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HIGHLIGHTS OF RESEARCH AT THE TUBERCULOSIS RESEARCH CENTRE, MADRAS

"In the future the battle against this plague of mankind (tuberculosis) will not just be concerned with an uncertain something but with a tangible parasite, about whose characteristics a great deal is known and can be explored."

Robert Koch

Though the above statement is more than a century old, it is of relevance even today. Currently three million people die from tuberculosis every year. At present the containment of this disease is out of control in many parts of the developing world. It remains a leading cause of death from any single infectious disease, accounting for over a quarter of all avoidable deaths[1]. The deadly link between turberculosis and AIDS has now been clearly established[2]. People with this dual infection have a 25 fold increased mortality.

For the treatment of tuberculosis to be successful, consistent uninterrupted medication of 6 to 8 months is required. Since available measures for ensuring diagnosis and patients' treatment compliance are inadequate, new drug resistant strains of tubercle bacilli are emerging at a rapid pace[3]. In such a seemingly bleak scenario it is necessary to recollect the pioneering contributions and continuing efforts being made by the Indian Council of Medical Research (ICMR) and the Tuberculosis Research Centre (TRC), Madras in tackling this dreaded disease.

A modest but notable beginning in the management of pulmonary tuberculosis in India was made in the 1950s by the ICMR, the Government of Tamil Nadu, the British Medical Research Council and the World Health Organisation by establishing the Tuberculosis Chemotherapy Centre (TCC) at Madras in Tamil Nadu.

The primary research priority of the TCC at the time of its inception was anti-tuberculosis chemotherapy. Over the decades, the Centre gradually evolved and an expansion of its activities to cover all aspects of tuberculosis fully justified its renaming in 1978 as the Tuberculosis Research Centre by the ICMR. The Centre has made important contributions in bacteriology, biochemistry, epidemiology and immunology of tuberculosis in addition to providing base-line data in the chemotherapy of tuberculosis.

CLINICAL STUDIES

The Madras Study—Efficacy of Home Treatment

The initial impetus for the establishment of this Centre was to explore the possibility of treating tuberculosis patients at their residence. This was done by a menticulosusly planned and executed randomised controlled trial which later became famous as the **'Madras study'**[4,5]. This landmark study established certain ground truths regarding treatment of tuberculosis. The conclusions of this study were:

(i) Tuberculosis can be effectively treated at home with no need for the patient to be admitted to a sanatorium.

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(ii) The key to successful chemotherapy is regularity of drug intake.

(iii) Nutritious diet does not play a role in the treatment.

(iv) Contacts of the patient at home do not have a greater risk of developing the infection.

(v) Most of the patients become non-infective within 2 months of regular treatment.

These findings revolutionised the approach to the treatment of tuberculosis and laid the foundation for the National Tuberculosis Control Programme in India, and in other developing countries. There are several advantages of domiciliary treatment which include substantial reduction in capital expenditure, reduction in cost of treatment per patient and feasibility of the organisation of mass chemotherapy programmes. Bed strength in a sanatorium was no longer a key factor involved in successful treatment. Patients in rural areas far from sanatoria could also be treated at no extra cost since the treatment given on an outpatient basis for one year is less than 10 per cent of the cost of maintaining a bed in a sanatorium for the same period[6,7].

Short Course Chemotherapy (SCC)

SCC was very early recognised as the need of the hour because traditionally the treratment was of 12-24 month duration which led to a major problem of treatment adherence (patients' compliance). Serious and intensive efforts to evolve shorter regimens eventually led to the development of highly effective regimens of 5, 6, 7 and 8 months duration which included powerful drugs such as rifampicin, isoniazid, pyrazinamide, streptomycin and ethambutol[8-10]. Among the primary anti-tuberculosis drugs, the most expensive one is rifampicin. In order to further reduce the cost of treatment, the Centre evaluated regimens without rifampicin and these were found to be equally efficacious. Chemoprophylaxis with isoniazid was also studied in very young family contacts.

The value of intermittent chemotherapeutic regimens in the treatment of pulmonary tuberculosis has also been thoroughly investigated[11,12].

Study of drug resistance has been a major priority for research and reports of drug resistant tubercle bacilli in India were first documented by the ICMR from this Centre[13,14]. Alternate regimens have been evolved to treat drug resistant cases with adequate success[15].

Extrapulmonary Tuberculosis

The experience and expertise gained during the conduct of controlled clinical trials in pulmonary tuberculosis were utilised to study tuberculosis of the spine, tuberculous meningitis, tuberculous lymphadenitis, tuberculoma of the brain, abdominal and skin tuberculosis.

It was found that the time of initiation of chemotherapy, rather than chemotherapy alone had greater relevance in the outcome of tuberculous meningitis in children. There was better prognosis and fewer sequelae with earlier treatment[16,17].

For spinal tuberculosis, effective ambulatory treatment regimens of 6 to 9 months duration without resorting to radical surgery and/or hospitalisation were successfully developed[18]. This led to increase in cost effectiveness since surgery and hospitalisation were avoided.

Short course regimens of 6 to 9 months duration have also been evolved for tuberculoma of the brain, tuberculous lymphadenitis and abdominal tuberculosis[19-21].

These regimens are considered robust with negligible relapse rates and treatment failures, and have been accepted for the treatment of such patients in the National Tuberculosis Programme (NTP).

The Tuberculosis Control Programme

The TRC has pioneered the introduction of short course chemotherapy for pumonary tuberculosis under the district tuberculosis programme in 18 districts in 10 states all over India (Unpublished data). During this period, several practical constrainst were identified and remedial measures were suggested to the State authorities to improve the efficiency of the Programme. A programme was developed for data processing which suggested methods to overcome avoidable deficiencies[22]. The benefits accrued from these studies are evident by the fact that there has been a substantial increase in the number of sputum examinations and detection of cases at the public health institutions (PHIs) along with a reversal in the trend of more numbers being detected at the District TB Centres (DTCs). These studies were of invaluable help in implementing the short course chemotherapeutic regimens at the national level under the DTP[23-26].

Operational Research

In operational research studies, the potential role of *dais* (traditional birth attendants) in tuberculosis case finding has

been explored to help in the grass-root operations of the NTP in the villages. Valuable results have also emerged from studies to explore the use of literate tribal youth in NTP activities in remote tribal areas to establish a link between the governmental agencies and the community. Health educational materials have been developed to create an awareness of tuberculosis in the community. Group educational activities have been undertaken to ensure better community participation and commitment of health personnel to the programme. Collaborative studies in urban, semi-urban and rural areas have successfully established a system for eliciting accurate home addresses from out-patients attending chest clinics. They have also demonstrated the superiority of a home visit by a health visitor over a routine postal reminder in retrieving patients who fail to attend the clinic for collecting drugs. Such studies have been largely responsible for defining the reasons for default among rural populations, and for suggesting strategies to motivate defaulters for continuing chemotherapy[27-29].

LABORATORY STUDIES

Many landmark laboratory studies in the diagnosis and treatment of tuberculosis, in the diagnosis of drug resistance and in investigating the efficancy of newer anti-tuberculosis drugs have been conducted at the TRC since its inception in the 1950s.

Sputum Microscopy and Culture

Studies at the Centre established the importance of sputum microscopy in case finding. It was observed that the results of 2 sputum smear examinations are equivalent to one bacteriological culture[30]. The relevance of periodic sputum smear examination alone in monitoring progress of patients on treatment was realised. The sputum positive, culture negative picture was recognised as a phenomenon in the early phase of SCC[31]. The effects of storage of sputum at ambient temperature on smear and culture results have been studied[32]. The role of cetylpyridinium chloride in maintaining viability of tubercle bacilli upto 7 days at room temperature has been reported[33]. It was found that culture positivity could be enhanced in cases of extrapulmonary tuberculosis by using multiple media including inexpensive combinations such as Lowenstein-Jensen (LJ) with Kirchner's medium[34, 35].

Evaluation of Anti-tuberculosis Drugs and Susceptibility Testing

Methods for direct susceptibility testing to isoniazid, streptomycin and rifampicin have been standardised in order to reduce the time taken to diagnose multi-drug resistant tuberculosis (MDR-TB)[36]. Several *in vitro* studies on antimycobacterial sensitivity have been published from this Centre[37, 38]. These include studies on newer rifamycin derivatives such as rifabutin and rifapentine, quinolones such as ciprofloxacin, ofloxacin and lomefloxacin, aminoglycosides such as capreomycin and tuberactinomycin, and other drugs such as minocycline[39]. In the current situation where MDR-TB has assumed greater relevance and the search for newer antituberculosis drugs has become of utmost importance, these studies have yielded valuable information on tackling MDR-TB at the national level. Studies on the early bactericidal activities (EBA) have shown that divided dosage of anti-tuberculosis drugs taken daily had a similar response to that of patients taking all 4 drugs (such as rifampicin, isoniazid, pyrazinamide and ethambutol) together during the early phase of chemotherapy[40]. This finding has a logistic importance to evolve a strategy to deliver drugs in blister packs to enhance patients' compliance, a strategy similar to that which was successfully implemented in leprosy control.

All patients undergoing chemotherapy at the TRC are carefully monitored for adverse drug reactions using biochemical parameters[41-46]. In this process, the existing methods for estimation of drugs which were earlier complicated became simplified. Invasive procedures requiring blood were replaced by non-invasive ones requiring urine and saliva. Quality control of the drugs administered to the patients is carefully monitored at the Centre. During such studies it was observed that cycloserine rapidly deteriorated under warm and humid conditions. A syrup preparation of isoniazid was also found to be ineffective becuase of the inactivation caused by the excipient[47].

Immunological Investigations in Tuberculosis

Using the recent explosion in information and techniques pertaining to molecular biology, intensive work is currently under way at the TRC to develop serological and molecular biological methods for the early diagnosis of tuberculosis[48, 49]. Immunological parameters relevant to tuberculosis are also being investigated both indigenously and in collaborative studies to elucidate those anti-parasitic mechanisms which may be important in containment of the disease[50-53]. Genetic predispositions which may play an important role in the development of pulmonary tuberculosis are being studied[54].

The South Indian Variant of *Mycobacterium tuberculosis*

One of the earliest studies undertaken was to elaborate the properties of tubercle bacilli. These studies established that the tubercle bacilli isolated in South India have a unique phenotype compared to strains obtained from other geographical areas. These include their lower virulence in guineapigs, enhanced susceptibility to thiophen-2-carboxylic acid hydrazide, and peculiar phage susceptibility pattern[55]. Today, the South Indian variant of *M. tuberculosis* is well established and many studies are in progress both at the Centre and elsewhere to elucidate the molecular biological basis of the differences observed in these strains[56]. An effort is also being made to develope probes using these strains for the diagnosis of tuberculosis in this part of the world[57, 58]

Cardio-pulmonary Studies, Post-chemotherapy Rehabilitation

Pulmonary tuberculosis patients are likely to have impaired lung function due to fibrosis. In the case of spinal tuberculosis, spinal deformities could lead to compression of the thoracic cage thereby compromising lung function. In all these situations there is a deterioration of the quality of life. Currently, quality of life measurements on such patients are being undertaken in the Centre[59, 60]. The outcome of these studies are of direct relevance in rehabilitating patients during the post chemotherapeutic phase.

EPIDEMIOLOGY OF TUBERCULOSIS

The South Indian BCG Trial

A trial to study the efficacy of BCG in protecting against the adult form of pulmonary tuberculosis was undertaken in the rural population of the Chingleput district of Tamil Nadu in South India under the joint auspices of the ICMR, the World Health Organisation, and the CDC and the USPHS (until June 1976) from 1968 to 1980. The results of this study, to date the largest of its kind in the world, unambiguously showed that BCG does not seem to offer any protection in individuals over 12 years of age[61]. These findings have aroused widespread comment and raised pertinent questions on various aspects of tuberculosis. At the TRC, Madras, currently many research projects are under way which are examining some of the questions raised by the findings of the South Indian BCG trial. The role of environmental mycobacteria as immunomodulatory agents in the protective response elicited by BCG has received the most attention. Several laboratory studies in the Centre have been carried out to further investigate bacteriological, ecological and immunological aspects pertinent to this hypothesis. These studies have shown that bacteria of the *Mycobacterium avium* complex are predominant in the water and dust of the South Indian BCG trial area while organisms of the *M. fortuitum* complex are predominant in the soil of this area[62]. Animal experiments using guineapigs further showed that oral immunisation with *M. avium* complex organisms did not adversely affect the protective efficacy of BCG[63]. It was further shown that while no apparent immunomodulatory effect was observed in the early stage of infection when animals had been exposed to *M. avium* prior to immunisation with BCG, at the later stages the barrier at the site of the infection appeared not to be intact since challenge *M. tuberculosis* organisms could be detected in the spleen of such animals compared to their absence in the spleen of animals which had been immunised with BCG alone[64]. The relevance of this finding is currently being further explored in animal model studies.

Prevalence Studies

An age-wise bias in the distribution of the disease with its concentration among the population in the productive age group has been clearly demonstrated in studies conducted by the Centre[65]. These pioneering studies carried out by the ICMR at this Centre in the 1950s provide essential base-line data to planners in Health Services in India even today. Subsequent to these studies it has not been possible to carry out similar exercises on such a magnitude anywhere else in the country.

Sample surveys carried out by the Centre have shown that prevalence of tuberculosis in urban, rural and tribal areas varied from 4-10 per thousand population[66]. The annual risk of infection was found to be between 1.0 and 1.5. During the South Indian BCG trial the prevalence of the disease among the study population was found to be 404 per 100,000[61]. In surveys conducted in North Arcot district in Tamil Nadu and Raichur district in Karnataka in the 1980s, total bacteriological prevalence of 430 and 1090 per 100,000, respectively, was reported. These studies domonstrate fluctuations in the prevalence rates within India with the potential for the occurrence of very high risk of infection in some areas.

A study of short course chemotherapy in rural areas under programme conditions has shown 79 per cent acceptance. Treatment completion rates were 51 per cent for the twice weekly regimen and 63 per cent for the daily regimen.

At the end of chemotherapy there were 73 per cent culture negative of whom 95 per cent remained culture negative at the end of 18 months of follow up.

A cross-sectional survey of patients treated earlier showed that 80 per cent of the patients who had 80 per cent or more of the prescribed chemotherapy were quiescent upto 3 years. Even among patients who had taken less than 50 per cent of the prescribed chemotherapy, only 46 per cent were bacteriologically positive.

To sum up, the intensive efforts of the Centre demonstrated for the first time in the world that domiciliary treatment of tuberculosis is possible and can be effectively used in combating and controlling the disease. The study on efficacy of BCG in protecting against pulmonary tuberculosis unambiguously showed that BCG does not seem to offer any protection in individuals over 12 years of age. Clinical trials carried out by TRC demonstrated the safety and efficacy of short course chemotherapy (SCC) in pulmonary and extrapulmonary tuberculosis including tuberculoma of the brain, both in adults and children. Following these studies, the SCC was introduced into the National Tuberculosis Control Programme. Alternative regimens have been evolved to treat drug resistant cases with adequate success. Using modern biotechnological/molecular biological methods the Centre is currently undertaking intensive work to develop methods for early diagnosis of tuberculosis and also trying to identify genetic predisposition to the disease.

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This write-up has been contributed by Dr. C.N. Paramasivan, Officer-in-Charge, Tuberculosis Research Centre, Madras.

85TH ANNIVERSARY CELEBRATIONS OF ICMR

The Indian Council of Medical Research entered 85 years of its existence in November 1995. To mark the occasion the Council and its various Institutes/Centres located in different parts of India have planned various scientific programmes spread over a year (till November 1996) with the main aim of disseminating to scientists, professionals, planners and policy makers as well as the general public the contributions/achievements of the Council.

To facilitate effective dissemination of information, each month, between November 1995 to October 1996, a specific topic/subject will be highlighted. Nutrition being one of the most important areas of research in the Council and the National Institute of Nutrition, Hyderabad—the oldest and the most well known Institute, Nutrition was selected as the theme for the inaugural month *ie* November 1995.

The National Institute of Nutrition (NIN), Hyderabad started the celebrations on November 28, 1995. Dr. G.V. Satyavati, Director-General, ICMR, while inaugurating the celebrations at the NIN exhorted the scientists to strive for a multifaceted, futuristic approach to research.

Sh. A.P.V.N. Sarma, Secretary, Medical, Health and Family Welfare, Government of Andhra Pradesh, who presided over the function released a Special Issue of the Indian Journal of Medical Research on Nutrition Research. An inter school painting competition was also organized on the occasion at the Institute's campus in which nearly 250 students (Junior and Senior) from 40 schools of Hyderabad participated.

The Malaria Research Centre, Delhi, organized an exhibition and a lecture on "Malaria and Nutrition" at the Delhi Public School, R.K. Puram, New Delhi on November 28, 1995.

The National Institute of Cholera and Enteric Diseases, Calcutta, organized an open house on December 1, 1995 where visitors were informed about the nutritive value of foods, balanced diets, *etc.* A nutrition quiz competition was also organized for students.

The National Institute of Virology, Pune, organized, as part of an awareness programme on Nutrition, 3 lectures—one on Nutrition by Prof. Kunda S. Redey (SNDT College), another on Therapeutic Nutrition by Prof. S.R. Kukade from SNDT College, Pune, and the third on Naturopathy: Application to Viral Diseases by Dr. Jitendra Arya, Nisargashram, Pune (December 8, 1995).

All the Bombay-based ICMR Institutes/Centres *viz.* the Institute for Research in Reproduction (IRR), Institute of Immunohaematology, Enterovirus Research Centre and ICMR Genetic Research Centre jointly organized an awareness programme on Nutrition for the general public at the IRR campus on November 30, 1995. In the afternoon a nutrition quiz and screening of video films on Nutrition were also arranged for school children.

The Rajendra Memorial Research Institute of Medical Sciences, Patna, organized a symposium on Nutrition on November 30, 1995. The topics covered in the symposium included role of vitamins and trace metals, balanced diets, nutrition for children, *etc.*

At Madras, the Tuberculosis Research Centre, the Institute for Research in Medical Statistics and the CJIL Field Unit at Avadi jointly organized awareness programmes on Nutrition. The celebrations were launched on November 28, 1995 at the World Vision India, a NGO involved in the community development programme in the slums of Madras. Similar nutrition awareness programmes were organized at several places in Madras city and Irulancheri village of Tiruvallur taluk, Perumalpattu and Tirur villages of Chengi-MGR district; and Thirumazhisai town of Sriperumbudur taluk during November 29 to December 11, 1995.

Centre for Research in Medical Entomology, Madurai, organized symposia on 'Nutrition' and 'AIDS' on December 21, 1995.

The Regional Medical Research Centre for Tribals, Jabalpur, organized a public meeting on November 29, 1995 which was attended by over 500 individuals (mostly women and children). The meeting was marked by lectures, video shows and question-answer session on Nutrition.

The Desert Medicine Research Centre, Jodhpur, organized an awareness programme on Nutrition and Health on November 29, 1995 which included poster display, group discussion, and nutrition quiz, debate and essay competition and drawing contest for school children.

ICMR NEWS

The following meetings of various technical groups/ committees of the Council were held:

Meetings of the Research Advisory Groups (RAGs)/ Project Review Committees (PRCs)/Scientific Advisory Committees (SACs)/Task Forces (TFs) of the Council held:

RAG of the ICMR Unit for Research in HIV/AIDS in North Eastern States of India	December 7, 1995 (at Calcutta)
PRC on Pharmacology	December 13, 1995 (at New Delhi)
SAC or the Centres for Advanced Research in Enteric Diseases at Vellore and New Delhi	December 18, 1995 (at New Delhi)
TF on Development of Instruments for Psychosocial Stress	December 20, 1995 (at New Delhi)
PRC on Virology	January 9, 1996 (at New Delhi)

Participation of ICMR Scientists in Scientific Events:

Dr. B.N. Nagpal, Senior Research Officer, Malaria Research Centre, Delhi, participated in the II Neem Awareness Workshop at Nairobi (December 3-9, 1995).

Dr. S.P. Pani, Deputy Director, Vector Control Research Centre, Pondicherry, participated in a meeting on cross-site clinical data analysis related to the WHO multi-country, multi-centric studies on socio-economic burden of lymphatic filariasis at Dar-es-Salaam (December 4-15, 1995).

Dr. S.K. Bhattacharya, Director, National Institute of Cholera and Enteric Diseasses, Calcutta, participated in IV Symposium on International Medical Cooperation at Tokyo (December 11, 1995).

Dr. M.D. Gupte, Officer-in-Charge, CJIL Field Unit at Avadi, Madras, visited Geneva to assist the WHO Action Programme for the Elimination of Leprosy to develop standardized protocols and simplified models (January 3-12, 1996).

Dr. Kamala Krishnaswamy, Deputy Director (Sr. Grade), National Institute of Nutrition, Hyderabad, participated in the V Expert Panel meeting of the project on Diet and Cancer of the World Cancer Research Fund at Rome (January 8-10, 1996).

Appointments:

Dr. M. Mohan Ram took over as Director of the National Institute of Nutrition, Hyderabad w.e.f. December 22, 1995.

Lectures/Orations:

Prof. Ranjit Roy Chaudhury, Emeritus Scientist, National Institute of Immunology, New Delhi, delivered the Dr. D.N. Prasad Memorial Award Oration of ICMR on Challenges in Clinical Pharmacological Evaluation of Medicinal Plants, at the ICMR Headquarters, New Delhi on November 21, 1995.

Prof. G. Padmanabhan, Director, Indian Institute of Science, Bangalore, delivered the first Dr. B.R. Ambedkar Centenary Award Oration of the ICMR on Antimalarials to Gene Therapy, at the ICMR Headquarters, New Delhi on December 8, 1995.

Prof. Indira Nath, Head, Department of Biotechnology, All India Institute of Medical Sciences, New Delhi, delivered the Basanti Devi Amir Chand Prize Oration of the ICMR on Leprosy a Paradigm of Host-Pathogen Interaction, at the ICMR Headquarters, New Delhi on January 17, 1996.

ICMR AIDED SYMPOSIA/SEMINARS/WORKSHOPS/COURSES/CONFERENCES

Symposium/Seminar/Workshop/ Course/Conference	Date & Place	Contact Address
Symposium on Casava in Nutrition and Health.	February 10-11, 1996; (at Thiruvananta-puram)	Dr. K. T. Shenoy, Organising Secretary of the Symposium, Department of Gastroenterology, Medical College, Thiruvanantapuram.
National Symposium on Molecular and Cellular Biophysics.	February 18-21, 1996 (at New Delhi)	Dr. V. Kothekar, Convenor of the Symposium, Department of Biophysics, All India Institute of Medical Sciences, New Delhi.
V National Conference of Biomechanics.	February 22-24, 1996 (at Madras)	Dr. S. Radhakrishna, Organising Secretary of 5NCB, Department of Applied Mechanics, Indian Institute of Technology, Madras.
Internationl Conference on Current Status and Challenges in Medical and Veterinary Microbiological Research Particiation Third World Countries.	February 26-28; 1996 (at Jabalpur)	Prof. S.M. Singh, Organising Secretary of the Conference, Department of Biological Sciences, R D. University, Jabalpur.

COUNCIL'S TRAINING PROGRAMMES FOR 1996-97

Virology

At the National Institute of Virology, Pune:

- Diploma in Medical Virology (June 1996-May 1997).

Reproductivve Biology

At the Institute for Research in Reproduction, Bombay:

- Training Course on Techniques in Neuroendocrine Research (February 6-10, 1996).

Endocrinology

At the National Institute of Nutrition, Hyderabad:

- Annual Training Course on Endocrinological Techniques and their Applications (August 1, 1996-September 15, 1996).

Nutrition

At the National Institute of Nutrition, Hyderabad:

- M.Sc. in Applied Nutrition (June 1, 1996-February 28, 1997).
- Annual Training Course in Nutrition (December 1, 1996-February 28, 1997).

Occupational Health

At the National Institute of Occupational Health. Ahmedabad:

- Orientation Course on Occupational Health for Industrial Medical Officers (January 15-25, 1996).

Medical Entomology

At the Vector Control Research Centre, Pondicherry:

- M.Sc. in Medical Entomology (from August 1996; for 2 years).

Laboratory Animal Technology

At the National Centre for Laboratory Animal Science, National Institute of Nutrition, Hyderabad:

- Training Course for Laboratory Animal Techniques (June 15-July 31, 1996).
- Training Course for Laboratory Animal Supervisors (September 1-November 30, 1996.

Biostatistical Techniques

At the Institute for Research in Medical Statistics, Madras:

- Training Course for Doctors in Biostatistical Techniques in Controlled Clinical Trials (March 4-15, 1996).

INDIAN COUNCIL OF MEDICAL RESEARCH

Grant-in-aid for organising Seminars/Symposia/Workshops

The Council provides partial financial assistance for organising Seminars/Symposia/Workshops. Applications for grant of financial assistance (complete in all respects in the prescribed proforma), will be considered only if furnished **at least four months before the date of commencement of the Seminar/Symposium/Workshop,** *etc.*

ICMR PUBLICATIONS

	Price (Rs.)
Nutritive Value of Indian Foods (1985), by C. Gopalan, B.V. Ramasastri and S.C. Balasubramaniam, Revised and Updated (1989), by B.S. Narasinga Rao, K.C. Pant and Y.G. Deosthale (Reprinted 1995)	23.00
Growth & Physical Development of Indian Infants and Children (1972, Reprinted 1989)	10.00
Studies on Weaning & Supplementary Foods (1974, Reprinted 1986)	6.00
Studies on Pre-school Children (1974, Reprinted 1984)	6.00
A Manual of Nutrition (Second Edition 1974, Reprinted 1992)	4.50
Low Cost Nutritious Supplements (Second Edition 1975, Reprinted 1994)	4.00
Menus for Low Cost Balanced Diets and School Lunch Programmes Suitable for South India (Third Edition 1977, Reprinted 1991)	4.50
Menus for Low Cost Balanced Diets and School Lunch Programmes Suitable for North India (Second Edition 1977, Reprinted 1994)	4.50
Some Common Indian Recipes and their Nutritive Value (Fourth Edition 1977, Reprinted 1991) by Swaran Pasricha & L.M. Rebello	10.00
Nutrition for Mother & Child (Third Edition 1978, Reprinted 1991) by P.S. Venkatachalam & L.M. Rebello	9.00
Japanese Encephalitis in India (Revised Edition 1980)	5.00
Some Therapeutic Diets (Fourth Edition 1988, Reprinted 1995) by Swaran Pasricha	4.50
Nutrient Requirements & Recommended Dietary Allowances for Indians (1990, Reprinted 1995)	16.00
Fruits (1983, Reprinted 1992) by Indira Gopalan & M. Mohan Ram	7.00
Count What You Eat (1989, Reprinted 1991) by Swaran Pasricha	9.00
Diet & Diabetes (Second Edition 1993) by T.C. Raghuram, Swaran Pasricha & R.D. Sharma	18.00
Dietary Tips for the Elderly (1992) by Swaran Pasricha & B.V.S. Thimmayamma	3.50
Diet and Heart Disease (1994) by Ghafoorunissa and Kamala Krishnaswamy	26.00
*Depressive Disease (1986) by A. Venkoba Rao	58.00
**Medicinal Plants of India Vol.2 (1987)	136.00
**The Anophelines of India (Revised Edition 1984) by T. Ramachandra Rao	150.00

* 10 per cent discount allowed to individuals.
** 25 per cent discount allowed to individuals.

These publications are available on prepayment of cost by cheque, bank draft or postal order (bank and postal charges will be extra) in favour of the Director-General, Indian Council of Medical Research, New Delhi. Money orders are not acceptable. All correspondence in this regard should be addressed to the Chief, Division of Publication and Information, Indian Council of Medical Research, Post Box No.4911, Ansari Nagar, New Delhi-110029 (India).



Dr. Som Nath Ghosh
(21 March 1929 - 19 October 1995)

A TRIBUTE

Dr. Som Nath Ghosh, formerly Director Grade Scientist, National Institute of Virology (NIV), Pune, passed away on 19th October 1995 at the age of 66.

After obtaining the MBBS degree in 1953 from Darbhanga University, Bihar, Dr. Ghosh joined the Indian Institute of Chemical Biology (IICB) (formerly Indian Institute of Experimental Medicine) Calcutta. He was awarded a NIH Fellowship in 1961 which enabled him to work for his Ph.D. under the guidance of Dr. George Gifford at the University of Florida, USA. In 1965 he returned to Calcutta and rejoined the IICB as a Pool Officer. In 1967 Dr. Ghosh joined the National Institute of Virology, Pune, where he worked till he retired in 1990. During this span he developed the Division of Immunology at NIV. In India he was a pioneer in the field of Interferons, and autoimmune neurological disorders. His work on Interferon has been well recognised all over the world and he was made a member of the International Society for Interferon Research to represent the Indian Chapter. Self-sufficiency in the field of monoclonal antibodies was his aim and under his supervision a battery of monoclonal antibodies was developed against Japanese encephalitis (JE) virus. These were used to analyse the JE virus envelope protein. He introduced the concept of molecular immunology by working on synthetic peptide on JE virus which indicates his scientific enthusiasm even at the time of retirement.

In addition to being a scientist he was an excellent teacher. Fifteen scholars obtained their Doctorate/Masters Degrees by research under his supervision. Dr. Ghosh was responsible for developing a healthy scientific culture not only among his students but in the entire NIV. Dr. Ghosh will be fondly remembered in NIV as a genial, soft spoken person, a true scientist and a revered teacher.

Dr. K. Banerjee
Director
National Institute of Virology, Pune

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