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DR. C. GOPALAN

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EDITOR
DR. G.V. SATYAVATI



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BIOMEDICAL ENGINEERING

Recent advances in science and technology have brought a much needed integration between the life sciences and the physical sciences resulting in the birth of many a new discipline. Biomedical engineering is one such new inter-disciplinary field which has come to the forefront in recent years.

The term "Biomedical Engineering" encompasses not only the fabrication, maintenance, repair and operation of sophisticated equipment, but also monitoring the practical application of advanced technological procedures for health care as well as biomedical research. Biomedical engineering entails, therefore, a multifaceted, multi-disciplinary approach involving various fields like electronics, instrumentation, biophysics, biomechanics, prosthetics, biomaterials, etc. Biomedical Engineering is a new and growing science which has not been given the attention it deserves in our country. The application of computers in medical research, formulation of standards and safety codes for biomedical equipment, development of artificial limbs, innovation of advanced techniques for testing the functions of vital organs like the heart, central nervous system, liver etc., fall in the purview of biomedical engineering.

A major bottleneck in biomedical research as well as health care systems in our country has been not so much the lack of sophisticated equipment but the dearth of expertise to maintain and operate the equipment available in most of the major research institutes and hospitals. Expensive biomedical equipment procured by major hospitals are known to be

lying unused. In 1968, a Study Group on hospitals set up by the Ministry of Health and Family Planning reported that the equipment lying idle at that time in the big hospitals in India, for want of repairs and maintenance, were adequate to meet the needs of 10 new medical college hospitals, if these equipment could be kept in working condition. Another survey carried out by the Electronics Corporation of India revealed that over 60 per cent of biomedical equipment in our country was unserviceable. While advances in the field of biomedicine have created greater demand for the use of complicated and sophisticated instruments for diagnosis, therapy, monitoring, visualization and data processing and analysis, there has been no corresponding increase in the technological services to deal with these sophisticated apparatus. As more and more sophisticated biomedical equipment are coming into use, the requirement of specialized services for maintenance and repair will become more and more critical. Inadequate maintenance degrades the quality of medical services, which in the long run results in the wastage of not only equipment but also man hours. A well planned maintenance programme can enhance the life and performance of the equipment and markedly reduce the total expenditure.

Another facet of the problem is the safety of the patients subjected to various procedures for diagnosis, treatment, rehabilitation etc., particularly in situations where several instruments are used simultaneously on the same patient. A systematic approach is required for protection of patients against

such electrical or radiation hazards as posed by these advanced techniques, by providing proper earthing, shielding and fault-detection facilities. This naturally requires expert technical knowledge in the field of biomedical engineering and also in the selection, installation, operation and maintenance of the various components of the system.

Realizing the growing importance and scope of Biomedical Engineering, the Indian Council of Medical Research constituted a Study Group on Biomedical Engineering in order to formulate research proposals of practical relevance to our country, in this field. The Study Group met on September 1-2, 1976 at the ICMR, New Delhi, under the chairmanship of Wing Commander N. Mohan Murali. Over 30 experts from different parts of India participated in this meeting.

The Group discussed a wide range of topics such as the role of biomedical engineers in improving the quality and extending the outreach of health care services; the formulation of safety codes and standards for electromedical equipment; the identification of research and development needs in the field of biomedical instrumentation; the potential uses of computers in medicine, both with respect to hospital management as well as field operations; the development of biomaterials and polymers for medical applications; the role of biomedical engineering in the rehabilitation of the handicapped; new engineering tools for pollution control and industrial hygiene.

In view of the high proportion of biomedical equipment in hospitals which were apparently unusable for lack of proper maintenance facilities, the Study Group recommended the setting up of in-house medical engineering service units for hospitals and regional servicing centres to carry out major repairs and servicing. The Group also emphasised the need for greater participation of specialists in biomedical engineering in medical research as well as postgraduate teaching in medical colleges. The Group emphasised the need for training of more and more scientists and technicians to meet the current needs. The Group further recommended that short term training courses in biomedical engineering should also be conducted at the under-graduate and post-graduate levels at various centres.

In the field of electro-medical instrumentation including biophysics, several proposals were discussed on its current state

in the country as well as the mechanisms for development of technology in medical electronics. The Study Group recommended greater support for research oriented towards the development of new techniques on the basis of which diagnostic kits suitable for early diagnosis of diseases and leading to institution of early therapy, could be made indigenously. The Group also emphasised that proper testing procedures of indigenously developed medical electronic equipment, including its evaluation should be conducted at various centres. One of the priority approaches identified for such a development was that of a health care van which could provide mobile medical facilities to the rural areas.

In the field of application of computers in medicine and biomedical research, the Group recommended that medical data analysis and retrieval which has already been initiated in some institutes should be extended to a few other centres where good computer facilities exist. The Study Group also recommended the setting up of a computer research division under the Indian Council of Medical Research to collect scientific data and also to conduct studies on the morbidity pattern in the country with relevance to regional or ethnic distributions and trends.

With regard to biomaterials, the scope and application of which has been extended beyond the development of artificial internal organs, hospital disposables, food package materials, substances of controlled biodegradability as required for long term therapy with drugs including contraceptives etc., the Study Group recognized the need and importance of indigenous development of biomaterials such as polymers, metals, ceramics and composite metals.

The Group recommended that biomaterials required for common and mass application should receive high priority. It was recommended that biomaterials and bioimplants should be obligatorily tested for biocompatibility before undertaking clinical trials. For this purpose, standards for biomaterials and bioimplants need to be drawn up. The Group also stressed that the development of freeze-drying for skin homografts needs to be encouraged, in view of the fact that research in the field of skin prosthesis is currently in its early phase of development.

The Study Group also discussed the role of biomedical engineering in the rehabili-

tation of the handicapped. While appreciating the current efforts on the production of artificial limbs, the Study Group felt that more attention should be directed towards developing technology that could benefit the poor masses residing in rural areas. In order to achieve this, the Group emphasised that there was an imperative need for adopting the currently available technology to suit the Indian rural conditions so that rehabilitation devices could be brought within the reach of the poor masses. The Group also recommended that special attention should be paid to the requirement of materials for limb prosthesis procedures for hot as well as humid conditions.

The Group discussed the application of biomedical engineering for pollution control and industrial hygiene. The following areas were identified as important in this field:-

- (1) Development of techniques to determine quantities of pollutants in air and water.
- (2) Development of systems for continuous monitoring of pollutants and to keep a vigil on the concentration of the pollutants in the environment.
- (3) Development of systems for continuous monitoring of effluent quality in treatment plants to ensure that the treatment systems for purification of polluted air and water are functioning properly.
- (4) Computer systems for the prevention and control of discharge of pollutants from industrial processes at the source of pollution.
- (5) Development of techniques to follow the pathways of pollutants in the human system

for a better understanding of the effects of pollutants on human health.

- (6) Instrumentation for control of noise pollution.

The Council now proposes to follow up the recommendations of the Study Group by formulating concrete research proposals to be undertaken in different parts of the country depending on the expertise and facilities available. A beginning in this direction has already been made by the Council by setting up regional instrumentation units at two or three centres. One such centre is functioning at the National Institute of Nutrition, Hyderabad. This unit is subserving the following functions:-

- (i) maintenance and repair of equipment at the Institute and provision of necessary maintenance and service facilities, in the initial stages, to various other establishments of the Council in the neighbourhood.
- (ii) calibration and modification of existing equipment.
- (iii) procurement and indigenous fabrication of spares.
- (iv) inspection of new equipment and its installation.
- (v) advice on safety codes and standards.
- (vi) training in biomedical engineering for suitable candidates/scientists sponsored by the Council.

Training courses in Biomedical engineering are being organised for research workers including the ICMR Talent Scheme fellows.

HIGHLIGHTS OF THE SECOND ICAR-ICMR JOINT PANEL MEETING HELD AT KRISHI BHAVAN, NEW DELHI ON 22ND SEPTEMBER, 1976

The Second Annual Meeting of the ICAR-ICMR Joint Panel was held on 22nd September, 1976 at Krishi Bhavan, New Delhi under the Chairmanship of Dr. M.S. Swaminathan, Director-General, Indian Council of Agricultural Research.

The Panel first considered a few schemes related to the possibilities of fortification

of milk with suitable iron salts, utilization of leaf protein in food supplements for children in organised trials in institutions and better utilisation of root vegetables, specially potato, sweet potato, tapioca, etc.

The Panel then considered the reports of two independent investigations by the All India Institute of Medical Sciences, New Delhi

and the National Institute of Nutrition, Hyderabad, into the outbreaks of liver disease associated with food contaminants. One related to the outbreak of acute toxic hepatitis in parts of Western India (Rajasthan and Gujarat) associated with the ingestion of maize contaminated with aflatoxin; the other related to the outbreak of endemic ascites and veno-occlusive disease in areas of Sarguja District of Madhya Pradesh, associated with the consumption of a minor millet, *gondhli* (*Panicum miliare*), contaminated with the weed of *Crotalaria* species. The observations of these groups on various aspects of the outbreaks relating to epidemiology, aetiological factors involved, clinical features and histopathology of target tissues appeared identical. Appropriate measures for control and prevention of such outbreaks were considered. The following suggestions were generally accepted:

(a) With regard to prevention of aflatoxin contamination, it was suggested that the farmers should be educated on better methods of storage of staples. Since the studies at NIN, Hyderabad, have shown that some varieties of maize are relatively resistant to toxin elaboration, it was suggested that agricultural extension services should try to popularise cultivation of such resistant varieties. It was also suggested that there should be a continuous monitoring of this area both for fresh outbreaks of the disease as also prevalence of *A. flavus* contamination in staples. It was noted that NIN, Hyderabad is already carrying out such investigations.

(b) With regard to the prevention of veno-occlusive liver disease in parts of Sarguja District, since evidence suggested that it was due to contamination of the staple *gondhli* with seeds of *jhunjhunja* (a *Crotalaria* species), deweeding operation could be tried. It was also pointed out that the weed involved is known to have symbiotic relationship with the millet cultivated and also the advantage of fixing nitrogen in the soil, it was suggested that a more practicable solution would be, to educate the tribals to remove the weed seeds at the household level by mechanical operations or sieving. It was also suggested that extension services of the agriculture and health departments could undertake the educative campaign in these villages.

It was further suggested that such investigations need to be pursued further in other areas where *gondhli* is grown, with a

view to look for such weed contamination and epidemiological studies for the prevalence of ascites and veno-occlusive liver disease.

Damage to the stored food grains caused by extensive floods in U.P. was discussed. The Chairman suggested that samples suspected to have become damaged due to floods may be collected from these areas and sent to the NIN, Hyderabad, for examination of their fungal flora and fungal toxins.

There was a detailed discussion on the reports presented by the Tamil Nadu Agricultural University on the problem of fluorosis in cattle and human beings in some areas of Tamil Nadu. Data on fluorine content of water and soil, and copper and molybdenum contents of soils were presented. It was pointed out that copper deficiency was invariably associated with fair degrees of excess of molybdenum in soils and these conditions appeared to exaggerate the proneness to fluoride toxicity in cattle and perhaps in the human population also. It was suggested that the copper and molybdenum contents of foods should be looked into. As part of control measures, it was suggested that high fluoride water could be treated with calcium oxide or Magnesium silicate and the possibility of diversion of water supplies with low fluoride from contiguous rivers or canals be examined.

A position paper on rural wages related to nutritional needs was taken up for consideration. It was suggested that at least 50 per cent of the wages to agricultural labourers could be given in kind, as food-grains. This approach may be tried out on a pilot scale in some areas where integrated rural development schemes will be started and based on this experience, it could be extended to other areas with suitable modifications.

Newer sources of edible oils was another topic taken up for consideration. The recent organised efforts to exploit sources such as rice-bran and sal seeds were reviewed. It was suggested that more detailed investigations should be taken up on mango seed kernel oil for testing its edibility and wholesomeness. It was pointed out that the National Institute of Nutrition has standardised a protocol for testing the edibility and toxicological aspects of new oils from plant sources. The Chairman pointed out that the ICAR-ICMR panel in consultation with the Oil Technologists Group may consider bringing out a comprehensive monograph on all possible sources of new plant oils, pointing out particularly the

available information on physico-chemical characters and the gaps in our knowledge with regard to edibility and toxicity. Such a

monograph could motivate further research on areas where information is needed.

ABSTRACTS

Some Research Projects completed recently

Erythropoiesis and erythropoietin in hypo and hyperthyroidism

To evaluate the nature and mechanism of altered erythropoiesis commonly associated with hypo and hyper-thyroidism, qualitative and quantitative studies of erythropoiesis were done in 23 hypo and 21 hyperthyroid patients. These included the routine haematological evaluation, bone marrow morphology, status of serum iron, B₁₂ and folate, red blood cell mass and plasma volumes by radio-isotope methods, erythrokinetics and radiobioassay of plasma erythropoietin. Majority of patients with hypothyroidism had significant reduction in the red blood cell mass (per kg of body weight). The presence of anaemia in many of these patients was not evident due to concomitant reduction in the plasma volume. The erythrokinetic data in hypothyroid patients showed evidence of significant decline of erythropoietic activity of the bone marrow. Erythroid cells in the bone marrow were considerably depleted and showed reduced proliferative activity as indicated by a relatively lower ³H thymidine labelling index. Plasma erythropoietin levels were remarkably reduced, often being immeasurable by the polycythaemic mouse bioassay technique. These changes in erythropoiesis in the hypothyroid state appeared to be part of a physiological adjustment to the reduced oxygen requirement of the tissues due to diminished basal metabolic rate.

Investigations in patients of hyperthyroidism revealed mild erythrocytosis in a significant proportion. Lack of erythrocytosis found in other patients of this group was associated with impaired erythropoiesis due to deficiency of haemopoietic nutrients such as iron, vitamin B₁₂ and folate. The mean plasma erythropoietin level of these patients was significantly elevated. The bone marrow showed erythroid hyperplasia in all cases of hyperthyroidism. The mean ³H thymidine labelling index of the erythroblasts was also significantly higher in hyperthyroidism.

Erythrokinetic studies also provided evidence of increased erythropoietic activity in the bone marrow. It is postulated that excess of thyroid hormones stimulates erythropoiesis (probably mediated through erythropoietin), leading sometimes to erythrocytosis, provided there is no deficiency of haemopoietic nutrients.

K.C. Das
and
R.J. Dash
Deptt. of Haematology
and Endocrinology,
Postgraduate Institute
of Medical Education
and Research,
Chandigarh.

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Das, K.C., Mukherjee, M., Sarkar, T.K., Dash, R.J., and Rastogi, G.K. (1975). *J. Clin. Endocrin. Metabol.* 40, 211.

A study of the association between systemic auto-immune disorders and auto-immune thyroiditis

A cross sectional study of thyroidal iodokinetics was undertaken in different auto-immune disorders. For this purpose, 50 patients with systemic auto-immune disorders (39 cases of rheumatoid arthritis, 6 of type II nephritis and 5 of systemic lupus erythematosus i.e. S.L.E.) were investigated.

Goitre was noted to occur in 10 cases of rheumatoid arthritis and two cases of SLE. None of the 6 cases of nephritis had goitre. Hyperthyroidism was evident only in one case of rheumatoid arthritis. Out of 10 biopsies done, only in two there was lymphoid infiltration in the thyroid. In the others only two gave a positive TRC (Tanned Red Cell) agglutination test.

Based on this study, it appears that auto-immune damage to the thyroid gland is not

a salient feature of rheumatoid arthritis. However, further studies are required to find out if the histological evidence of anti-immune damage is preceded or followed by a rise in serum anti-thyroid antibodies. Also, in cases in which histological evidence of lymphocytic infiltration is lacking, serial

biopsies may be necessary to delineate the natural history of the disease.

M. Bhaskar Rao
Department of Medicine
Maulana Azad Medical College
New Delhi.

SUMMARY OF THE SANDOZ CANCER RESEARCH AWARD (1975) ORATION

Dr. C.R.R.M. Reddy, Professor of Pathology, Andhra Medical College, Visakhapatnam, delivered the Sandoz Cancer Research Award (1975) Oration on 'Reverse smoking and carcinoma of hard palate in coastal Andhra' at the Indian Council of Medical Research, New Delhi, on 23rd September, 1976.

Reverse smoking of *chuttas* is a very common habit in the coastal districts of Visakhapatnam and Srikakulam in Andhra Pradesh. Carcinoma of the hard palate is also very common in these areas. To investigate a possible association between reverse smoking and cancer palate, a study was undertaken at Visakhapatnam.

3955 men and 5445 women from 20 villages in a field survey and 3400 women and 2600 men in the hospital, hailing from villages other than the 20 surveyed, were examined and their smoking habits and changes in the palate were studied. It was found that 25 per cent males and 50 per cent females, aged 20 years and above, indulged in reverse smoking. About 70 to 80 per cent of them showed stomatitis nicotina, a papular umbilicated lesion of the glandular zone of the hard palate, demonstrated by vital staining with toluidine blue. Severe type of stomatitis nicotina was seen in reverse smokers in both the field and hospital studies. One-third of the reverse smokers showed atypia and some showed microinvasive carcinoma. The atypia was highest in the squamous metaplastic epithelium of the duct. When the type of smoking and the epithelial atypia were correlated it was seen that more atypia was seen in reverse smokers than in other smokers. Microinvasive carcinoma was also seen along with stomatitis nicotina. In the field study, it was found that women with a long history of smoking had regressing stomatitis nicotina with a thickened palate, whitish or pigmented with flattened papules and small depressions. On biopsy, it was found that there was hyperorthokeratosis of the mucosa in between the openings of the ducts

along with the surface keratinization. When whole papules were biopsied it was seen that metaplasia of ducts and partial atrophy of the glands below, had occurred because of obstruction of the ducts. Some ducts were convoluted and tortuous or dilated or even had papillomatous projections into them. It was found that atypia occurred at an earlier age than cancer but the hyperorthokeratotic change without atypia occurred at the same age as cancer. Karyopyknotic (KP) index of smears from the palate, tongue, and cheek of normal and reverse smoking females was studied. It was seen that in reverse smokers, the palatal KP index increased while that of the cheek did not. The tongue showed an increase in KP index but not to the same extent as the palate. When 30 palatal ulcers or big stomatitis nicotina papules with more than 4 to 5 mm umbilication were followed by toluidine blue staining for a period of 3 years, it was found that 3 out of 8 positive ulcers turned malignant while only one of the 22 negative ulcers became malignant.

From an area with a million population, all the oral and oropharyngeal cancer cases which came to the hospital over a particular period were also studied to determine the relative risk of their developing oral cancer due to smoking (reverse or otherwise) and chewing pan and tobacco. It was found that reverse smoking did not carry any risk of the development of pharyngeal, laryngeal, oesophageal or nasopharyngeal carcinomas.

An interesting finding of the study was that more often than not, stomatitis nicotina regressed. The initial reaction to the pyrolytic products was hyperorthokeratosis of the mucosa in between the openings of the glands and also squamous metaplasia of the duct lining. If the ducts are keratinized early and get closed, papular lesions of stomatitis nicotina do not occur as the glands drained by the ducts fail to undergo hyperplasia and only atrophy. In most of the cases of reverse smoking, stomatitis nicotina papules develop.

But on continued reverse smoking, the squamous metaplastic lining of the ducts undergoes keratinization, getting merged with the surface keratinization and later closing up. This results in a flattened, pitted, whitish and pigmented mucosa of the palate, as seen in a majority of cases. Rarely, the ducts do not close up and the newly formed squamous metaplastic lining may undergo atypical changes and progress to carcinoma.

Another interesting finding was the localization of microinvasive carcinoma and carcinoma of the hard palate in the glandular zone of the hard palate without being present in the buccal mucosa, tongue, soft palate and the non-glandular area of the hard palate, though all the sites have a chance of being bathed by the pyrolytic products of tobacco. The reverse smoker is denied even the length of the *chutta* as a filter and the pyrolytic products have a direct access to the palatine mucosa. The results of cytological and histopathological studies have thrown some light on the factors leading to this localization of the lesions. The atypia seen in the squamous metaplastic lining of the ducts in stomatitis nicotina is more as compared to other areas, showing that the pyrolytic products of tobacco which are known to be carcinogenic

might gain entry through the ducts of the glands. If there is an effective expulsion of the carcinogenic agents from the glands, which probably occurs when the glands are situated in between muscle fibres, the lesions may not occur and even if they do, they may not progress further. Such a situation is found in the posterior one-third of the tongue and soft palate which escape getting stomatitis nicotina, microinvasive carcinoma or carcinoma, even though glands are present in these areas. The buccal mucosa has glands but is free from lesions due to reverse smoking because it does not get exposed directly to the pyrolytic products of tobacco, as the mucosa gets opposed to the alveolar borders during the act of sucking in air, to keep lit the end of the *chutta*. The anterior two-thirds of the tongue has no glands and hence, perhaps, escapes. The glands of the hard palate mucosa are situated between the bone above and keratinized mucosa below, having no effective emptying mechanism except that of gravitational force and therefore, lesions are localised to that area.

The studies have thus revealed a good correlation between reverse smoking and carcinoma of the hard palate.

ICMR NEWS

Dr. Usha K. Luthra, Deputy Director-General, ICMR, has been elected Fellow of the Indian National Science Academy.

The Scientific Advisory Committee of the Cholera Research Centre, Calcutta, met on the 21st September, 1976.

A symposium on "Alternative Approaches to health care delivery systems" was held at the National Institute of Nutrition, Hyderabad, between 27th and 30th October, 1976.

The newly built second floor of the Isolation Block of the Government Royapettah Hospital, Madras, is being taken over by the Tuberculosis Chemotherapy Centre for the OPD and laboratory services of the ICMR project on 'Chemotherapy of Mycobacterial Diseases'.

Dr. K. Banerjee took over as Deputy Director, Virus Research Centre, Poona, on the 29th September, 1976.

VISITS ABROAD:

Dr. C. Gopalan, President of the International Union of Nutritional Sciences, visited Brazil between 1st and 5th October in connection with the organisation of the XI International Congress of Nutrition (Brazil 1978).

Dr. C. Gopalan participated in the XVI General Assembly of the International Council of Scientific Unions at Washington D.C. between 10th and 16th October, 1976.

Dr. N.P. Gupta, Director, Virus Research Centre, Poona, participated in the meeting of the WHO Expert Committee on Viral Hepatitis held at Geneva from 11th to 16th October, 1976.

Dr. M.S. Bamji, Assistant Director and Dr. K. Prema, Senior Research Officer, National Institute of Nutrition, Hyderabad and Dr.

K.D. Virkar, Assistant Director and Dr. U.M. Joshi, Senior Research Officer, Institute for Research in Reproduction, Bombay, participated in the meeting of the WHO Task Force on Interaction of Contraceptive Agents and Methods with Nutrition and other Health Variables held at Geneva between 25th and 28th October, 1976.

Shri I.M.S. Lamba, Data Processing Officer, ICMR, New Delhi, proceeded on a 3 month WHO fellowship to the University of California at Los Angeles.

Dr. N. Raghuramulu, National Institute of Nutrition, Hyderabad proceeded on a one year NIH Post-doctoral fellowship at the Department of Biochemistry, University of Wisconsin, Madison, Wisconsin, USA.

Shri A.L. Aggarwal, Research Officer, National Institute of Occupational Health, Ahmedabad,

proceeded on a 10 month WHO fellowship to the Netherlands for training in public health engineering.

Shri H.V.K. Bhatt, Research Officer, National Institute of Occupational Health, Ahmedabad, attended the UNESCO sponsored International Course on Modern Problems in Biology which commenced on 5th October, 1976 at Prague, Czechoslovakia.

Dr. S.S. Gogate, Research Officer, Virus Research Centre, Poona, proceeded on a WHO fellowship for 6 months, starting from October, 1976, for training in advanced techniques for culture of viruses.

Dr. Tarala V. Purandare, Assistant Research Officer, Institute for Research in Reproduction, Bombay, has been awarded a 6 month Ford Foundation Fellowship to work on autoradiography and immuno-histochemistry.

ICMR AIDED SYMPOSIA/SEMINARS/WORKSHOPS

A workshop is being organised on the 'Role of Paediatricians in the delivery of health care' at Srinagar between 1st and 4th October, 1976.

An International Symposium on 'Molecular Basis of Host Virus Interaction' organised by the Institute of Medical Sciences, Banaras Hindu University, Varanasi, will be held between 17th and 20th October, 1976.

A workshop and teaching seminar on 'Radioisotopes, Instrumentation and Techniques in practice of Nuclear Medicine' is being organised as part of the 8th Annual Conference of the Society of Nuclear Medicine (India) at Bangalore on 6th November, 1976.

A satellite symposium of the 9th International Diabetes Congress on 'Nutrition and Diabetes' is being organised by the Diabetes Association of India at the Osmania Medical College, Hyderabad, November 8th and 9th, 1976.

A symposium on 'Development in Malaria Immunology' is being organised by the Indian College of Allergy and Applied Immunology, at the V.P. Chest Institute, New Delhi, on 8th November, 1976.

As part of the 45th annual meeting of the Society of Biological Chemists (India),

Symposia are being organised on Reproductive Biology and Aging, Stress and Metabolic Disorders between November 12th and 14th, 1976, at the National Institute of Nutrition, Hyderabad.

The second National Symposium on 'Cryogenics' is being organised by the Indian Institute of Technology, Madras from 8th to 10th December, 1976.

An International Symposium on 'Vitamin and Carrier Functions of Polyprenoids' is being organised at the Indian Institute of Science, Bangalore between 8th and 11th December, 1976.

A Symposium on 'Prophylactic measures to combat deficiencies of fat soluble vitamins', is being organised at the Indian Institute of Science, Bangalore, on 10th and 11th December, 1976.

The Sixth All India Symposium on 'Bio-medical Engineering' is being organised at the Indian Institute of Science, Bangalore, between 14th and 16th December, 1976.

The Fourth Seminar on 'Data base of Indian Economy with special reference to Health and Education' is being organised by the Indian Association for Study of Population at the Institute of Social and Economic Change, Bangalore on 22nd December, 1976.

A workshop on 'Research Methodology in Pharmacology' is being organised during the 9th Annual Conference of the Indian Pharmacological Society at the Institute of Medical Sciences, Varanasi between 26th and 28th December, 1976.

A Symposium on 'Physiology and Physical Performance' is being held during the 22nd Annual Conference of Physiologists and Pharmacologists of India, at the S.N. Medical College, Agra between 27th and 29th December, 1976.

A Symposium on 'Research and Treatment in Burns' is being organised during the 36th Annual Conference of the Association of

Surgeons of India, at New Delhi, from the 27th to 31st December, 1976.

A Symposium on 'Carcinoma breast and its Comprehensive Approach' is being held in connection with the 30th Annual Congress of Radiology at Chandigarh, between 1st and 4th January, 1977.

A Symposium on 'Atherosclerosis' is being organised during the 3rd Annual Conference of the Association of Biochemists of India at the Medical College, Baroda, between 7th and 9th January, 1977.

An International Symposium on 'Venom and Toxins' is being organised by the Haffkine Institute, Bombay in February, 1977.

SCIENTIFIC LECTURES TO BE HELD AT INDIAN COUNCIL OF MEDICAL RESEARCH HEADQUARTERS OFFICE DURING OCTOBER AND NOVEMBER, 1976.

Date	Topic	Speaker
15.10.1976	Virology in Public Health: Not an island entire in itself (Basanti Devi Amir Chand Prize Oration)	Dr. K.M. Pavri, Poona
29.10.1976	Long term effects of Vasectomy	Dr. Shanta S. Rao, Bombay
3.11.1976	Etiology of Chronic Cor Pulmonale in Delhi. [Dr. Kamala Menon Medical Research Award (1975) Oration]	Dr. S. Padmavati, New Delhi.
19.11.1976	Depressive illness and suicide in India. [Dr. P.N. Raju Award (1975) Oration]	Dr. A. Venkoba Rao, Madurai

COUNCIL'S TRAINING PROGRAMMES FOR 1976-77

(A) EXISTING ANNUAL TRAINING COURSES:

Nutrition and Endocrinology:

At the National Institute of Nutrition,
Hyderabad.

- (1) Annual Certificate Course in Nutrition;
(December 1, 1976 to February 28, 1977)

- (2) Ninth M.Sc. (Applied Nutrition) Course:
(June 1, 1976 to February 28, 1977)

- (3) *Fourth Annual Certificate Course in Human
Nutrition for Teachers in Agricultural
Universities.

- (4) Fifth Annual Training Course in
Endocrinological Techniques and their
application: (August 19 to September 30
1976)

Reproductive Biology and Fertility Control:

At the Institute for Research in Reproduction, Bombay.

- (1) Annual Training Course in Reproductive Endocrinology: (September 15, 1976 to October 15, 1976)
- (2) Seventh Annual Training Course in Reproductive Biology and Fertility Control: (November 1, 1976 to February 28, 1977)
- (3) Sixth Annual Training Course on Hormone Assays: (February 1, 1977 to March 31, 1977)

Haematology:

At the Blood Group Reference Centre, Bombay.

Training Course in Blood Banking and Basic Haematology for Technicians (February 16, 1976 to May 15, 1976)

Amoebiasis:

At the School of Tropical Medicine, Calcutta.

Technicians Training Course on Amoebiasis: (April 1, 1976 to June 30, 1976)

Biostatistics:

At the National Institute of Nutrition, Hyderabad.

Third Annual Training Course in Biostatistics for Statisticians and Medical Research Workers: (September 1976)

Animal Technicians Training:

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

Ninth Annual Animal Technicians Training Course: (September 1, 1976 to November 30, 1976)

Virology:

At the Virus Research Centre, Poona.

Diploma Course in Virology of Poona University (July 1, 1976)

Clinical Pharmacology:

At the Department of Pharmacology, Seth G.S. Medical College, Bombay.

A Training Course in Clinical Pharmacology and Drug Evaluation: (January 15, 1977 to February 28, 1977).

(B) NEW TRAINING COURSES DURING 1976-77:

Reproductive Biology and Fertility Control:

At the Institute for Research in Reproduction, Bombay.

Course in Cytology and Cytogenetics: (September, 1976)

Occupational Health:

At the National Institute of Occupational Health, Ahmedabad.

- (1) ICMR/WHO Training Course of Evaluation and Control of Industrial Environment: (February 16-28, 1976)
- (2) *Training Course on the organization of Occupational Health Programmes in Industry:
- (3) Training Course on Industrial Hygiene to be organised in collaboration with the National Safety Council: (November, 1976)

Haematology:

At the Blood Group Reference Centre, Bombay.

A certificate course in Blood Banking Technology and basic Haematology for medical Officers for a period of eight weeks (February 1, 1977 to March 31, 1977).

Laboratory Animal Technology:

At the Virus Research Centre, Poona.

A short-term course in breeding and maintenance of laboratory mouse colonies: (March 1977).

(C) COURSES FOR TALENT SEARCH SCHEME FELLOWS:

Principles and Methods in Medical Statistics:

Clinical Chemistry and Instrumentation:

At the Tuberculosis Chemotherapy Centre,
Madras: (December, 1976)

At the National Institute of Nutrition
Hyderabad (March 1-10, 1976)

Immunological Techniques:

Cell-Biology and Cyto-Genetics:

At the Indian Institute of Science,
Bangalore: (April 12-21, 1976)

At the Department of Biochemistry, All
India Institute of Medical Sciences,
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According to the new scheme, an advertisement is issued in the press in the month of January and copies of the same sent to all Directors/Principals of Medical Colleges in the country every year, with the request that the advertisement be exhibited on the college notice-boards. The advertisement carries the announcement that the Council will award Senior Research Fellowships of Rs.750/- in the 1st year, on a rising scale per mensem tenable for 3 years to talented medical graduates willing to opt for a medical research career. The selection is made on the basis of a competitive examination consisting of a written test. The test is held simultaneously in 3 or 4 centres in the country and has a common paper to ensure uniformity of standards. The candidates for the examination are selected from those applicants, under 25 years, who have secured 60 per cent or more in the aggregate marks of the final MBBS, and have passed all MBBS examinations in the first attempt. These candidates largely represent the cream of available medical talent in the country.

During the period of their fellowship the candidates are allowed to work for and obtain a postgraduate qualification e.g., M.D. in their chosen fields working in their respective colleges. Subjects such as Anatomy, Otorhinolaryngology, Ophthalmology, Anaesthesiology, Radiology and Surgery are not accepted. During the period of 3 years, while pursuing their postgraduate training programme leading to the M.D. degree, the candidates will be offered special training courses in important frontier areas of biomedical research. There will be 2 such courses every year, each course lasting for 10-14 days. The training courses which are envisaged, will cover such areas as Biostatistics, Epidemiology, Clinical Chemistry, Instrumentation, Animal Experimentation, Cell Biology, Cytogenetics, Immunology, Use of Isotopes in medical research, Haematological Techniques, New Advances in Fertility control Research etc. In addition to this core training programme, elective programme will also be offered to candidates depending upon their special requirements. These programmes will be conducted in appropriate institutions in the country where the requisite expertise and facilities exists, and the entire travel expenditure and per diem expenditure involved will be borne by the Council.

The candidates will be required to give an undertaking (sign a bond) at the time of their selection, that, after completion of the fellowship period of 3 years, they will serve the Council for a minimum period of 3 years. At the end of the three years fellowship period, the Council will offer to suitable candidates a regular assignment as Research Officer, which will eventually make them eligible for absorption in the permanent research cadre of the Council. The candidates not offered such regular assignment will, however, be free to seek other avenues and employment. It is hoped that this arrangement will provide training in biomedical research techniques and methodology for a large number of bright medical graduates every year, and will also generate a pool of well trained medical graduates from among whom selection to the permanent research cadre in the Council can be made.

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Volume I of the Monograph comprising 350 species of medicinal plants presented in alphabetical order, has just been released. It is modestly priced at Rs.30/- (plus postage Rs.6.50 for registered parcel and Rs.8/- for V.P.P.). Those who are desirous of procuring the Monograph by post may send Rs.36.50 in advance, in the form of bank draft or money order made out in the name of the Director-General, Indian Council of Medical Research, New Delhi. All requests for the Monograph may be addressed to the Chief, Division of Publication and Information, Indian Council of Medical Research, Post Box 4508, New Delhi-110016.

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