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IMMUNOLOGY OF SOLID TUMOURS AND PREMALIGNANT LESIONS

Cancer has been considered a cellular disease and therefore most of the research on cancer has been focussed on trying to uncover the fundamental cause of the disease at the cellular level¹. Cancer may be viewed as resulting from the development of modified cells that are capable of cloning in an otherwise hostile environment because the organism has somehow become incapable of responding in a proper fashion. The transformation of a normal cell into a cancer cell leads to a permanent alteration in cell behaviour, which is maintained and transmitted to descendent generations of cells through the chromosome which represent the genetic component of the cell². The failure of malignant cells to respond to the homeostatic control of the host, their ability to invade surrounding tissues and their frequent propensity for metastasis has prompted many researchers to look into the biological behaviour of the malignant cells.

In 1908 Ehrlich³ postulated that cancer cells arise frequently and they bear membrane changes that could be recognised as foreign antigens by the host and the cellular immune responses may be sufficient for cancer cell rejection in most cases. Later Thomas⁴ stated that the development of cell mediated immunity was driven by the need for immunological surveillance of newly arising neoplasms. Based on these theories Burnet⁵ put forward the immunological surveillance hypothesis which states that the heterogeneity of histocompatibility antigens and

the associated capacity of the immunological apparatus of higher vertebrates to distinguish self from nonself is concerned with the elimination of somatic mutation. The failure of immune surveillance need not necessarily lead to overt malignancy.

The primary role of the normally functioning immune system is to provide defense against malignant cells which are constantly arising through out the body. Subsequently it was predicted that immune deficiency states could give rise to frequent, multiple and diverse tumours early in life⁶. This has gained support from reports of tumours arising in patients with genetic disorders associated with immunodeficiency⁷. It has been postulated that patients with naturally occurring immunodeficiencies are prone to malignancy. Malignant events generally become apparent in early life. It is generally accepted that there are immunological derangements in patients with cancer.

About 4000 new cancer patients are registered every year at the Regional Cancer Centre, Trivandrum. Of these, 27 per cent are affected with oral cancer, 14 per cent with cervical cancer and 7 per cent with breast cancer⁸. Eventhough these three cancers constitute about 50 per cent of the total cancer incidence in Kerala, very little work has been carried out to evaluate the immunological derangements in these patients, as also those with the

pre-malignant lesions. The prevalence of pre-malignant lesions, especially of the oral cavity namely oral leukoplakia and oral submucous fibrosis, are also reported to be very high in Kerala^{9,10}.

The failure in immune surveillance has been reported to be an important factor in the development of cancer⁵. Tumour specific antigen (TSA) may be present both on the surface as well as in the interior of the tumour cells. The immunological reaction directed against the antigen on the cell surface is likely to interfere with the growth of the tumour. Antibodies may bind to the surface and cause complement components to be fixed which lyse the cell membrane. Immunologically specific cytotoxic 'T' lymphocytes may bind the surface antigens and destroy the tumour cells or inhibit the growth. Such antigens are referred to as transplantation specific tumour antigen (TSTA). They mimic the histocompatibility antigens that are responsible for rejection of foreign tissue grafts¹¹.

It has been shown that the sites for antigen recognition on the lymphocytes are blocked by circulating antigens in tumour bearing animals. However, reports of such blocking factors in human cancers are rare^{12,13}. It is well known that if the surface characteristics of lymphocytes are altered their normal circulation pattern inside the body will also be changed. Alteration in the surface characteristics of lymphocytes by any means such as neuraminidase treatment¹⁴ or by antilymphocyte serum treatment¹⁵ will change the distribution pattern of the lymphocyte.

It has been shown¹⁶ that the pre-incubation of the lymphocytes from tumour bearing animals will increase the cytotoxic activity of T lymphocytes. This may be due to the removal of blocking factors (antigens or antibodies or immune complexes) from the surface of the lymphocytes. It was hypothesised that if the blocking factors are present on the surface of lymphocytes, their homing pattern may also be changed. On this basis a study was conducted to evaluate the alterations in the surface characteristics of lymphocytes of patients with oral cancer¹⁷. Chromium labelled lymphocytes from normal persons and oral cancer patients were injected into mice and the radioactivity in the liver and spleen of the animals were measured. A drastic change in the homing patterns was observed when the patients lymphocytes were injected. After incubation the lymphocytes of the patients showed normal homing pattern. This study¹⁷ suggested that the surface characteristics of lymphocytes in cancer patients are altered probably due to the presence of blocking factors.

A close association between cellular immune responses and malignancy has been reported by many

workers^{18,19}. The failure in immune surveillance has been reported to be an important mechanism in the development of cancer and in tumour progression^{5,20}. Therefore the assessment of cellular immunity is believed to be of use in the diagnosis and/or prognosis, as well as in the treatment of cancer. Enumeration of T lymphocytes by rosette formation with sheep erythrocytes (E rosettes) has been used as a method to assess cellular immunity in normal individuals as well as in cancer patients²¹. Many modifications have been suggested to improve the technique of E rosette formation. A depression in cellular immunity as assessed by a depression in E rosette forming cells has been reported in patients with cancer^{22,23}. Because of the differences in the values obtained Weese *et al*²⁴ employed a modified method by which two types of rosette forming cells (RFCs) could be identified and differentiated. The total rosette forming cells (TRFCs) included all T cells which form rosettes with sheep red blood cells (SRBC) at low temperature on prolonged incubation whereas the high affinity rosette forming cells (HARFCs) form rosettes at 29°C with fewer number of SRBC. This was later supported by Bashford and Gough²⁵.

The HARFC were reported to be decreased in patients with carcinoma of breast, lung, uterine cervix and hematological neoplasms^{24,26}. Similar studies on head and neck tumours are scanty. Moreover, no attempts were made to evaluate the changes in HARFC with the progression of the disease. The effect of treatment on the HARFC level was also not evaluated. In view of this lacuna a study was undertaken at the Regional Cancer Centre, Trivandrum, to evaluate the changes in TRFC and HARFC levels, not only in head and neck tumours, but also in carcinoma of breast and uterine cervix as well as in the pre-malignant lesions²⁷. The changes in HARFC with progression of disease and the effect of treatment on the HARFC level were also investigated. No change was observed in the TRFC levels in any of the pre-malignant or malignant lesions. However, HARFC levels were found to be decreased in cancer patients and the decrease became more pronounced with the progression of clinical stages. If the treatment was effective, the HARFC returned to normal level, while in patients with residual lesions after the treatment, the HARFC level remained depressed. In the case of pre-malignant lesions, HARFC showed depression only in patients with oral submucous fibrosis²⁸. These results were in agreement with previous reports^{24,25}. Though monoclonal antibodies may be more useful to characterise the different subsets of T lymphocytes, the enumeration of HARFC seems to be a very simple, reliable and less expensive method to assess cellular immune response in cancer patients.

Pathological process in the tissues and organs usually produce tissue damage with concomitant release of proteins into the circulation. The immunoglobulins play an important role in the inactivation and neutralization of the antigens associated with tumours. Hence the immunoglobulins continue to be a subject of investigative interest. Serum immunoglobulin levels are used as parameters to assess the status of humoral immunity in cancer patients. Eventhough the presence of cytotoxic antibodies in cancer patients have been described, the humoral immune system has been described as being interfering or blocking in nature^{29,30}. However, cell mediated and humoral responses are interdependent on each other³¹.

A rise in serum IgG in patients with uterine cervix was reported as early as in 1971 by Vasudevan *et al*³², which was later supported by others³³. The levels of IgG in oral and breast cancers were reported to be normal^{34,35}, elevated³⁶ or even decreased³⁷. Vijayakumar and colleagues³⁸ observed increased levels of serum IgG only in patients with cervical cancers and not in breast or oral cancer patients.

Elevated levels of serum IgA have been observed in oral cancer, breast cancer and cervical cancer patients^{33,38}. The serum IgA levels were found to increase with progression of clinical stages; and the levels of clinically cured patients were within the normal limits. Thus serum IgA seems to be a good indicator for the diagnosis and/or prognosis of these solid tumours.

Serum IgM levels were reported to be elevated in oral cancer by Khanna *et al*³⁴. But many workers^{33,35,39,40} reported normal values for IgM in cancer patients. Vijayakumar *et al*³⁸ did not find any change in the serum IgM fraction even in the advanced stages of the disease, but observed increased levels of serum IgD and IgE in patients with solid tumours and the values were found to increase with progression of the clinical stages. Munzarova *et al*⁴¹ reported decreased level of IgD in breast cancer and Scully³⁵ reported that IgD level is unaltered in oral cancer patients. A rise in serum IgE in oral cancer was reported earlier^{35,42,43}, but the IgE levels in breast cancer patients were reported to be normal⁴⁰. That the rise in IgE may reflect a defect in cellular immunity has been suggested⁴⁴.

Analysis of immunoglobulin levels in the sera of patients with premalignant lesions was also carried out^{28,38}. Alterations in immunoglobulin levels were observed only in patients with oral submucous fibrosis. The tissue immunoglobulin levels were also evaluated in patients with oral cancer and oral premalignant lesions^{45,46}. Immunoglobulins were detected in the tissues

from areas of oral submucous fibrosis and oral cancer but not in oral leukoplakia.

Tumour associated antigens may be released from a developing tumour into the extracellular environment and subsequently be found in free form and/or as antigen antibody complexes or circulating immune complexes (CICs) in the serum and in other body fluids⁴⁷. The detection and clinical significance of CICs in human neoplasias were reported by many workers^{48,49}. A progressive rise in CICs with progression of clinical stages was observed in patients with solid tumours⁵⁰. An elevation of CICs in oral cancer³⁵ and breast and gynaecological tumours were reported^{51,52}. The earlier studies had not quantitated the immunoglobulin contents of the CICs and had failed to characterise the antigen. Eventhough Vijayakumar and colleagues⁵⁰ could not characterise the antigen, the antibodies (Igs) were quantitated. It was observed that the level of immunoglobulins (G and M) were significantly elevated in the CICs of cancer patients. It seems possible to predict the effectiveness of treatment from the CICs and its immunoglobulin contents⁵⁰. The higher levels of CICs in oral cancer patients may be due to the increased herpes simplex virus infection which was reported to be one of the etiological factors for oral cancer⁵³.

Remani and associates⁵⁴ detected elevated levels of CICs in patients with oral submucous fibrosis and oral cancer. It was stated that the CIC and its antibody content may help in monitoring the malignant transformation of oral submucous fibrosis. Earlier Vijayan and co-workers⁵⁵ had reported that the Jack Fruit lectin staining pattern may help in predicting the malignant transformation of premalignant lesions.

Sasidharan and co-workers⁵⁶ had reported a decrease in the absolute peripheral lymphocytes and normal B cell counts in patients with cancer. It was also shown that there is an impairment in delayed hypersensitivity in cancer patients especially those with metastasis. Sasidharan and associates⁵⁷ had tried to evaluate tumour directed cellular immune responses in oral cancer patients by leucocyte migration inhibition assay. A significant depression in mean migratory index was observed in oral cancer patients. The depression was more pronounced in the advanced stages of the disease.

The complement system, which is the essential part of normal immune responses, is essential for phagocytosis and lysis of bacteria and viruses⁵⁸. In many pathological conditions, such as cancer, some of the components of the complement system elicit typical primary or secondary responses. It is reported to be the primary humoral mediator of antigen antibody reactions⁵⁹. Many attempts

have been made to evaluate the role of complements in neoplastic diseases. Elevated levels of total complement activity or complement components were observed in cancer patients⁶⁰⁻⁶².

In the earlier reports the number of patients studied were not many and no attempts were made to assess the changes in complement activity with progression of tumours. Moreover, the effect of treatment on the complement system was not evaluated. Vijayakumar *et al*⁶³ tried to evaluate the changes in complement activity in patients with solid tumours, at different clinical stages as well as before and after treatment⁶³. The total complement activity and C3 and C4 were found to be elevated in patients with solid tumours. The rise in the complement activity was in accordance with the clinical stage of the disease. Clinical cure reduced the values to normal levels. In premalignant lesions of breast and cervix, there were no alterations in the complement activity. In oral submucous fibrosis the values were found to be altered⁶⁴. From this study it can be assumed that the complement system tries to maintain immunologic homeostasis by compensating the weakened cellular immune responses.

Conclusions

From these studies it can be concluded that there is alteration both in the cellular and humoral immune responses in patients with solid tumours. The depression in immunity seems to be progressive with the clinical stage of the disease. The immunological status of patients returns to normal level if they respond to treatment. In case of benign lesions of breast and cervix no significant alteration in immunity was observed. But in case of oral premalignant lesions, especially oral submucous fibrosis, depression in both cellular and humoral immunity was observed. The assessment of the immunological parameters seems to be of help in the diagnosis and prognosis of solid tumours.

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SURVEILLANCE FOR AIDS—AN UPDATE

Clinical and serological surveillance for HIV infection in India has been further intensified during the last 6 months.

Till September 15, 1989 a total of 3,71,887 persons have been screened for HIV antibodies. Of these, 1571 persons have been found to be seropositive (seropositivity rate 4.2/1,000). Profile of the seropositive individuals detected is given in Table I.

Table I. Details of seropositive individuals detected in India
(from October, 1985 to September 15, 1989)

Number of persons screened	371887
Number of persons found seropositive	1571
Seropositivity rate (per 1000)	4.2

Risk group	Male	Female	Total
INDIANS:			
Heterosexually promiscuous	332	549	881
Homosexuals	2	-	2
Blood donors	386	4	390
Patients on dialysis	2	0	2
Pregnant women	-	7	7
Recipients of blood/blood products	39	3	42
Relatives of AIDS patients	9	13	22
Suspected ARC/AIDS cases	23	8	31
Intravenous drug users	3	1	4
Others	85	16*	101
Sub total	881	601	1482
FOREIGNERS:			
Students	44*	10*	54*
Others	26*	9	35*
Sub total	70*	19*	89*
Total	951	620	1571

*Figures are lower than those reported earlier because of reclassification and elimination of duplicates.

The serosurveillance programme provided the database for formulation of a rational National AIDS Control Programme. The trained and sensitized personnel of the surveillance centres will be able to take care of the increasing need for serodiagnosis, and the centres would act as nodal training and quality control centres in their respective states. Thus sentinel surveillance, diagnostic service provision and manpower development for future needs can all be achieved within the existing health infrastructure.

Thirty two AIDS patients have been detected so far. Twelve of them were foreigners; 14 Indian patients appeared to have acquired the infection abroad, while 6 seemed to have got the infection in India. Most of the Indian AIDS patients have probably acquired the infection through heterosexual promiscuity (Table II).

Table II. AIDS patients detected in India
(till September 15, 1989)

	Male	Female	Total
Indian	17	3	20
Foreigners	9	3	12
Total	26	6	32

Probable source of infection in Indians	In India	Abroad
Heterosexual promiscuity	4	11
Blood transfusion	1	1
Blood products infusion	0	1
Homosexual contacts	0	1
Spouse of AIDS patient	1	-

The Directorate-General of Health Services (DGHS) has organised a series of workshops to sensitize clinicians for early detection, and to initiate appropriate therapy for AIDS patients. These steps might result in prolonging the survival of AIDS patients in India.

Blood Donor Screening

Screening of high risk blood donors, as a part of the serosurveillance programme led to the detection of seropositive donors in the later half of 1987. By the end of 1988, it became obvious that seropositivity rate among blood donors was progressively rising. The ICMR Expert Group reviewed these findings and recommended that blood donor screening for HIV antibodies needs to be intensified, monitored and expanded in a phased manner. In response the DGHS, in collaboration with State health authorities, have drawn up an action plan and initiated steps to ensure safety of blood and blood products in India. In the first stage, blood donor screening has been initiated in four metropolitan cities of India by linking existing blood banks to selected centres where facilities for HIV antibody detection are available. It is envisaged that over the next year there will be a phased expansion of this programme. In order to ensure that the programme starts without any delay, ICMR was requested to assist the DGHS in the initial phase by using the systems and networks established by ICMR for the HIV serosurveillance programme in—

- (i) import of ELISA readers and kits and other supplies for the programme;
- (ii) storage and distribution of kits and readers to the depot and screening centres; and

- (iii) training of personnel for the screening centres.

The surveillance/reference centres responded to the request for screening the sera from blood donations sent to them for HIV antibody testing. According to the reports received by ICMR in the short period of 5 months from April 1 to August 31, 1989 a total of 1,20,953 sera from blood donations have been screened and 137 of them were ELISA reactive.

Evaluation of ELISA Kits

In view of the increasing demand for HIV screening in India, there is an urgent need to explore feasibility of bringing down the cost of kits by their indigenous manufacture. At the request of the Ministry of Health and Family Welfare and the Department of Biotechnology (DBT), ICMR initiated an evaluation of immuno-diagnostic kits for HIV antibody detection, to select a suitable kit for indigenous production. Three kits have been recommended to DBT on the basis of specificity and sensitivity. It was noted that neither of the visual assays tested were specific and sensitive enough for use in screening centres.

Sentinel Surveillance for HIV Infection

There is an urgent need to initiate sentinel surveillance for monitoring time trends in prevalence of HIV infection in order to evolve appropriate intervention programmes for AIDS control and to study the impact of these intervention strategies. A proposal for such sentinel surveillance for HIV infection in general hospitals, institutions dealing with specific diseases like tuberculosis and in urban and rural communities has been drawn up and is expected to be initiated shortly.

ICMR NEWS

The following meetings of various Scientific Advisory Groups/Project Review Committees/Expert Groups of the Council were held during the month:

Meetings of the Scientific Advisory Groups (SAGs):

SAG of the Division of Epidemiology and Communicable Diseases.	September 8-9, 1989 (at New Delhi)
SAG of the Division of Publication and Information.	September 25, 1989 (at New Delhi)
SAG on Traditional Medicine Research.	September 29, 1989 (at Madras)
SAG of the Division of Basic Medical Sciences.	September 29, 1989 (at New Delhi)

Meetings of Project Review Committee (PRC)/Expert Group (EG), held at New Delhi.

PRC on Human Genetics, Immunology and Allergy.	September 8, 1989
EG on HIV Infection in India.	September 21, 1989

Participation of ICMR Scientists in Scientific Events:

Dr. S.P. Tripathi, Addl. Director-General, ICMR, participated in a workshop on AIDS, at Srinagar (September 1, 1989). He also participated in a Clinical Update on AIDS, at Bombay (September 16-17, 1989).

Dr. H. Srinivasan, Director and Dr. M.D. Gupte, Deputy Director, Central Jalma Institute for Leprosy,

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India

Agra, participated in the Joint IMMLEP/THELEP Scientific Working Group meeting of WHO, at Geneva (September 4, 1989). Dr. Srinivasan also participated in an ad-hoc IMMLEP/THELEP Sub-Committee meeting on Leprosy Reactions and Nerve Damage, at Geneva (September 5-6, 1989).

Dr. Suman Mehta, Asstt. Director-General, ICMR, participated in the meeting of WHO Steering Committee of the Task Force on Safe Motherhood Research, at Geneva (September 4-6, 1989). She also participated in the meeting of WHO Steering Committee on the Task Force on Safety and Efficacy of Fertility Regulating Methods, at Geneva (September 26-29, 1989).

Dr. C.B. Pandya, Senior Research Officer, National Institute of Occupational Health, Ahmedabad, participated in the conference on Health of Inner Cities and Urban Areas, at Cardiff, Wales, U.K. (September 4-7, 1989).

Dr. Vinodini Reddy, Director, as well as Dr. Ghafoorunissa, Dr. I.S. Shenolikar and Dr. C. Rukmini, Asstt. Directors, National Institute of Nutrition (NIN), Hyderabad, participated in the PORIM International Palm Oil Development Conference, at Kuala Lumpur (September 5-9, 1989).

Dr. M.D. Gupte participated in the second WHO IMMLEP/THELEP meeting on Field Research in Leprosy, at Geneva (September 5-6, 1989). He also participated in the 33rd IMMLEP Steering Committee and the Joint IMMLEP/THELEP meetings, at Geneva (September 7-8 and 8, 1989 respectively).

Dr. N. Raghuramulu, Dy. Director, NIN, Hyderabad, participated in the first joint meeting of the International Conference on Calcium Regulating Hormones and American Society for Bone and Mineral Research, at Montreal (September 9-14, 1989).

Dr. N. Pralhad Rao, Dy. Director, NIN, Hyderabad, has taken up an assignment as a Short-term WHO Consultant for assisting Government of Iran in preparing Outline and Formats for National Nutrition Surveys, and for Training Personnel (September 11-25, 1989).

Dr. Tripathi delivered a guest lecture on Short-course Chemotherapy of Tuberculosis at SAARC meeting of Expert Groups on Tuberculosis, at Bangalore (September 18, 1989).

Dr. G.V. Satyavati, Sr. Deputy Director-General, ICMR, participated in the meeting of the Programme

Advisory Committee of DST on Medical Biology, at New Delhi (September 20-21, 1989).

Dr. Uma Ganguly, Asstt. Director, National Institute of Cholera & Enteric Diseases (NICED), Calcutta, participated in 50th Asian Conference on Diarrhoeal Diseases, at Kathmandu (September 21-23, 1989).

Dr. H. Srinivasan participated in the Asian meeting on Leprosy, at Kuala Lumpur (September 22-25, 1989).

Dr. A. Roy, Sr. Research Officer, National Institute of Virology, Pune, participated in the VI Bucher Symposium on Growth Factors: Their Nature and Role in Medicine, at Berlin, (September 24-28, 1989).

Dr. S.C. Pal, Director, NICED, Calcutta, participated in the 18th All Union Congress of Microbiologists, Epidemiologists and Parasitologists, at Alma-Ata, USSR (September 26-29, 1989).

Dr. P.K. Rajagopalan, Director, Vector Control Research Centre, Pondicherry, participated in the WHO Steering Committee meeting of the Scientific Working Group on Filariasis, at Geneva (September 26-29, 1989).

Dr. Usha K. Luthra, Addl. Director-General, ICMR, delivered a talk on Cancer Problems in India and National Cancer Control Programmes and our Commitments, at Maulana Azad Medical College, New Delhi (September 29, 1989).

Science and Technology Exhibitions:

Council's National Institute of Nutrition, Hyderabad and Vector Control Research Centre, Pondicherry, participated in Science & Technology Demonstration Campaign-cum-Exhibition, organized by the CSIR, New Delhi, at Ottapalam in Palghat district of Kerala (September 1-14, 1989).

As part of "Hindi Diwas" celebration, a Science Exhibition (in Hindi) was organised at the campus of ICMR Hqrs., in collaboration with the major ICMR Institutes/Centres located in Delhi. This Exhibition comprized display material (both visual and audio-visual) on various health problems of national relevance, in Hindi, for the benefit of laymen. Senior scientists of ICMR were interviewed by the All India Radio for giving short messages in Hindi on malaria, filariasis, cancer, traditional remedies *etc.*

ICMR AIDED SYMPOSIA/SEMINARS/WORKSHOPS/COURSES/CONFERENCES

Symposium/Seminar/Workshop/ Course/Conference	Date & Place	Contact Address
Symposium on Head Injuries (Surgery).	September 2, 1989; Baroda	Prof. S.N. Sharma, President, Association of Plastic Surgeons of India, and Head, Department of Plastic Surgery, Medical College, Baroda.
Conference on Biotechnology in Biomedicine.	September 9-10, 1989; Madras	Dr. G.S. Kailash, Institute of Physiology, Madras Medical College Madras.
National Seminar on Newer Challenges in Medicine.	September 9-10, 1989; Jabalpur	Dr. B.N. Shrivastava, Professor & Head, Department of Medicine, and Dean, Government Medical College, Jabalpur.
Symposium on Early Breast Cancer, and Workshops on Laser in Cancer Surgery; and Epidemiology of oral cancer.	September 9-10, 1989; Indore	Dr. S.K. Shukla, Organizing Secretary, VI National Cancer Convention, M.G.M. Medical College, Indore.
Continuing Medical Education in Haematology, and Workshop on Advanced Laboratory Techniques in Routine Haematology.	September 18-20, 1989; Chandigarh	Dr. P.L. Wahi, Director, Postgraduate Institute of Medical Education and Research, Chandigarh.
XV Mid Term Conference of Indian Association of Paediatric Surgeons.	September 28-30, 1989; Srinagar	Dr. Mahmooda Khan, Professor & Head, Department of Surgery, Government Medical College, Srinagar.
Seminar on New Trends in Methodology for Social and Population Research.	October 1-3, 1989; Tirupati	Prof. K. Mahadevan, Department of Population Studies, S.V. University, Tirupati.
National Workshop on Burns Injuries and their Sequele.	October 7-8, 1989; Chandigarh	Dr. C.P. Sawhney, Professor & Head, Department of Plastic Surgery, Postgraduate Institute of Medical Education and Research, Chandigarh.
XVI Annual Conference of Indian Immunology Society and Symposium on Tropical Immunology.	October 12-14, 1989; Sevagram	Dr. B.C. Harinath, Professor & Head, Department of Biochemistry, Mahatma Gandhi Institute of Medical Sciences, Sevagram, Wardha.
Symposium on Reproductive Biology and Fertility Control.	October 12-14, 1989; Imphal	Dr. B.K. Omar, Professor & Head, Department of Anatomy, and Secretary, Anatomical Society of India, Regional Medical College, Imphal.
Symposium on Nurse and MCH Services.	October 13-14, 1989; Srinagar	Dr. M. Regu, Department of Nursing Education, Sher-I-Kashmir Institute of Medical Sciences, Srinagar.
Seminar on Surgery for Base of Skull.	October 13-14, 1989; New Delhi	Dr. S. Bahadur, Additional Professor, Department of Otolaryngology, All India Institute of Medical Sciences, New Delhi.
Symposium on Respiratory Allergy and Applied Immunology.	October 14-16, 1989; Hyderabad	Dr. M. Sundaramma, Professor & Chest Physician, Osmania Medical College and A.P. Chest Hospital, Hyderabad.
XXII Annual Convention of the Indian Dietetic Association.	October 19-20, 1989; Hyderabad	Dr. Indira Ray, Reader, Home & Social Science Department, Calcutta University, Calcutta.
Seminar on Acute Respiratory Infections Among Children in the Context of Primary Health Care.	October 20-22, 1989; Guwahati	Dr. A.C. Patowary, Director, Medical Education of Assam, and Hony. Professor and Head, Department of Social and Preventive Medicine, Gauhati Medical College, Guwahati.

Symposium/Seminar/Workshop/ Course/Conference	Date & Place	Contact Address
Brachytherapy Workshop for Cancer Cervix.	November, 1989; Betul (M.P.)	Dr. Anand Vijay Kumar, Secretary, Paramedical Section, Christian Medical Association of India, Smruti Theatre Compound, Nagpur.
National Workshop on Advances in Flexible Fiberoptic Bronchoscopy.	November 4-5, 1989; Chandigarh	Dr. S.K. Jindal, Department of Chest Diseases, Postgraduate Institute of Medical Education and Research, Chandigarh.
All India Symposium on Biophysics of Cell Structure and Function.	November 6-8, 1989; Chandigarh	Dr. P.C. Mangal, Chairman, Department of Bio-Physics, Punjab University, Chandigarh.
International Symposium on Levels of Awareness and Conscious Experiences.	November 6-9, 1989; Visakhapatnam	Prof. P.V. Krishna Roa, Director, Institute for Yoga & Consciousness, Andhra University, Vijayanagram Palace, Visakhapatnam.
Seminar on Zoonoses.	November 9-10, 1989; Dibrugarh	Dr. L.P. Datta, Director, Regional Medical Research Centre (ICMR), P.B. No.105, Dibrugarh.
XVI Biennial Conference of the Indian Association of Leprologists.	November 9-12, 1989; Trichur	Dr. P. Vijay Shanker, Damien Institute, Ayyappankavu, Trichur.
Seminar on Pathology of Cardiomyopathies.	November 11, 1989; Bhubaneswar	Professor L.N. Mohapatra, Convenor, Indian Association of Pathologists and Microbiologists (Orissa Chapter) and Director, Regional Medical Research Centre (ICMR), Bhubaneswar.
Conference on Health Care for the Villagers and Urban Slums.	November 23-25, 1989; Calcutta	Dr. Ashok Sahani, Professor & Hony. Executive Director, Indian Society of Health Administrators, 104 (13/37), Cambridge Road Cross, Ulsoor, Bangalore.
National Seminar on Squint and Amblyopia.	Novemer 25-27, 1989; New Delhi	Dr. Vimla Menon, Dr. Rajendra Prasad Centre for Ophthalmic Sciences, All India Institute of Medical Sciences, New Delhi.
All India Symposium on Reproductive Biology and General Endocrinology.	November 26-28, 1989; Baroda	Prof. P.M. Ambedkar, Department of Zoology, M.S. University of Baroda, Baroda.
Workshop on Recent Advances in Intensive Care.	November 26-30, 1989; New Delhi	Dr. H.K. Kaul, Professor & Head, Department of Anaesthesiology, All India Institute of Medical Sciences, New Delhi.
XXXIII All India Obstetric and Gynaecological Congress.	December 28-30, 1989; Patna	Dr. J. Mishra, Department of Obstetrics and Gynaecology, Hospital for Women, Patna Medical College Hospital, Patna.
Seminar on Indian Speech, Language and Hearing Tests - the proposed ISHA battery.	February 8-9, 1990; New Delhi	Dr. S.K. Kacker, Professor & Head, Department of Otorhinolaryngology, All India Institute of Medical Sciences, New Delhi.

COUNCIL'S TRAINING PROGRAMMES

Virology

At the National Institute of Virology, Pune:

... Short-term Course on Detection and Isolation of Arboviruses Using Mosquito Inoculation and Mosquito Cell Culture (October, 1989).

Nutrition

At the National Institute of Nutrition, Hyderabad:

... Annual Certificate Course in Nutrition (December 1, 1989 to February 28, 1990).

Occupational Health

At the National Institute of Occupational Health, Ahmedabad:

- ... Refresher Course for Industrial/ESIS-Medical Officers (October 9-14, 1989).
- ... Training Course on Disaster Management of Hazardous Chemicals in Industry for Industrial Physicians, Chemists, Safety Officers, Hygienists (November 6-10, 1989).

Cytology

At the Institute of Cytology and Preventive Oncology, New Delhi:

- ... Indo-US Workshop on Chemoprevention of the Uterine Cervical Dysplasia with Nutrient Intervention (December, 1989).

Laboratory Animal Technology

At the Laboratory Animal Information Service Centre, National Institute of Nutrition, Hyderabad:

- ... Training Course for Laboratory Animal Supervisors (September 1 to November 30, 1989).

SOME AVAILABLE ICMR PUBLICATIONS

	Price Rs.
Growth & Physical Development of Indian Infants and Children (1972), Reprinted 1989	10.00
Studies on Weaning & Supplementary Foods (1974), Reprinted 1984	6.00
Studies on Pre-School Children (1974), Reprinted 1984	6.00
A Manual of Nutrition (1973), Second Edition 1974, Reprinted 1984	2.50
Low Cost Nutritious Supplements (1972), Second Edition 1975, Reprinted 1977	1.50
Menus for Low Cost Balanced Diets and School Lunch Programmes Suitable for South India (1959), Third Edition 1977, Reprinted 1984	2.00
Menus for Low Cost Balanced Diets and School Lunch Programmes Suitable for North India (1959), Third Edition 1977, Reprinted 1984	2.00
Some Common Indian Recipes and their Nutritive Value (1964), Fourth Edition 1977, Reprinted 1984, by Swaran Pasricha and L.M. Rebello	6.00
Nutrition for Mother & Child (1962), Third Edition 1978, Reprinted 1983, by P.S. Venkatachalam and L.M. Rebello	5.00
Japanese Encephalitis in India (Revised Edition 1980)	5.00
Some Therapeutic Diets (1969), Fourth Edition 1981, Reprinted 1983, Revised 1988, by Swaran Pasricha	2.00
Recommended Dietary Intakes for Indians (1981), Reprinted 1984	4.60
Lathyrism: A Preventable Paralysis (Revised Edition 1983)	1.50
A Manual of Laboratory Techniques (1983), Edited by N. Raghuramulu, K. Madhavan Nair and S. Kalyanasundaram	30.00
Fruits (1983), by Indira Gopalan and M. Mohan Ram	2.50
Count What You Eat (1989), by Swaran Pasricha	4.50
The Anophelines of India (Revised Edition 1984), by T. Ramachandra Rao	150.00
Depressive Disease (1986), by A. Venkoba Rao	58.00
Medicinal Plants of India, Vol. 2 (1987)	136.00

Unpriced Publications

(for limited distribution)

- Collaborative Study on Short-term Sequelae of Induced Abortion (1981)
- Proceedings of the Indo-UK Workshop on Leishmaniasis. (1983)



Peoples of India—Some Genetic Aspects (1983)

Management of Acute Diarrhoea (1985)

Plague Conquest and Eradication in India (1987) by S.C. Seal

Laboratory Manual for the Diagnosis of Haemophiloid Disorders (1989),
by Manorama Bhargava and Dinesh Jain

These publications are available on prepayment of cost by cheque or postal order (bank and postal charges will be extra) drawn 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.4508, Ansari Nagar, New Delhi-110029.

Some available publications of the Institute of Immunohaematology, Bombay

	Price Rs.
Techniques in Blood Banking, by H.M. Bhatia	12.00
Genetic Atlas of the Indian Tribes, by H.M. Bhatia and V.R. Rao	125.00
These publications are available on prepayment of cost by money order or Bank draft, from Director, Institute of Immunohaematology, 13th floor, New Multistoreyed Complex, KEM Hospital Campus, Parel, Bombay-400012.	

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For further information, Dr. B.N. Saxena, Sr. Deputy Director-General, Indian Council of Medical Research, Ansari Nagar, New Delhi-110029 may be contacted.

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