible owing to the extent of under-reporting.

HOSPITAL-BASED MORTALITY

Appendix 3 shows the principal causes of mortality reported in government hospitals and medical institutions in Malaysia in 1988.

Of the total 22 433 hospital deaths throughout Malaysia, 17 617 (78%) were reported in Peninsular Malaysia, 2 837 (13%) in Sabah and 1979 (9%) in Sarawak. The main causes of death in each of these three regions vary. However, Heart Diseases and Diseases of Pulmonary Circulation was a significant cause common in all three and which accounted for nearly 18% of total deaths in the whole country.

Mortality trends are reported in greater depth in Chapter 14 of this report.

DISEASES PREVENTION AND CONTROL

COMMUNICABLE DISEASES

Statistics from notification of specific infectious diseases are collected routinely in order to obtain information on the trend of occurence of major communicable diseases and their epidemiological features for surveillance and immediate institution of appropriate preventive and control measures.

As from 1983 the list of communicable diseases gazetted as notifiable by law has been reduced to 24 diseases; however the epidemic-prone diseases within this list is still being monitored via the most expenditious means, viz., notification by telephone.

Despite constant efforts at disease control by Ministry of Health, undesired levels of incidences of certain diseases still prevail. Many of the outbreaks of Typhoid and Food Poisoning, and more recently, Viral Hepatitis, which quite often have been found to be food-borne, had its cause in the unhygenic handling of food and of eating habits. Similarly, high incidences of Gonorrhoea and for the past two years Syphilis have been traced to callous attitudes despite pervasive health education and establishment of Skin and Social Hygiene Clinic. On the optimistic end, it is comforting to note that Measles has been reduced to manageable proportions with improvements in immunization coverage. Incidence of measles has fallen dramatically for the past four years from 1985.

A comprehensive description of the main activities of the control programme for communicable diseases is given in Chapter 5.

NON COMMUNICABLE DISEASES (NCD)

Non-communicable diseases are recognised as an important cause of morbidity and mortality in Malaysia. However, as greater emphasis was given to communicable diseases and there was yet no planned programme for NCD only a little prevention and control works were being done on NCD: such works relate to the analysis of available data on cardiovascular diseases, cancer, anti-smoking and health, visual disabilities and on organising and attending workshops on NCD.

The general trend of the major non-communicable diseases in terms of hospital admission and mortality continued to increase in 1988 from those of previous years.

Cancer

The true magnitude of cancer as a health problem is not precisely known in the absence of a registration system for cancer, but there is evidence from mortality statistics of the importance of cancer as a cause of death.

The National Cancer Registry was reviewed and Guidelines Manual was produced. Computer Software for the management of this registry is currently being developed.

Cancer did not change much between 1987 and 1988. In 1987, there were 24 472 admissions (143.6 per 100,000 population), with 2 003 deaths, while in 1988 there were 25 169 admissions (also 143.6 per 100,000 population) with 2 087 deaths.

Cardiovascular Diseases (CVD)

A workshop was carried out in Ipoh to review the protocol for Cardiovascular Disease Prevention and Control Programme. A plan of action was formulated during this workshop.

The admission rate and mortality rate in Government hospitals for cardiovascular diseases which includes hypertension, ischaemic heart disease, cerebrovascular disease, rheumatic heart disease and other cardiovascular diseases has risen from 401.4 and 36.1 per 100,000 population in 1987 to 418.1 per 100,000 and 36.7 per 100,000 population respectively in 1988. Out of these several groups of Cardiovascular Diseases, the rate of admission from the Ischaemic Heart Diseases was 111 per 100,000 while the mortality rate from them was 12.5 per 100,000. There is as yet no information system that captures the incidence rate of non-communicable diseases in this country.

Health Education activities aimed at improving community knowledge, awareness and attitude toward non-communicable diseases were strengthened. These included dissemination of information on health hazards of smoking, proper eating habit and life styles, and other measures to be taken to prevent and control non-communicable diseases, especially cardiovascular diseases.

Several lectures and health forums were held, and documentaries were shown over radio and television. A number of seminars, workshops and training sessions were also held. Health education materials were produced and distributed.

In view of the increasing trend of non-communicable diseases in line with the changing pattern of disease occurrence in this country, more emphasis will be accorded to the non-communicable diseases in the near future.

CONCLUSION

Generally, the health status of the population in Malaysia has and will continue to improve. Reflective of this improvement are a lowering of mortality rates among the younger population and among mothers, longer life expectancy, a better hold on disease outbreaks, and increasing realization and efforts to combat the more prominent of the so-called non-communicable diseases particularly heart diseases and cancer.

CHAPTER 5

CONTROL OF COMMUNICABLE DISEASE PROGRAMME

INTRODUCTION

The Communicable Diseases Control (CDC) Programme forms a part of the Epidemiological Services provided by the Epidemiology Unit in the Health Services Division of the Ministry of Health. Alongside with the CDC Programme are other specific disease (communicable) control programmes, some of which were established long before the CDC Programme was formulated. Notable among them were the National Tuberculosis Control Programme (1961), Malaria Eradication Programme (1967), National Leprosy Control Programme (1969) and the Vector-Borne Diseases Control Programme (1981). The Malaria Eradication Programme however, is now replaced by the Vector-Borne Diseases Control Programme.

The general objective of the CDC Programme is to closely monitor the epidemiological patterns of communicable diseases so as to effect timely and appropriate preventive and control measures so that the morbidity and mortality due to these diseases are decreased and unnecessary suffering and economic losses are minimised.

Although CDC forms the main focus of Disease Control in this country, the time has come for extending the scope of the programme into Non-Communicable Disease Control (NCDC). This is especially relevant in view of the changing pattern of disease occurrence in a rapidly developing country like Malaysia.

ACTIVITIES AND ACHIEVEMENTS

Routine surveillance through notification on communicable diseases continue to be the main activity in 1988 with the focus on diseases associated with food preparation and handling, environmental sanitation & personal hygiene, sexually transmitted diseases and also diseases associated with childhood.

The new Prevention and Control of Infectious Diseases Bill was passed in Parliament in July and subsequently gazetted on 8th. September, 1988. Regulations for the Act are now being formulated. The Prevention and Control of infectious Diseases Act (1988) lists 24 diseases in contrast to the 37 diseases listed in the Quarantine and Prevention of Diseases Ordinance (1939), which is repealed.

1988 also saw the implementation of the CDC Information System (CDCIS) which provides more efficient channelling of data from the operational areas to higher managerial levels. Incidence of the 24 notifiable diseases in the country for 1988 is presented together with incidences of the preceding years for comparison in Table 5.1.

No cases of Plague, Poliomyelitis, Rabies, Relapsing Fever and Yellow Fever occured in 1988.

CONTROL OF DIARRHOEAL DISEASES

The occurrence of diarrhoeal diseases was invariably linked to environmental sanitation, personal hygiene, including eating habits, water supply and food handling.

Prevention and control activities carried out by the Health Ministry were thus aimed at interrupting and breaking the chain of transmission of diarrhoeal disease causing agents such as by ensuring a clean environment and good sanitation, promotion of good personal hygiene and eating habits, a safe water supply and care in food preparation and handling. Intra and

TABLE 5.1 – Notifiable Infectious Diseases in Malaysia, 1984 – 1988

DISEASES	1984	1985	1986	1987	1988
1. Acquired Immune Deficiency Syndrome (AIDS)	0	0	1 case 3 carriers	1 case 1 ARC 3 carriers	4 cases 17 carriers
2. Cholera	67 (1)	68 (4)	54 (2)	584 (9)	753 (17)
3. DF & DHF	702 (5)	367 (12)	1 408 (8)	2 025 (8)	1 428 (3)*
4. Diphtheria	17 (3)	39 (5)	28 (9)	26 (7)	20 (5)
5. Dysenteries (All Types)	1 545 (3)	785 (3)	846 (1)	955 (1)	774
6. Food Poisoning	1 700 (2)	1 418 (3)	1 877 (11)	2 272 (10)	1 643 (25)
7. Leprosy	289	308 (1)	272	294	321 **
8. Malaria	30 242 (17)	46 408 (74)	42 710 (47)	33 151 (10)	50 721 (72)*
9. Measles	8 147 (3)	5 163 (16)	4 697 (18)	5 429 (117)	2 304 (3)
10. Plague	0	0	0	0	0
11. Poliomyelitis (Acute)	2	4	0	0	0
12. Rabies	0	0	0	0	0
13. Relapsing Fever	0	0	N.A.	9	0
14. Chanoroid	49	47	143	171	123
15. Gonococcal Infections (All Forms)	4 845	3 777	5 685	5 409	5 324 (1)
16. Syphilis (All Forms)	849	928	1 440	1 887 (2)	1 790
17. Tetanus (All Forms)	64 (6)	49 (11)	51 (6)	86 (16)	52 (14)
18. Tuberculosis (All forms)	9 156 (133)	8 904 (147)	9 421 (89)	9 432 (107)	10 944 + (535) + +
19. Typhoid & Other Salmonelloses	2 000 (20)	2 358 (17)	2 845 (23)	2 962 (12)	1 731 (4)
20. Typhus & Other Rickettsioses	159	173	166	262	217 *
21. Viral Encephalitis	45 (8)	40 (4)	53 (10)	92 (8)	62 (3)
22. Viral Hepatitis	2 223	3 210	7 261 (3)	4 529 (4)	4 533 (3)
23. Whooping Cough	57 (2)	150 (1)	68	121 (2)	27
24. Yellow Fever	0	0	0	0	0

Source: Epidemiological Unit, Ministry of Health.

( ) means death.
* VBDC Programme, Ministry of Health.
** National Leprosy Control Centre, Ministry of Health.
\+ N.T.B.C. Ministry of Health.
\+ + Vital Statistics 1988, Peninsular Malaysia.
N.A. Not Available.

inter-sectoral collaboration and co-operation in advocating the above measures were also essential towards achieving the objectives of interrupting and breaking the chain of transmission for diarrhoeal diseases.

Training and re-training of field officers especially in disease outbreak investigation and control techniques continued to be carried out in the past year.

In 1988, diarrhoeal diseases (namely, cholera, typhoid, dysentery, food poisoning, hepatitis) continued to pose a public health problem in Malaysia and itself accounted for 11.8% of total incidence for communicable diseases. Apart from the above diarrhoeal diseases, other non-specific diarrhoeas and gastro-enteritis continued to be closely monitored.

Table 5.2 presents the number of cases for specific diarrhoeal diseases (namely, cholera, typhoid, dysentery, food poisoning and infectious hepatitis), and its incidence rate per 100,000 population occuring in Malaysia.

TABLE 5.2 – Incidence of Five Specific Diarrhoeal Diseases (Food-borne and water-borne) in Malaysia, 1984 – 1988.

		1984	1985	1986	1987	1988
CHOLERA	Cases	67	68	54	584	753
	Deaths	1	4	2	9	17
	I.R.	0.43	0.43	0.33	3.53	4.44
	C.F.R.	1.49	5.88	3.70	1.54	2.25
TYPHOID	Cases	2 000	2 358	2 845	2 962	1 731
	Deaths	20	17	23	12	4
	I.R.	13.10	15.04	17.66	17.92	10.20
	C.F.R.	1.00	0.72	0.81	0.41	0.23
DYSENTERY	Cases	1 545	785	846	955	774
	Deaths	3	3	1	1	0
	I.R.	10.12	5.00	5.25	5.77	4.56
	C.F.R.	0.19	0.38	0.12	0.10	0.00
FOOD POISONING	Cases	1 700	1 418	1 877	2 272	1 643
	Deaths	2	3	11	10	25
	I.R.	11.13	9.04	11.65	13.74	9.68
	C.F.R.	0.12	0.21	0.59	0.44	1.52
VIRAL HEPATITIS (ALL FORMS)	Cases	2 223	3 210	7 261	4 529	4 533
	Deaths	0	1	3	4	3
	I.R.	14.56	20.47	45.07	27.40	26.72
	C.F.R.	0	0.03	0.04	0.09	0.06

I.R. — Incidence Rate Per 100,000 Population;
C.F.R. — Case Fatality Rate in %.

Source: Epidemiology Unit, Health Services Division.

Cholera

A total of 753 cases of cholera with 17 deaths occurred in 1988 compared to 584 cases and 9 deaths in 1987. This increase in incidence and deaths were a result of isolated outbreaks in Sabah (494); Penang (124), Sarawak (96) and Kedah (26)—See Table 5.3. The outbreaks were primarily water-borne with some cases due to secondary food contamination.

TABLE 5.3 – Cholera in Malaysia by State, 1988.

STATE	Case	Death	Carrier
Perlis	1	0	2
Kedah	26	0	16
Penang	124	1	63
Perak	5	0	10
Selangor	2	0	0
Wilayah Persekutuan	4	0	0
Negeri Sembilan	0	0	0
Malacca	0	0	0
Johor	0	0	0
Pahang	0	0	0
Kuala Terengganu	0	0	0
Kelantan	1	0	0
PENINSULAR MALAYSIA	163	1	91
Sabah	494	13	543
Sarawak	96	3	491
TOTAL	753	17	1 125

Source: Epidemiology Unit, Health Services Division.

Typhoid

The incidence rate for typhoid declined from 17.9 per 100,000 population in 1987 to 10.2 per 100,000 population in 1988. There were no major outbreaks in the country in 1988.

Dysentery

The incidence rate for dysentery was also lower in 1988, i.e. 4.6 per 100,000 population in 1988 (774) compared to 5.8 per 100,000 in 1987 (955). Most of the cases occurred in Kelantan, Sabah and Perak.

Food Poisoning

The number of food poisoning cases was lower in 1988 (1,643) in comparison to the previous year (2,272); i.e. a decrease of 27%. However the case fatality rate increased from 0.4% in 1987 to 1.5% in 1988. There were 25 deaths in 1988 and it is the highest figure recorded over the past 10 years. The worst affected state was Perak with 13 deaths out of 17 cases reported. Active case detection which was carried out following these reports, picked up another 45 probable cases. A special task force was also set up with the assistance of international experts in toxicology to investigate the cause of the outbreak. Aflatoxin was subsequently implicated as the contaminant.

Viral Hepatitis

In 1988, there were 4,533 cases of viral hepatitis reported in the country, of which 44% (1,977) were hepatitis A, 25% (1,151) hepatitis B and 31% (1,405) "unspecified". The "unspecified" grouping includes hepatitis non-A and hepatitis non-B in which the diagnosis

is made by exclusion i.e. in the absence of serological markers for either type A or type B and also the absence of other possible cases of liver damage (such as medications, alcoholism, hepatoxins, congestive heart failure, cancer and other infection, particularly CMV and Epstein-Barr virus).

Overall infectivity rate for hepatitis B was estimated at 10 – 20 per 100,000 population. The Ministry of Health in its bid to further prevent and control the spread of hepatitis B has embarked on a programme of nationwide screening of high risk groups such as blood donors, drugs addicts, medical and health workers exposed to infected body fluids of patients and carriers and also all persons engaged in the production and handling of blood and blood products.

INFECTIOUS DISEASES OF CHILDHOOD

The incidence of infectious diseases of childhood which were immunisable continued to reduce in 1988, with further improvements in immunisation coverage.

Immunisation is routinely provided against Poliomyelitis, Diphtheria, Whooping Cough, Tetanus, Tuberculosis and Measles. In 1988, the immunisation programme against *Rubella* was launched throughout the country.

The impact of the immunisation programme is evident in the lower incidence of the 5 EPI (Expanded Programme for Immunisation) diseases recorded in 1988 as compared to the previous year (1987). See Table 5.4.

It is significant that no cases of poliomyelitis occurred since 1986. Nevertheless, the Ministry of Health stepped up its efforts in the control of Poliomyelitis in line with the strategies of the Universal Child Immunisation (UCI) and Polio Eradication Programme which aims at eliminating the wild polio virus in the country. Malaysia was at stage B of the "WHO Global Polio Situation", for 1988.

In February of 1988, there was a localised outbreak of diphtheria in the Klang District of Selangor. 158 clinically suspected cases were detected during the outbreak and 7 cases including 1 death were confirmed. 3 other cases not related to the outbreak occurred in the state of Selangor, which together made up 50% of the 20 confirmed cases reported in the country.

The immunisation coverage against diphtheria (DPT3) during the period was adequately high at 78.1% (whole country) and 74% (Selangor state), however, one particular group of people in the Klang District rejected immunisation, hence resulting in the outbreak where 3 of the 7 cases were from one family. All of them were not immunised.

SEXUALLY TRANSMITTED DISEASES

Sexually Transmitted Diseases (STD) continued to pose a public health problem in the country although it had stabilised at around 7,000 cases a year over the last 3 years. See Table 5.1.

Gonococcal infections remained the commonest STD reported in the country. The national incidence rate for gonorrhoea (notified) was 31.4 per 100,000 population in 1988. Sabah and Sarawak had the highest incidence rate of 111.97 and 104.07 respectively which was more than triple the national incidence rate—see Table 5.5.

The incidence rate for Syphilis had been increasing steadily from 5.5 per 100,000 in 1984 to 10.6 per 100,000 in 1988. The states with highest incidence rates were Sarawak and Penang.

Incidence rate for chancroid also increased from 0.32 per 100,000 in 1984 to 0.72 per 100,000 in 1988. However, the number of cases were relatively small compared to gonorrhoea and syphilis.

A survey on the actual extent of STD in the country which was started in 1986 using the non-nominal notification card was completed in December 1988, and the findings are being analysed. Meanwhile the magnitude and extent of Penicillinase-Producing Neisseria Gonorrhoea continued to be closely monitored.

ACQUIRED IMMUNE DEFICIENCY SYNDROME (AIDS)

The risk of AIDS in the country is relatively low in comparison to the Western Countries. In 1988, 4 new cases of AIDS were detected in the country. There were all males between the age of 24 – 48 years. Three of them died in the same year.

The Ministry of Health, in its efforts to step up the prevention and control programme for AIDS had by the end of 1988, established 46 screening centres throughout the country. 24 major centres use the ELISA method of screening while the other 22 smaller centres (all in East Malaysia) use the particle agglutination test method. A total of 187,850 units of donated blood were screened for anti-HIV in 1988, and 2 of them were found positive giving a detection rate of 0.001%. Apart from donated blood, 9,578 samples from the high risk groups/ suspects were also screened and again 2 samples were positive with a detected rate of 0.02%.

In addition, Serosurveys were also conducted on 89 prostitutes (in January), 80 tuberculosis patients (in March), and some massage parlour workers (October – December). None of them was found to be positive.

Other prevention and control activities carried out in 1988 include:-

- stepping up of health education campaigns where 140,000 new posters and leaflets on AIDS were printed and distributed to the public. Feature articles on AIDS were published in the local newspapers, spot announcements were made on radio and television and health education talks were organised at national and state levels.
- reviewing and re-editing the 'Plan of Action for the prevention and control of AIDS'— 4,500 copies were printed and circulated in November.
- conducting training programmes on AIDS for clinical specialists and senior health officers in the form of seminars.

The Prevention and Control of Infectious Diseases Act 1988 also requires all HIV infections to be notified to the health department while prohibiting HIV infected persons from knowingly spreading the disease.

INTERNATIONAL HEALTH AND QUARANTINE SERVICES

The International Health and Quarantine Services (IHQS) is aimed at preventing the importation of quarantinable diseases (such as Yellow Fever and Plague) into the country. The services are provided in accordance with the International Health Regulations which ensure the provision of maximum security against the spread of diseases with minimum interference to traffic and passenger convenience. Table 5.6 details the output activities for the IHQS from 1986 to 1988.

Passenger Surveillance

From a total of 1,934,213 passenger arrivals in 1988, 143 were from Yellow Fever endemic areas of which 31 (or 21.6%) did not have valid Yellow Fever certificates. 15 were quarantined and the other 16 kept under close surveillance.

For the departing travellers (1,711,324), a total of 52 were vaccinated against Yellow Fever (39 at Penang port, 8 at Kuching airport, 5 at Kota Kinabalu airport) and 1,201 received cholera innoculations (on request). Vaccination against Meningococcal Meningitis for Haj pilgrims was started in 1988 as required by the Saudi Government. A total of 31,269 doses of vaccine was given to 87.8% of total eligible pilgrims.

Health clearance was also given to 97 dead bodies imported (mostly by air) and 15 dead bodies exported. Only a small percentage of sick travellers seeked medical care at port and airport health clinics.

Ship/Vessel Surveillance

In 1988, a total of 12,530 vessels were inspected for health clearance, and 26% (3,258) were kept at quarantine anchorage. 65 (2%) of them were fumigated and issued deratting certificates (DC) and 977 (30%) given deratting exemption certificates (DEC). Of the 65 vessels fumigated, 37 of them had rodent infestation and the other 28 had expired DCs. Deratting certificates were only issued at 4 major ports, viz. Port Kelang, Penang, Kuantan and Pasir Gudang.

A total of 43 vessels mostly from Yellow Fever endemic countries were fogged to eliminate imported aedes mosquitoes which might transmit disease.

TABLE 5.4 – Incidence Rate of Five EPI Diseases*, 1985 – 1988.

DISEASES/STATE	1985	1986	1987	1988
1. POLIOMYELITIS				
Sabah	0.24	0	0	0
Sarawak	0	0	0	0
Peninsular Malaysia	0.01	0	0	0
Malaysia	0.02	0	0	0
2. MEASLES				
Sabah	164.5	193.2	206.4	50.04
Sarawak	30.1	38.2	14.1	2.38
Peninsular Malaysia	20.8	12.5	18.2	11.28
Malaysia	32.9	29.2	32.8	13.58
3. TETANUS NEONATORUM				
Sabah	2.5	1.8	4.4	1.02
Sarawak	0.3	0.1	0.3	0
Peninsular Malaysia	0.1	0.2	0.2	0.01
Malaysia	0.3	0.3	0.5	0.08
4. DIPHTHERIA				
Sabah	2.2	0.6	1.1	0.36
Sarawak	0	0.5	0	0.06
Peninsular Malaysia	0.1	0.1	0.1	0.10
Malaysia	0.2	0.2	0.2	0.11
5. WHOOPING COUGH				
Sabah	0.6	0	0.5	0.21
Sarawak	0.3	0.2	0	0
Peninsular Malaysia	1.1	0.5	0.8	0.17
Malaysia	0.9	0.4	0.7	0.15

*State specific incidence rate per 100,000 population

Source: Epidemiology Unit, Health Services Division.

TABLE 5.5 – Incidence Rate of Notified STD Per 100,000 Population by State in Malaysia, 1984 – 1988

STATES	GONORRHOEA					SYPHILIS					CHANCROID				
	1984	1985	1986	1987	1988	1984	1985	1986	1987	1988	1984	1985	1986	1987	1988
Perlis	0.61	0.59	5.84	1.7	0.55	0.61	—	1.16	0.56	5.55	—	—	—	—	—
Kedah	16.78	5.92	5.25	6.63	3.16	15.89	14.62	14.6	10.03	7.80	—	0.07	—	0.07	0.07
Penang	32.94	30.4	20.46	21.61	58.17	20.79	17.04	8.31	15.54	25.51	1.16	0.56	0.18	0.64	2.62
Perak	4.09	5.07	8.23	8.01	5.39	1.71	3.99	3.38	5.45	5.90	0.35	1.08	0.58	1.7	0.74
Selangor	1.96	1.79	2.52	6.77	12.22	2.85	2.37	1.4	7.21	6.32	—	—	—	0.65	2.28
Wilayah Persekutuan	8.82	7.88	119.71	104.25	39.10	3.15	2.8	54.19	52.77	14.24	—	—	10.34	8.63	1.93
Negeri Sembilan	11.25	8.48	5.58	8.83	9.41	1.42	0.77	2.86	3.24	7.18	—	0.3	0.3	0.44	—
Malacca	5.08	5.14	6.51	13.66	30.29	0.78	0.38	1.67	3.09	7.30	—	0.19	0.18	—	—
Johor	7.8	7.02	8.6	8.65	11.06	3.84	8.14	4.9	8.4	8.25	1.04	0.69	0.31	0.05	0.09
Pahang	12.84	10.01	8.85	3.27	3.17	0.78	2.28	4.1	1.94	2.58	0.22	—	—	—	—
Terengganu	3.57	1.42	4.22	4.53	5.09	2.6	1.58	1.81	2.04	2.82	—	—	—	—	—
Kelantan	9.36	3.26	14.23	3.94	9.46	0.78	7.29	5.17	6.17	7.03	0.09	—	—	—	0.08
Sabah	124.07	105.05	123.68	91.39	111.97	1.27	3.43	3.38	2.26	2.18	0.16	—	—	0	0.51
Sarawak	149.64	103.43	115.19	126.58	104.07	13.38	6.9	11.88	24.77	35.38	0.41	0.13	0.19	0.7	0.06
MALAYSIA	31.74	24.09	35.29	32.72	31.39	5.56	5.91	8.93	11.41	10.55	0.32	0.29	0.88	1.03	0.72

Source: Epidemiology Unit, Health Services Division.

TABLE 5.6 – International Health and Quarantine Services, 1986 – 1988, Malaysia.

		1986	1987	1988
A.	**International Travellers:**			
1.	Number of passenger arrivals	1 507 349	1 804 990	1 934 213
2.	Number of passenger arrived from yellow fever endemic area	246	557	143
3.	Number of passenger without valid yellow fever vaccination certificate	22	27	31
4.	No quarantined	5	7	15
5.	No. put under surveillance	17	20	16
6.	Number of travellers departure	1 526 176	1 636 059	1 711 324
7.	Number vaccinated with yellow fever before departure	39	61	52
8.	Number vaccinated with cholera before departure	2 840	1 732	1 201
9.	Number of dead bodies imported	125	137	97
10.	Number of dead bodies exported	13	35	15
B.	**Shipping Control**			
1.	Total vessels inspected	10 944	11 260	12 530
2.	Total were considered 'Q' vessels	NA	2 506	3 258
3.	No. of Deratting Certificate (DC) issued	21	32	65
4.	No. of Deratting Exemption Certificate (DEC) issued	718	717	977
5.	No. of extension of DC/DEC	85	64	73
6.	No. of Transit Order (TO) issued	67	110	97
C.	**Vector Control**			
1.	No. of vessels fumigated	23	32	65
2.	No. of vessels fogged	NA	21	43
3.	Mean perimeter Aedes Index (AI)	NA	<5%	<5%

NA = Not Available

Source: Epidemiology Unit, Health Services Division.

OTHER PORT AND AIRPORT HEALTH SERVICES

Other than passenger and ship surveillance, additional medical and health services were also provided, with the coordination of port and airport authorities. These services are:-

- Medical care for pilgrims with the objective of ensuring that all pilgrims are medically fit for the haj journey and do not bring any infectious diseases into the country on their return. The service was provided only at 5 international airports, viz. Subang, Bayan Lepas, Senai, Kota Kinabalu and Kuching.
- Food surveillance to ensure that no contaminated food enters the country. A total of 3,745 food samples were analysed in 1988 and 177 samples were found to have traces of radionucleides. However, only 1 sample exceeded the permissible level of CS-137 138 bg/kg. Most of the contaminated food were skim milk powder.
- Air Disaster Unit to provide emergency medical services during situations where there is a possible danger to the life of passengers, such as during emergency flight landings, flight take-off problems, engine failures and bomb threats.
- Port and airport environmental sanitation to monitor and maintain the sanitation of port and airport premises, including vector control. Larviciding and fogging activities within a 400 metre radius of port and airport premises were carried out from time to time. Aedes Index was maintained at below 5%. Deratting activities were also carried out as a general precautionary measure.

CHAPTER 8

VECTOR BORNE DISEASES CONTROL PROGRAMME

INTRODUCTION

On the whole, the implementation of the strategies and activities in the Vector Borne Diseases Control Programme (VBDCP) in 1988 has been satisfactory. Prevention and Control of the diseases under the VBDCP has been implemented successfully. However the number of recorded cases of dengue and malaria still pose a problem to the programme. Thus, more intensive measures have been carried out to check the spread of these diseases.

In 1988 special emphasis has been given to the Primary Health Care approach towards the control of malaria. The new approach shall be continued and the training of Primary Health Care volunteers will be given priority.

FINANCE AND MANPOWER

In 1988 a total amount of $39,302,940 has been allocated and of which $38,565,379 (98.1%) has been spent.

In the same year, the programme has 5,111 posts comprising of all categories and out of which 3,876 posts (75.8%) has been filled. See Table 8.1.

TABLE 8.1 – Number of Posts Available and Number Filled, 1988.

	No. of Posts Available	No. of Posts Filled
Peninsular Malaysia	4 214	3 173
Sabah	550	421
Sarawak	347	282
MALAYSIA	5 111	3 876

Source: VBDC Programme, Ministry of Health.

TABLE 8.2 – Financial Allocation and Expenditure, 1988.

	Allocation	Expenditure
Peninsular Malaysia	$29 514 940	$28 903 607
Sabah	$ 5 374 050	$ 5 352 979
Sarawak	$ 4 413 950	$ 4 308 793
MALAYSIA	$39 302 940	$38 565 379

Source: VBDC Programme, Ministry of Health.

ACTIVITIES AND ACHIEVEMENTS

Malaria

In 1988 a total of 50,721 cases of malaria were reported in Malaysia as compared with 36,657 cases reported in 1987. This clearly indicated that the number of cases has increased by 14,064 (38%) in 1988.

Peninsular Malaysia has reported a total of 12,432 cases while Sabah and Sarawak reported 37,272 cases and 1,017 cases for the same year. This indicated that Peninsular Malaysia had recorded an increase in number of cases by 2,422 (24%) whereas in Sabah the cases increased by 11,757 (46%) compared with the previous year 1987. However the number of cases reported in Sarawak decreased by 115 (10%).

For 1988, the number of deaths attributed to malaria total 72 when compared with 75 deaths in 1987. Most of the deaths were due to the patients receiving late diagnosis and treatment. See Table 8.3.

TABLE 8.3 – Number of Malaria Cases and Deaths due to Malaria Occuring in Malaysia in 1988.

	Number of cases	Number of deaths	Case fatality rate per 1000
Peninsular Malaysia	12 432	16	1.3
Sabah	37 272	55	1.5
Sarawak	1 017	1	1.0
MALAYSIA	50 721	72	1.4

Source: VBDC Programme, Ministry of Health.

On the whole it was found that more transmission was caused by P. falciparum especially in Sabah (75.8%) and Peninsular Malaysia (51.7%). However in Sarawak, most of the transmission were due to P. vivax amounting to 65.9%. See Table 8.4.

If we look at Table 8.5, we find that the number of malaria cases is still high in non-malarious areas in Peninsular Malaysia. This is due to imported cases of malaria occurring in malaria free areas and in land schemes that have been developed in states like Johore and Pahang. Apart from that, illegal Vietnamese in Pulau Bidong and local Orang Asli have also contributed to malaria cases in areas that are malaria free. In 1988 a total of 658 cases were reported to have been imported through foreign workers especially from Indonesia and Thailand.

Spraying Operation

The spraying of houses with insecticide i.e. DDT 25% E.C. and DDT 75% W.D.P. continued for the year 1988. Other spraying activities include routine spraying, special spraying and focal spraying carried out in malarious areas such as Perlis, Kedah, Perak, Kelantan, Terengganu and Pahang every 6 months. The achievement for 1988 is indicated in the Table 8.6.

TABLE 8.4 – Infection by Type of Parasite in Malaysia in 1988.

	P. Falciparum	P. Vivax	P. Malariae	Mixed Infection	Total
Peninsular Malaysia	6 422 (51.7%)	5 796 (46.6%)	31 (0.2%)	183 (1.5%)	12 432
Sabah	28 255 (75.8%)	8 701 (23.3%)	99 (0.3%)	217 (0.6%)	37 272
Sarawak	281 (27.6%)	670 (65.9%)	63 (6.2%)	3 (0.3%)	1 017
MALAYSIA	34 958 (68.9%)	15 167 (29.9%)	193 (0.4%)	403 (0.8%)	50 721

Source: VBDC Programme, Ministry of Health.

TABLE 8.5 – Number of Malaria Cases Occurring in the 3 Stratified Operational Areas for Malaria Control in Malaysia, 1988.

REGION	Malarious Areas	Malaria Prone Areas	Non-Malarious Areas	Total
Peninsular Malaysia	5 931 (47.7%)	2 966 (23.9%)	3 535 (28.4%)	12 432
Sabah	35 282 (94.7%)	1 810 (4.8%)	180 (0.5%)	37 272
Sarawak	590 (58.0%)	349 (34.3%)	78 (7.7%)	1 017
MALAYSIA	41 803 (82.4%)	5 125 (10.1%)	3 793 (7.5%)	50 721

Source: VBDC Programme, Ministry of Health.

TABLE 8.6 – Routine Spraying Operations Carried Out in 1988.

	First Cycle (Jan. – Jun)	Second Cycle (July – Dec.)
No. of areas sprayed	1 215	1 716
No. of houses sprayed	90 687	87 719
Population covered	424 900	409 161
No. of areas not sprayed	73	17
No. of closed houses	4 648	4 517
No. of houses refused entry	879	734
Spraying coverage	94.3%	94.4%
Spraying progress	91.3%	93.6%
Average house sprayed per sprayer	6.8	6.9
Dosage DDT per sq. metre	1.5	1.5

Source: VBDC Programme, Ministry of Health.

Focal spraying is normally carried out in malaria prone areas and in malaria free areas where there are cases occurring. The achievement for focal spraying for 1988 is indicated in Table 8.7.

TABLE 8.7 – Focal Spraying Carried Out in Malaria Prone and Non-Malarious Areas, 1988.

No. of areas	2 222
No. of houses sprayed	52 606
Population covered	285 298
Average houses sprayed per sprayer	6.4
Technical DDT/houses	337

Soure: VBDC Programme, Ministry of Health.

Special spraying operations are carried out in 'kongsi' houses in land development schemes such as Felda, Felcra, etc. These 'kongsi' houses were sprayed with DDT 75% w.d.p. every 3 months. Other states included were Terengganu, Pahang, Negeri Sembilan and Johore. The achievement of these 4 cycle spraying in 1988 is indicated in Table 8.8.

TABLE 8.8 – Spraying Operation Carried Out in 'Kongsi' Houses and Land Schemes, 1988.

	First Cycle	Second Cycle	Third Cycle	Fourth Cycle
No. of areas sprayed	204	278	197	285
No. of 'kongsi' houses sprayed	1 518	2 317	1 020	1 836
No. of population covered	12 310	16 997	9 752	16 285
Dosage DDT per sq. metre (Tech DDT gm)	1.7	1.9	1.5	2.4

Source: VBDC Programme, Ministry of Health.

Case Detection

Surveillance in Malaria is being maintained through intensified Passive Case Detection and Active Case Detection.

In 1988, the number of Primary Health Care volunteer workers increased from 950 (1987) to 2,816.

In the same year, case detection has been expanded to land development schemes, estates and Orang Asli Settlement.

The achievement for these activities are shown in Table 8.9.

TABLE 8.9 – Slide Positivity Rate, Annual Blood Examination Rate and Annual Parasite Incidence Rate in 1988.

INDICATOR	Peninsular Malaysia	Sabah	Sarawak	Total
No. of slides examined	1 332 139	511 775	407 518	2 251 432
No. of positive slides	12 432	37 272	1 017	50 721
Slide Positivity Rate	0.93%	7.28%	0.25%	2.25%
Annual Blood Examination Rate	6.5%	30.9%	18.5%	9.6%
Annual Parasite Incidence Rate	0.90%	27.20%	0.64%	3.03%

Source: VBDC Programme, Ministry of Health.

Dengue

In 1988, a total of 1,428 cases of Dengue Fever (DF) and Dengue Haemorrhagic Fever (DHF) were reported in the whole country as compared to 2,025 cases reported in the previous year. Out of the total of 1,428 only 653 (46%) has been reported confirmed through laboratory tests. The decrease in the number of cases as compared to 1987 are in the States of Perak, which shows a decrease of 267 cases, Kuala Lumpur 188 cases, Negeri Sembilan 30 cases, Pahang 32 cases, Sarawak 92 cases and Sabah 3 cases.

Meanwhile, the State of Kedah has showed an increase of 15 cases, Penang 130 cases, Johor 115 cases, Terengganu 43 cases, Malacca 3 cases and Kelantan 10 cases.

The increase in cases in some states was caused by the unsatisfactory measures carried out and late action in prevention and control of the disease. Certain Local Authority

did not take much concern as regards to control measures in their areas.

Although Dengue normally occurs in urban areas, in 1988 the number of cases occuring in rural areas has increased considerably. Out of 1,428 cases reproted, 886 (62%) were from urban areas whereas 542 (38%) were from rural areas.

TABLE 8.10 – Dengue Incidence in Malaysia, 1988.

STATE	Dengue Fever (DF)	Dengue Haemorrhagic Fever (DHF)	Total DF and DHF	Death	
				Number	%
Peninsular Malaysia	967	203	1 170	1	0.08
Sabah	6	1	7	—	—
Sarawak	222	29	251	2	0.8
MALAYSIA	1 195	233	1 428	3	0.2

Source: VBDC Programme, Ministry of Health.

In 1988 vector control activities were carried out including new areas where problems have arisen:-

(i) In places where used-tyres were collected for use as artificial reefs problems had arisen due to Aedes breeding in these tyres.

(ii) The breeding of Aedes in Septic Tanks also requires special attention.

(iii) The breeding of Aedes in cocoa-pods also contributed to a high vector density in some areas.

In 1988, a total number of 16,697 warning letters and 13,068 compound letters were issued on 39,750 premises found with Aedes breeding. House-owners are also given health advice and Health Education and verbally warned. Appendix 11 denotes the achievements in Vector Control activities in Malaysia for the year 1988.

In addition a total number of 22 Aedes Control Stations were actively functioning to monitor the Aedes situation and to evaluate the effect of various measures taken in the control of Aedes.

Filariasis

In 1988, 19 Filariasis teams have carried out surveys in various kampongs to detect and treat the population affected by Filariasis. A total of 685 positive cases were reported out of 165,504 persons covered by the surveys. States reporting high cases of Filariasis are Perak (140) Johor (50) and Terengganu (87), while Sabah reported 142 and Sarawak 201 cases.

In 1988, a total of 3 filariasis teams were transferred from Peninsular Malaysia to Sabah and Sarawak to assist in the Filariasis Control activities in the two states. Refer to Appendix 12.

Typhus and Japanese Encephalitis

The VBDC Programme with the co-operation of Research Laboratories and the Epidemiology Unit of the Ministry of Health continues to keep a close watch on the situation of these two diseases.

TABLE 8.11 – The Incidence of Typhus and Japanese Encephalitis in 1988.

Types of Diseases	Peninsular Malaysia	Sabah	Sarawak	Malaysia
Typhus	214	0	3	217
Japanese Encephalitis	31	0	0	31

Source: VBDC Programme, Ministry of Health.

THE CONTROL OF RODENTS AT SEAPORTS AND AIRPORTS

The strategy of controlling Rodents centered at all Seaports and International Airports in this country is to ensure that ships and aircrafts that come in from countries where Plague is endemic do not bring in rodents infected with the disease.

However, rodent control activities are not carried out at Bayan Lepas Airport, Penang and Kuching even though these two airports cater for international flights.

Rodent control activities are only carried out at Subang International Airport. The activities carried out at this airport and at all seaports in this country for the year 1988 are shown in Table 8.12.

TABLE 8.12 – Rodents Control Activities in Seaports and Airport in 1988.

ACTIVITIES	SEAPORT					Subang Airport	Total
	Port Klang	Kota Kinabalu	Pasir Gudang	Tg. Berhala	Telok Ewa		
Number of traps set	140	260	200	29	20	50	699
Number of rodents caught	227	42	352	20	16	511	1 168
Number of rodents examined for the rat flea	227	42	352	20	16	511	1 168
Number of rodents harbouring fleas	19	30	211	0	0	N.A.	260
Number of fleas found (Xenopsylla Cheopis)	9	N.A.	N.A.	0	0	0	9
Flea Index	NIL	2	1	NIL	NIL	NIL	3

Source: VBDC Programme, Ministry of Health.

CONCLUSION

Out of the seven vector-borne diseases, malaria, dengue and filariasis continue to be a major public health problem in the country. A large proportion of manpower and money is allocated for the prevention and control of these three diseases.

Although malaria cases had increased by 38% in 1988, dengue cases had reduced by 29%. This means that the anti-aedes activities, including law enforcement are carried out

satisfactorily for the control of dengue. Filariasis control activities will be continued and intensified in the rural villages and new areas.

The surveillance of typhus and Japanese encephalitis are carried out with the cooperation of research institutions.

Although there are no cases of yellow fever and plague reported so far, close surveillance for the two diseases are carried out in the airports and seaports.

CHAPTER 23

BIOMEDICAL RESEARCH

INTRODUCTION

The Institute for Medical Research (IMR), which was established in 1900, carries out research into the biomedical aspects of the various diseases prevalent in Malaysia; provides specialised diagnostic and consultative services to the various hospitals and agencies; trains medical and paramedical staff; and produces cholera and typhoid vaccines as well as snake antivenoms.

The Institute also collaborates actively with the various international agencies. It is the World Health Organization (WHO) Regional Centre for Research and Training in Tropical Diseases and Nutrition, and the National Centre for the Southeast Asian Ministers of Education Organization – Tropical Medical Programme (SEAMEO TROPMED). It also houses the United States Army Medical Research Unit (USAMRU-M). In 1987, the IMR was appointed the secretariat for the proposed Inter-Islamic Network on Tropical Medicine (INTROM) of the Islamic Foundation for Science, Technology and Development (IFSTAD).

RESOURCES

Manpower

A total of 108 posts was vacant during the year. This was more than that (87 posts) of the previous year reflecting an increased shortage of staff at the Institute.

Finance

IMR's total expenditure for 1988 was as follows:-

(i)	Operating expenses (Ministry of Health)	:	$9,363,072
(ii)	Training and Scholarship allowances (Ministry of Health)	:	$1,282,229
(iii)	U.S.Army Medical Research Unit Projects	:	$1,031,080
(iv)	SEAMEO-TROPMED	:	$ 367,150
(v)	WHO/PORIM	:	$ 395,771

There was also an allocation of $6.8 million under the fund of which $2,190,890 was expended during the year and the remainder carried forward to 1989.

Facility

No development expenditure was incurred.

ACTIVITIES AND ACHIEVEMENTS DURING 1988

Research

The Institute's research activities have been redirected from the previous disease orientated research to that of problem solving research. This change is in line with the current philosophy that available resources should mainly be used in solving probelms encountered in the implementation of the Ministry's health programme. In addition to reemphasis in traditional research areas, other new research areas have also been included. Thus behavioural and health systems research projects have been given importance as are

those that utilize the newer technologies to enhance the efficiency and quality of findings with the ultimate objectives of producing results which are of relevance to the prevention, diagnosis and management of disease or of use to health planners in the formulation and implementation of the various intervention and health programmes.

The main source of funding for the Institute's research programme is from the Government's Research & Development Fund, a special allocation under the Fifth Malaysia Plan and managed by the Ministry of Science, Technology and Environment, to encourage and intensify research in priority areas. In addition, substantial research funding are also obtained from other sources like the WHO and PORIM.

The performance of the Institute in research for 1988 has been satisfactory. Of the research projects funded under the Research & Development (R&D) Fund, 78 were started and 13 completed by the end of the year. Of the non-R&D funded projects, 57 were started and 23 completed during the year. A total of 70 research papers was published or accepted for publication in local or international journals.

Research highlights of some of the work undertaken during the year and their principal findings are summarized below.

Behavioural Research

A medical-anthropological study to determine the similarities and differences in behavioral characteristics between the 'indigenous and settler' group and the 'migrant' group was conducted in Kelantan. Results of this study would indicate whether any correlation exists between certain behavioral patterns and the individual or group status in malaria infection.

The extent to which the Primary Health Care (PHC) concept is understood and implemented in various malaria communities was also studied.

Research was undertaken with the aim of furnishing the Ministry with data regarding the characteristics of 'bomohs' in the Federal Territory and their utilization by the community.

Blood Disorders

Active collaboration with workers in Japan and the United States in the usage of DNA technology to study thalassemias in the local population continued with encouraging transfer of technology in our favour. A total of 75 DNA samples was collected this year and are being analysed using probes received from Japan and the United States. Some of these samples have been sent to Japan for further analysis.
A national registry for thalassemia is being created to characterise the incidence, distribution and clinical behaviour as well as infrastructure facilities for clinical care of the thalassemias.

The effects of the oral contraceptive pill on the coagulation system and platelet function are also being studied. A total of 62 cases have been investigated, 50 being non-pill users (control group) and 12 oral pill users (patient group). A series of coagulation tests are being done both in the IMR and LPPKN laboratories to determine whether there are any statistical differences in the various coagulation parameters between these two group. Platelet function tests being performed include whole blood aggregation, ATP release, platelet rich plasma aggregation and the measuremetns of thromoboxane and prostacyclin. Results are being analysed.

A clinical trial was carried out to assess the efficacy of vitamin E supplementation to prevent vitamin E deficiency and its possible effects on the neonate. Preliminary results showed that it may be useful to give vitamin pills routinely during antenatal period to prevent neonatal jaundice and physiological anemia of the newborn baby.

Community Health Research

A study was conducted to determine the factors affecting defaultation of tuberculosis (TB) treatment in states with high defaulter rates in Peninsular Malaysia as requested by the Ministry of Health. A retrospective analysis of records from 1 150 TB patients with a history of missed treatment or defaultation was conducted in 4 chest clinics (Perak, Terengganu, Kelantan and Kedah). Among other findings, this study revealed that TB patients usually defaulted during the second half of the intensive phase in Kedah and Kelantan. In Perak patients usually defaulted after 88 doses whereas in Trengganu, defaultation occurred most frequently between the 73rd and 80th doses. Patients in Kedah missed treatment more frequently for shorter durations whereas in Perak, patients missed treatment for longer durations but less frequently.

Another study was conducted from 1987-1988 to detect factors affecting defaultation of TB treatment by comparing defaulters in 4 study states.

Identification of these factors by follow-up of TB patients on their experience, knowledge and practices and comparing the defaulters with non defaulters will enable us to understand the problems encountered by TB patients.

This information can be used as a feedback to the Managers of TB Control Programme on improving and achieving required targets.

During the period 1st March 1987 to 31st December 1988 a total of 1 116 TB patients was registered and followed up till they completed their treatment. Questionnaires were administered on the first visit at review and every time the patient missed treatment. A total of 683 pairs of cases/controls were obtained. Data entry for computer analysis has been completed recently.

Dust-mite allergy

An in-house enzyme-linked immunosorbent assay (ELISA) for the detection of IgE antibodies specific to *Dermatophagoides pteronyssinus* was developed and this assay was found to be comparable in specificity and sensitivity with a commercial test kit.

Enteric Diseases

The prevalence of enterotoxigenic *Escherichia coli* (ETEC) in 433 stool samples from diarrhoeal cases of all ages was studied using two commercially available test kits for the detection of heat labile toxin (LT) and the infant mouse assay for the heat stable toxin (ST). Sixteen samples (3.7%) were positive for ETEC, of which 9 were producing ST alone, 6 LT alone and only 1 was producing both LT and ST. Although the percentage of isolation rate was low, its occurrence was almost as common as the *Shigella* spp. and *Salmonella* spp. in the same study. Of the two test kits examined, the Phadebact ETEC-LT Test 50 (Pharmacia Diagnostics, Uppsala, Sweden) was found to be more suitable for use in a routine diagnostic laboratory. Ten out of 12 (83%) of the strains tested were resistant to one or more antibiotics.

Febrile Illnesses

(i) Cytomegalovirus (CMV)

CMV probes have been raised and the CMV virus passaged to obtain sufficient viral DNA for the evaluation of the sandwich hybridization method as a practical and rapid diagnostic method of CMV diseases in immunosuppressed patients especially transplant recipients, neonates and AIDs patients.

(ii) Acute Viral Hepatitis

A project to study the viral causes of acute hepatitis was started in 1986. Of the 798 specimens analysed, 383 (48%) were positive for anti-HAV IgM, 161 (20.2%) were positive for HBsAg and 115 (4.11%) were positive for anti-HBa IgM. Only 134 sera could be tested for Delta and Anti-Delta antigen. Of these, 4(2.9%) were positive for Delta Ag and 12 (8.6%) were positive for anti-Delta. Eight patients (1%) were positive for CMV IgM. None was positive for IgM.

Filariasis

Research activities under the filariasis research programme concentrated on the development of more specific immunodiagnostic tests and contributed to W.H.O.'s effots in the search for more effective antifilarial compounds.

Studies were carried out to determine the specific antigenic recognition patterns of antibodies in the sera of filariasis patients with different clinical manifestations of the disease. These would allow us to isolate specific antigenic fractions for use in immunodiagnosis. Preliminary studies show that microfilaraemic and tropical pulmonary eosinophilic patients recognise similar adult worm polypeptides of between 66-84 kD molecular weight while elephantiasis patients recognises a unique prominent band of about 30 kD. Some of these antigenic polypeptides will be studied to determine their usefulness as immunodiagnostic agents.

In collaboration with Universiti Sains Malaysia, pharmacokinetic studies were carried out on CGP 20376, a benzothiazole compound which has been shown to have complete macro and micro-filaricidal activities at a single oral dose of 20 mg/kg body weight in leaf-monkeys. Doses between 5-15 mg/kg were tested and the results of these studies will have important implications on the design of future clinical trials with the compound.

Human Nutrition

A human feeding trial to assess the affects of dietary palm olein, corn oil and coconut oil on serum lipid levels was carried out. Eighty student volunteers were divided into 3 groups matched for sex, race, serum total cholesterol levels, smoking habit and menstrual cycle. Each group was assigned to one of three dietary sequences which consisted of three consective 5-week periods viz. coconut-palm-coconut, coconut-corn-coconut and coconut-coconut-coconut.

Subjects fed on the palm olein and corn oil diets had their serum cholesterol and LDL-cholesterol levels significantly lowered ($p<0.05$) from that of the initial coconut oil period. Compared to the pre-trial levels when the subjects were on their habitual diets, the coconut oil period raised serum cholesterol by 12% ($p<0.05$), the corn oil period lowered it by 29% ($p<0.05$) while the palm olein period resulted in a 9% of reduction.

The overall results in this study indicated that palm olein is not hypercholesterolemic and may have beneficial effects on the levels of the atherogenic serum components when included in our habitual diets.

In another study, the compilation of nutrient composition for 783 foods was completed.

This project, under the purview of the ASEAN Sub-Committee on Protein: Food Habits Research and Development and financed by the ASEAN Australian Economic Cooperation Programme signifies an important stage in the development of studies in nutrient composition of foods in this country.

Examination of records of all children (n = 93) who attended the Maternal and Child Health Clinics in Kerlan, Perak during the period June 1982 to December 1987 was carried out to determine whether the provision of milk supplements to children who failed to grow adequately had indeed followed the criteria laid down by the Ministry of Health. Findings showed that only 10.6% of the children whose weight-for-age remained stagnant or decreased between two consecutive visits received the supplements. These children were selected randomly without regard to their current nutritional status. Thus a redefinition of this criterion taking into consideration available financial and other resources appears necessary in order to ensure that children most in danger of developing severe malnutrition are provided with these supplements.

Malaria

Field studies among Orang Asli in a mesoendemic area in Betau, Pahang, showed that residual DDT spraying of houses, together with the treatment of positives at six-monthly cycles, could not reduce the infection rate to a satisfactory level, due to the special epidemiological features existing in this community. Thus even after three years of application of these measures, the parasite rate was only reduced from 47.2% in October/November 1985 to 15.4% in November 1988. Studies showed that there was no evidence of the development of DDT resistance in *Anopheles maculatus*, the principal vector. Other intervention measures are therefore needed to complement existing ones. We will explore the use of insecticide impregnated bednets as a control measure in the near future and in line with this, the bionomics of *A. maculatus*, was studied and important baseline data obtained for future use.

The drug sensitivity of *Plasmodium falciparum* isolates to common antimalarials was monitored to detect any changing pattern of parasite drug susceptibility. Of those isolates successfully tested, using the W.H.O. *in vitro* microtest kits, 19 out of 22 (86.4%) and 3 out of 21 (14.3%) were resistant to chloroquine and quinine respectively. All 20 isolates successfully tested were found to be mefloquine sensitive. The levels of resistance of these isolates to chloroquine and quinine were very similar to those in 1987 (81.8% respectively).

In line with our efforts to develop more sensitive and specific seroepidemiological tools, a sandwich enzyme-linked immunosorbent assay (ELISA), using the monoclonal antibodies (MABs), MAB PF IG8 and MAB PC IE12, was tested and found to have a specificity of 100% and a sensitivity of 95-98%. Future studies are being carried out to improve the sensitivity of the test.

The US Army Medical Research Unit - Malaysia (USAMRU-M) completed 2 malaria projects that characterized the malaria immune status of Orang Asli residing in a moutainous lowland forested area of Perak, Malaysia. In addition, the efficacy of Artemisinin (Qinghaosu) and Arteether as anti-malarials in the hamster model were described, and a new bioassay was developed for measuring the concentration of cycloguanil, a metabolite of the antimalarial drug proguanil, in human plasma.

Parasitic Diseases

A preliminary survey was carried out to determine the prevalence of cryptosporidiosis in paediatric diarrhoeal cases and whether the existing treatment given by physicians was effective against cryptosporidiosis. Cryptosporidium is considered an important pathogen causing diarrhoea especially in very young children and immunocompromised patients. Two

to three stool samples (total 414) were collected from 158 diarrhoeic patients at the paediatric ward in Klang Hospital and stained with the modified acid fast staining method (cold process). The positive cases were confirmed at the Department of Parasitology, Faculty of Medicine, UKM. The prevalence rate was found to be 4.4% with similar numbers among males and females. The infection was most common among the 1-4 year age group and more common among the Malays and Indians than among the Chinese. It was also noted that these cases were basically treated for their symptoms and the drugs used were not effective against cyptosporidiosis.

Vector Studies

(i) Biological Control Studies

Seventeen isolates of *Bacillus thuringiensis* and 6 isolates of *B. sphaericus* were obtained after screening. Other bacteria were also isolated and among these was an isolate of *Clostridium bifermentans*. This is the first time this bacteria is isolated and reported. This isolate exhibited high activity against *Anopheles maculatus, Mansonia uniformis* and *Aedes aegypti* at low spore counts when tested in the laboratory. The possibility of isolating and cloning the toxin genes into other bacteria is being looked into.

An atypical isolate of a *B. sphaericus*-like bacteria was also isolated for the first time. This isolate, unlike other known isolates of *B. sphaericus* which are active against *Culex quinquefasciatus*, is also active against *Aedes aegypti*.

Two fungal isolates which were larvicidal to *A. aegypti* and *Cx. quinquefasciatus* were isolated.

Isolates of *B. thuringiensis* (IMR-8) and *B. sphaericus* (IMR-BS-4) from Selangor and Malacca respectively produced in the laboratory were field tested against *Anopheles kawari* in Buntong, Ipoh. Preliminary results showed that IMR-8 gave about 90% reduction in larval population, 24 hours after treatment. The residual effects lasted about 5 days. The IMR-BS-4 reduced the larval population by almost 100% and the residual activity lasted about 11 days. A mixture of both isolates gave the best results as no larval breeding was found 15 days post-treatment.

(ii) Dengue surveillance

A total of 1 299 houses from 31 towns/localities in the states of Malacca, Kelantan and Terengganu was checked for *Aedes* larval breeding. In Malacca, 400 houses from 8 towns was examined. This average House Index (HI) and Breteau Index (BI) for *Aedes aegypti* were 3.3% and 3.5% respectively.

In Terengganu, 407 houses from 11 towns were examined; the HI and BI were 4.42% and 5.41% respectively.

(iii) Resistance studies in mosquitoes

Studies were conducted to investigate the resistance status of various spp. of mosquitoes to a number of insecticides. *Aedes aegypti* larvae were collected from 4 areas and bioassays conducted on the F1 stage indicated that mosquitoes from two areas had begun to exhibit resistance to temephos, though the level of resistance was low. However, temephos was found to be still effective at operational dosage.

Culex quinquefasciatus mosquitoes were collected from 9 localities in Kuala Lumpur city and initial results indicated temephos and malathion resistance in the *Culex* larvae.

For *Anopholes maculatus*, the primary vector of malaria in several areas in

Peninsular Malaysia, no resistance to DDT was detected.

From the present findings, it was shown that the increase in malaria cases in some areas or the continued transmission of malaria in certain areas were not due to mosquito resistance to DDT but to other factors.

(iv) New tools for vector control

Studies were done to determine the usefulness of three new tools namely, an insecticidal paint containing deltamethrin, repellant bar and bednet. Results obtained using the insecticidal paint against *Anopheles, Aedes* and *Mansonia* mosquitoes showed that wooden and cement surfaces that were coated with the paint gave 100% mortality in test insects throughout the test period of 5 months.

Two types of repellant bars, one containing 1% permethrin and the other containing a mixture of 0.5% permethrin and 20% DEET were field tested against vectors of malaria and filariasis. The results showed that the permethrin – DEET bar provided 9 hours protection from mosquito bites.

A bioassay was conducted for permethrin treated bednets in Kampong Jerek, Gua Musang, Kelantan to estimate the effective life of permethrin on the nets under normal usage. This was a collaborative study carried out by the Vector Borne Diseases Control Programme of the state of Kelantan, the WHO Regional Anti-malarial Team and the Division of Medical Entomology, IMR. The results indicated that the nets were still effective up to 8 months under actual conditions.

Specialised Diagnostic Tests/Referral Services

In 1988, the Institute carried out a variety of specialised diagnostic tests in several disciplines. It also performed some of the simpler diagnostic tests for the private sector.

The indirect Immunoperoxidase (IIP) Test Kit for Rickettsial Disease diagnosis designed by USAMRU-M has been distributed to Southeast Asia, USA, Japan and Korea. The USAMRU-M provides quality control checks for hospital and research laboratories using the kit. During the year, 85 quality control assays were conducted and 3,742 antigen slides were supplied to hospitals and laboratories in Malaysia and Thailand.

The breakdown of diagnostic tests for the year is shown in Table 23.1

Training

Apart from research activities, the Institute conducted training programmes for all categories of laboratory personnel for the entire national (Ministry of Health) and some international needs.

Schools for Medical Laboratory Technology

A total number of 217 trainees underwent two separate formal courses at the school. The details are as follows:-

(i) A three-year training course for Medical Laboratory Technologists.

First year	–	36 technologists
Second year	–	80 technologists
Third year	–	72 technologists

(ii) A one-year training course for Assistant Medical Laboratory Technologists. Total intake for the year was 29.

During the year, 59 medical laboratory technologists qualifed for the Medical

Laboratory Technologist Certificate and 23 for the Assistant Medical Laboratory Technologist Certificate.

(iii) Advanced Course for Medical Laboratory Technologists

This course which commenced in 1987 in the subjects of Chemical Pathology and Medical Microbiology continued this year. 17 candidates in Chemical Pathology and 15 candidates in Medical Microbiology were at various stage of completion in their dissertations/project/review and log books.

TABLE 23.1 – No. of tests done in the year 1987 and 1988.

DIVISION	1987	1988
Bacteriology	37 021	33 877
Biochemistry	75 570	71 919
Cytology	34 006	30 248
Entomology	91 118	80 480
Haematology	55 701	53 907
Malaria/Filariasis	19 401	20 270
Nutrition	30 283	21 635
Parasitology	8 400	5 650
Pathology	5 059*	6 354*
Radiochemistry	34 318	35 019
Serology	69 106	60 481
Stomatology	8 108	7 231
USAMRU	15 829	26 016
Vaccine Production	970	1 883
Virology	65 932	62 852
TOTAL	550 822	517 822

*No. of Cases

Source: I.M.R., Ministry of Health.

SEAMEO-TROPMED Course

As the National Central for Tropical Medicine and Public Health, the Institute under the auspices of SEAMEO-TROPMED, conducted 2 post-graduate courses during the year. For the Diploma of Applied Parasitology and Entomology (D.A.P. & E.) course, a Curriculum Review Committee comprising of faculty members from the IMR and representatives from WHO, UM, UKM, USM, and VRI was set up and a new curriculum was designed and implemented during the year. Seventeen students from 5 countries attended this six-months course. Of the candidates, 6 were from Indonesia, 4 from Philippines, 3 from Thailand, 1 from Solomon Islands and 3 from Malaysia.

Thirteen candidates comprising medical doctors, pharmacists and scientists attended the six-months post-graduate course leading to the Diploma in Medical Microbiology (D.M.M.). Of these, two were from Indonesia, 4 from Philippines, 3 from Thailand and 4 from Malaysia.

Visiting scientists/technicians

The Institute provided training for visiting Fellows and scientists/technicians spon-

sored by various agencies. These included visiting scientists from within Malaysia as well as outside the country. 27 of them from 11 countries were sponsored by WHO for varying periods of time.

Other Activities

The Dadah Reference Laboratory

The Dadah Laboratory continued to perform drug analyses in body fluids, supervise and conduct quality assessments and provide advisory service for all drug detection in the Ministry of Health.

National Quality Assessment Programme

The Division of Biochemistry continued to conduct National External Quality Assessment Programme to monitor the analytical performance of 26 laboratories, throughout the country. The Division of Bacteriology also continued its Quality Control Programme for antibiotic sensitivity testing.

The Anti-HIV secreening for all blood banks and hospital screening centres which started last year is being continued by the Division of Virology.

Snake Farm

Biological studies on normal bacterial oral flora of poisonous snakes showed that 74% of the bacterial spp. were gram negative while the majority of gram-postive bacteria (14%) was *Staphylococcus epidermidis*.

Vaccine Production

Production and supply of prophylactic cholera and typhoid vaccines and tuberculin injections continued as in previous years although there was a reduction in demand of the two vaccines.

The supply of Biological Products for the year was as follows:

Tuberculin	79,290 ml
Prophylactic Cholera Vaccine	131,790 ml
Typhoid Vaccine	209,400 ml
Antivenom	37,139 ml

In addition, a project was started to purify and concentrate immunoglobulin from Malaysia Pit Viper Antivenom in horse plasma supplied by the Snake Farm of the Institute.

Library and Information Services

The Library continued to fulfill the role of the National Focal Point for the World Health Organization's Regional Biomedical Information Programme and the co-ordinating Library for the SEAMIC Health Documentation and Publication activities by documenting medical and health information generated in Malaysia and by doing on-line searches on international data bases for medical and health personnel in the country.

Laboratory Animal Resources

During the year, a total of 37,871 animals was supplied to various divisions in the Institute, an increase of 8,695 as compared to 1987. This was attributed to the start of R&D projects with more researchers utilizing animals in their research.

IMR/WHO Activities

As the WHO Regional Centre for Research and Training in Tropical Diseases, the Institute has been able to contribute effectively towards the TDR programme by establishing linkages with lesser developed institutions in the Western Pacific Region in order to provide assistance to develop their research capabilities. During the year, the IMR received 7 research training grants from WHO for its scientists.

CONCLUSION

In general, the Institute for Medical Research performed satisfactorily in research, diagnostic, consultative and training activities. In particular there was an intensification of applied research projects directed at problem solving. New technologies were applied and will be further used in both research and diagnosis with the aim of maintaining the Institute in the forefront of medical science and in keeping with its role as a premier centre of research and reference laboratory.

CHAPTER 25

HEALTH SYSTEMS RESEARCH

The development of Health Systems Research as a mangement tool continued very actively during 1988, with the Public Health Institute continuing to provide leadership and support.

OBJECTIVE

Health Systems Research aims at improving the effectiveness and efficiency of the health delivery system by facilitating informed decision-making in the development and management of health programmes.

STRATEGIES

The main strategies in Health System Research programme were the provision of training and continued support for health service personnel to conduct less complex health systems research projects and use the findings in improving health cars; the conduct of more complex projects by institutions such as the Public Health Institute; the involvement of senior health managers in determining research priorities, supporting HSR projects and using research findings in health management; and providing technical advice and support for the development of related approaches that integrate Health Systems Research methodology into the health services e.g. Quality Assurance.

RESOURCES

The organisational structure and manpower for the Health Systems Research Programme remained the same as the previous year. Only one post was filled for Medical Officer of Health superscale 'G' and two Research Officer post were still vacant. Two full time Medical Officers and one Nursing Sister from training and service votes were on loan to the programme. The 'matrix management' concept continued to be practised particularly from the staff in the Health Education Unit and Educational Technology Unit, to assist the Programme carrying out the planned activites for the year.

In 1988, the programme continued to receive provision of operating budget as established in the 72000 series as follows:

Personal Emoluments	$57,900
Operating Expenditure	$38,000

In addition, a total of $320,136 allocation for 4 Health Systems Research projects were received from the Research and Development funds of the Government of Malaysia.

ACTIVITIES AND ACHIEVEMENTS IN 1988

Research Activities

A total of 19 research projects in varous stages of progress, were carried out. Some of these were carried out by the staff of the Public Health Institute while others were done by staff at state and district levels with advice and assistance from the Public Health Institute.

Training activities

Training activities aimed at developing a critical mass of health personnel who would be able to develop and conduct less complex research projects were actively implemented.

A total of 8 workshops were conducted in 1988, of which one was at International, 6 at national and one at state levels. A total of 175 health personnel from the Ministry of Health and foreign countries participated in the workshops.

In order to facilitate and support future training, two training packages were produced, viz:

(a) Training course in Health Systems Research Methodology for professional participants with post graduate qualifications consisting of 19 modules, and

(b) Training course in Health Systems Research Methodology for nursing personnel consisting of 14 modules.

Dissemination of Research Information

One issue of the "Health Systems Research: Abstract of Research Projects and Related Managerial (Followup) Measures" Bulletin was published and disseminated to all national programme directors, state and hospitals.

In addition, 8 research reports and papers were produced and disseminated.

Programme development

The focus of the development was to institutionalise Health Systems Research. In this context the major activities were:

(i) Follow up on the recommendation of the 1987 National Conference on Management of Research whereby two papers on the "National Priority Areas for Research" and "Research policies and strategies in the Ministry of Health" were prepared by the staff in Public Health Institute and Institute for Medical Research. In both of these papers, the importance of Health Systems Research was emphasised and particular attention was given to strengthening Health Systems Research and the utilization of research to improve health;

(ii) A short term WHO consultancy to review the situation and recommended suitable strategies to institutionalise HSR in Malaysia;

(iii) Advocacy of health systems research approaches to the research community in Malaysia;

(iv) Continued technical support was provided for the development of the Quality Assurance Programme of the Ministry of Health.

(v) Detailed proposals for integration of Health Systems Research into Nursing curricular were submitted to the Training and Manpower Division and the Nursing Division of the Ministry of Health.

CONCLUSION

Inspite of manpower an organisational contraints, the Health Systems Programme based at the Public Health Institute succeeded in implementing most of its planned activites. The success of this programme was very much attributed to the support and cooperation given at National, Institutional, State and district levels.

Ⅸ. マレイシア国保健医療セクターレビュー

<INDICATORS>
国名：マレイシア

1．基礎指標[8)]

首都	：クアラルンプール
面積	：３２万９、７５８平方キロメートル（１３州１連邦区、日本の１０分の９）
気候	：熱帯雨林気候、気温（年間）２４～３２度、年間降雨量約２、３００ミリ
人口　１９９０	：１７．９百万人[3)]
人種（民族）	：マレイ人及びその他の先住民５７．７%，中国人３１．８%，インド人９．９%，その他０．６%
宗教	：イスラム教が国教。その他仏教、ヒンズー教、キリスト教
公用語	：マレイ語、英語
政治体制	：英連邦加盟の立憲君主国
国家元首	：アズラン・シャー国王（１９８９年４月２６日即位、任期５年）
独立年月日	：１９５７年８月３１日
旧宗主国	：英国
通貨	：リンギット：１米ドル＝２．７０リンギット（１９８９年現在）

2．社会経済指標　（単位：億米ドル）

①経済指標

ＧＮＰ　１９８９	：３５８[1)]
一人当たりのＧＮＰ　１９８９	：２，０５０米ドル[1)]
一人当たりのＧＮＰ 年間増加率　１９８８	：４．０%[4)]
インフレ率　１９８９	：２．８%[1)]
対外債務　１９８８	：１６１[1)]
輸入額　１９８９	：２１０　主要相手国：日本、米国、シンガポール[1)]
輸出額　１９８９	：２４８　主要相手国：シンガポール、米国、日本[1)]

産業構造，ＧＤＰの分配　（農業，工業，サービス業）

ＧＤＰ　１９８９	：２３４．４[8)]
農　　業　１９８３	：２２．４%
工　　業	：２９．６%
製　造　業	：１８．０%
サービス業	：４８%

（ａ．製造業は工業部門の一部であるが、一般に同部門の中で最も動的な部分であるため、そのＧＤＰシェアを別掲した。）

政府歳入　１９８９（単位：億米ドル）[1)]

総歳入	：９３．６
総歳入対ＧＮＰ	：１４．８%
税　収	：６１．８
税金以外による歳入	：３１．８

政府歳出　１９８９（単位：億米ドル）[1)]

経常支出	：９２
資本支出	：２８．４
総支出	：１２０．４

国際収支：（ア）貿易収支（１９９０）：２５．３（輸出１５５．８、輸入１３１．６）
（イ）経常収支（１９８６～９０）：－９７．１（対ＧＮＰ比６．６%）

政府支出中の支出比率　%　１９７２[4)]

保健分野	：６．８%
教育分野	：２３．４%
住宅及び地域環境、社会保障及び福祉	：４．４%

絶対的貧困水準以下の人口の比率[2)]

都市	：１３%
農村	：３８%

②教育指標[2)]

初等教育における就学率	男：１０２　女：１０２
中等教育における就学率	男：　５９　女：　５９

成人の識字率　　男：　８３　女：　６５
人口1,000 人当たりのラジオの台数　：　４３６

３．保健指標

①人口統計指標

平均余命　１９８９　：７０ [2]
粗出生率（対人口 1,000）　：２７．１０ [9]
粗死亡率（対人口 1,000）　：４．７０ [9]
人口年間増加率　：２．６％ [2]
合計特殊出生率　１９８９　：３．９％ [2]
都市人口割合　１９８９　：４２％ [2]
都市人口年間増加率１９８８　：４．９％ [2]
人口全体における１５歳未満の人口の割合　１９８８　：３７．３％ [12]
〃　６０歳以上の人口の割合　：５．８％ [12]

②疫学的指標

乳幼児死亡率（対人口 1,000）　：２３ [2]
５才以下の小児の死亡率（対人口 1,000）　：３０ [2]
妊産婦死亡率（対人口 1,000）　：０．５９ [2]
ＰＭＩ－５５　：６１％ [10]
（b全死亡者数に対する55歳以上の死亡者数の比率（%））
疾病構造 [12]

死亡：主要原因　１９８７

疾患名	死亡者数	比率（%）
１．心臓疾患・循環器系疾患	７，７４１	２９．９％
２．腫瘍	２，９５１	１１．４％
３．新生児障害・分娩時死亡	２，２７２	８．８％
４．事故全般	１，５０５	５．８％
５．自動車事故	８６３	３．３％
６．敗血症	８４７	３．３％
７．先天性奇形	８１２	３．１％
８．肝炎	７６２	２．９％
９．腎臓系疾患	７６０	２．９％
１０．糖尿病	４４８	１．７％
１１．結核	３３９	１．５％
死因に占める感染症の割合		７．７％

主要な届け出感染症　１９８８

疾患名	症例数
１．マラリア	５０，７２１
２．結核	１０，９４４
３．ウイルス性肝炎	４，５３３
４．はしか	２，３０４
５．梅毒	１，７９０
６．腸チフス	１，７３１
７．食中毒	１，６４３
８．デング熱	１，４２８
９．赤痢	７７４
１０．コレラ	７５３

③栄養指標 [2]

低出生体重児の出生率　：１０％
栄養不良児の有症率　０～４歳　：中・重度？　％，　重度？％
一人当たりの毎日の必要カロリーの充足率　：１２１％

４．保健衛生サービス指標

完全な予防接種を受けた比率 1歳児　１９８９ [2]
結核　：９９％

３種混合 ：７２％
ポリオ　：７２％
はしか　：５０％
学校保健の普及率　：？
保健サービスを入手できる人々の比率　：？
衛生サービス　：？
安全な飲料水を入手できる人々の比率　１９８９　：全国８４％，都市９６％，農村７６％ [2]
下水道の普及率　１９８６　：３．２％ [13]
トイレの普及率　：？％

５．医療資源
一病床当りの人口　１９８９　：４１０ [11]
医師一人当たりの人口　１９８４　：１，９３０ [4]
看護婦一人当たりの人口　１９８４　：１，０１０ [4]
国民一人当たりの保健予算　１９８８　：２７．７米ドル（７４．７４M$） [12]
保健省予算　：４６８　４百万米ドル [12]
（１２６４．７million M$）
全政府予算に対する保健省予算の比率　１９８８　：４．４１％ [12]
ＧＮＰに対する保健予算の比率　１９８８　：１．９１％
公的及び私的医療機関での医療費　１９８３　：１、８２０million M$

６，政府開発援助（ＯＤＡ）指標
政府開発援助（ＯＤＡ）の受入額　１９８６　：１９２．７百万米ドル [7]
ＯＤＡ援助額上位３カ国（二国間計）１９８６　：１．英国、２．オーストラリア、３．日本 [7]
（１９７７－８４年まで日本が一位）
受入国の政府支出に占めるＯＤＡの比率　：０．８％
受入国のＧＮＰに占めるＯＤＡの比率　：０．２％

日本によるＯＤＡ実績
①贈与率　１９８６　：２０～３０％ [7]
②技術協力の累計　１９８９　：４３９．４０億円 [6]
イ．専門家派遣　：８９４人
ロ．開発調査　：６７件
ハ．協力隊派遣　：７９８人
ニ．機材供与　：６、００７百万円
ホ．プロ技協：１７件
③無償資金協力援助額累計（８９年までの）　：９０．６４億円 [5]
③有償資金協力援助額累計（８９年までの）　：４、９８０．１８億円 [5]
④保健医療分野における援助実績 [5]
無償資金協力：なし
プロジェクト方式技術協力：

プロジェクト名	要請機関名	協力年度	援助額
診療団	保健省	Ｓ４２．２～同９月	５．４５８百万円
合　　計			

単独機材供与：

プロジェクト名	要請機関名	協力年度	援助額
義肢義足製造機材	サラワク・クチン総合病院	Ｓ．３９	２．４４２百万円
合　　計			

７．資料

1）国別協力情報ファイル　マレイシア１９９１．ＪＩＣＡ
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3）世界人口白書　１９９１．ＵＮＦＰＡ
4）World Development Report 1990. World Bank
5）我が国の政府開発援助（下）国別実績　１９９０．外務省
6）国際協力事業団事業実績表　１９９０．ＪＩＣＡ
7）経済技術国別資料（援助地図）マレイシア　１９９８．ＪＩＣＡ
8）任国情報　マレイシア　１９９１．ＪＩＣＡ
9）The Malaysia Plan 1991-1995. Ministry of Health Malaysia
10）SEAMIC Health Statistics 1989. International Medical Foundation of Japan
11）開発途上国技術情報データシト(1/3) マレイシア　１９９０．ＪＩＣＡ
12）Annual Report 1988. Ministry of Health Malaysia
13）マレイシアの経済社会の現状第４版　１９８６．外務省