



**Annual Report
1997-98**



Annual Report 1997-98

SREE CHITRA TIRUNAL INSTITUTE FOR
MEDICAL SCIENCES AND TECHNOLOGY
THIRUVANANTHAPURAM
KERALA, INDIA

Contents

Historical	05
Overview	07
Patient Care	09
Post graduate Training Programme – Academic Affairs	14
Achutha Menon Centre for Health Science Studies	17
Departmental Reports	19
Biomedical Technology Wing	30
Scientific Publications	42
Patents Filed	49
Externally Funded Research Projects	50
Visits by Academic Staff abroad for international conferences	54
Statement of Accounts 97-98	57
Administrative Bodies	74

Historical

The origins of the Institute reach back to 1973 when the Royal Family of Travancore gifted a multi-storeyed building for the people and the Government of Kerala resolved to develop the gift as the Sree Chitra Tirunal Medical Centre for medical specialities.

The Medical Centre was inaugurated by Sri. P. N. Haksar in 1976 and the growth of a Biomedical Engineering and Technology Centre followed quickly at the Satelmond Palace, Thiruvananthapuram.

The concept and achievement of uniting technology and medical sciences within a single institutional framework was regarded sufficiently important by the Government of India to declare it as an Institute of National Importance by an Act of Parliament in 1980. The Act lays down the objectives of the Institute to be the promotion of biomedical engineering and technology, demonstration of high standards of patient care and the development of post-graduate training programmes of the highest quality in advanced medical specialities and biomedical engineering and technology.

Overview

The Institute maintained its momentum of progress in all its major spheres of activity during the year under review.

The infrastructure for biological evaluation of materials and devices was further strengthened and expanded. The technology for hydroxyapatite porous granules as bone graft material reached the stage of technology transfer. This marked the culmination of efforts to establish a development programme for bioceramics and glasses as hard tissue substitutes. By working in close association with TTK Pharma, standardization and quality assurance methods to meet the production needs of the Chitra prosthetic heart valve were evolved even as its steady commercial production commenced at Chennai.

The commissioning of a new imaging complex that incorporates state-of-the-art concepts in imaging technology significantly enhanced the diagnostic facilities available in the hospital. New initiatives in interventional cardiology, management of movement disorders and the rehabilitation of learning disabled children were some of the other patient care related developments during the year.

Development of DNA-based diagnostic methods for genetic and infectious diseases, studies on osteo induction using autologous bone calf serum, fibrin glue etc, and further work on developing an IPN membrane were carried out during the current year. Research on biofilm formation and antibiotic resistance as well as endothelial cell lining of plastic materials were also undertaken. The role of

nutritional imbalance resulting from low-protein-high carbohydrate diet in the aetio pathology of endomyocardial fibrosis (EMF) and the relevance of immunofluorescence techniques in detecting antistriated muscle antibodies for the diagnosis of muscular and neuromuscular diseases were investigated. Retrospective evaluation of transfusion practices by using audit criteria indicators, the role of thrombolytic therapy in acute occlusive stroke and evaluation of different drugs following angioplasty were some of the main clinical research carried out during the year. Establishing a Kerala Registry of pregnant women with epilepsy, a community-based case control study on the prevalence of EMF in coastal Kerala and validation of hepatitis C detection by ELISA with PCR techniques were some of the collaborative work undertaken during the year under review.

A major survey on the incidence of developmental language disorders & learning disability among school children in Kerala was launched this year. This and the ongoing epidemiological studies of epilepsy and diarrhoeal diseases marked the Institute's involvement in the area of public health. The teaching and research programmes in public health initiated by the Achutha Menon Centre are poised to gain international recognition.

The Institute thus remained committed to the objectives for which it was established and constantly strove to justify the trust reposed on it by the nation.

Patient Care

Dr. P. R. N. MENON MS

Medical Superintendent

Dr. S. K. JAWAHAR MBBS

Assistant Administrative Medical Officer

Increasing number of patients, the demand for high quality services and the rising cost of health care posed fresh challenges. However, continuous support given by the patients and relatives as well as co-operation from the hospital staff have significantly contributed to good patient care in the hospital. For improving the out patient services and also for decreasing congestion, speciality clinics were shifted to new OPD clinics. A waiting area for patients' relatives has been provided behind the medical block of the Institute.

The central clinical laboratory was linked to OPD, wards and ICU through the computer network. This has helped to get results of investigations without any delay. The weekly meeting of ward sisters, Nursing Superintendent and Medical Superintendent and periodic interactions with purchase, administration and accounts divisions helped the quality of patient care in the wards. The

hospital management committee met regularly and analysed various problems related to patient care. Trainees in the Dietry, sponsored by various hospitals and hospital management trainees sponsored by universities continued to attend the hospital.

Medico Social Work

Medico-social workers co-ordinated the registration of new patients and were involved in activities like assessment of income, motivation of blood donors, and providing guidance and counselling to patients. They also conducted family group counselling which is beneficial for patients with epilepsy in their psychosocial rehabilitation. They played a significant role in the organisation of large scale epilepsy epidemiological survey as well as outstation epilepsy clinics organised by the Institute in three districts of North Kerala.

Medical Records

Sri. P. KRISHNAMOORTHIA PILLAI, MA
Senior Medical Records Officer

Sri. N. G. THAMPI, MA, BMRSC
Medical Records Officer

During the year, the Division moved to the old library block. A policy decision was made to keep the patients' records for 10 years. Accordingly, all the inactive files were separated from the main filing areas. The division contributed to the efficient management of the hospital services. Statistical data were made available for planning clinical research and publication of scientific articles.

Table 1 Increase of Patients than previous year (1996-97)

New registration	10776	6%
Admission	6514	8%
Discharges	6499	8%
Reviews	50502	39%
Investigations	462527	31%
Operations	2231	4%
Charts retrieved	72470	26%

Table 2 Number of charts retrieved

Follow up in special clinics	50502
Correspondence of patients	10476
Analytical studies	6724
Pruning of charts	3583
Backlog feeding	200
Internal Audit	50
Cardiac surgery scrutiny	932

Table 3 Important Statistics

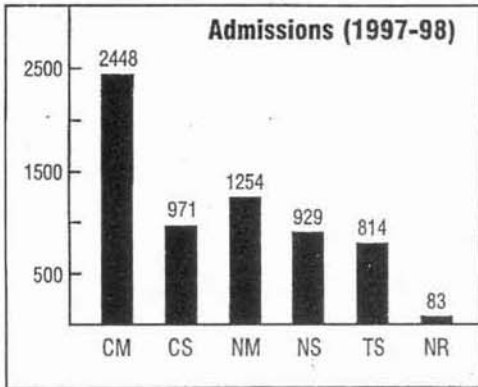
Sanctioned bed	200
Cardiac surgery	1394
Perfusion	787
Neurosurgery	837
New cases	10776
Repeat cases	50502

Admissions	6514
Discharges	6499
Deaths	241
Paying	75%
Non Paying	25%
Mortality rate	4%
Operative Mortality rate	6%
Lab. Investigations	462527
X-ray	16543
Physiotherapy	21908
ECG	12500
ECHO	15000
TMT	1232
CAG	1129
Cath and Angio	500
PTCA	43
PTCA + Stent	42
EPS	28
PPI	80
BMV	84
BPV	25
BAV	7
Balloon dilatation of COA	2
Balloon Atrial Septostomy	28
R.F. Ablation	23
PDA coil embolisation	5
Aortogram	223
CT Scan	500
MRI	2329
EEG	2266
VEEG	160
EMG	949
Bronchoscopy	57
IV DSA	32
Thrombolysis	5
Cerebral Angiogram	384
Spinal Angiogram	12
Radio Angioplasty	44
Embolisation	52

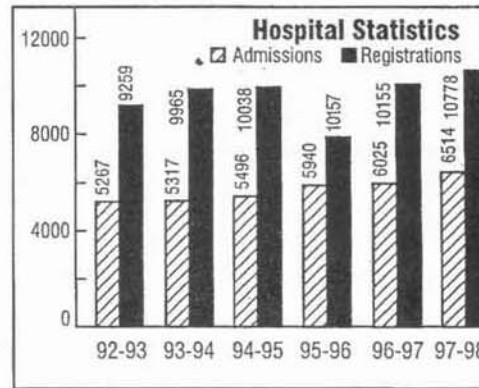
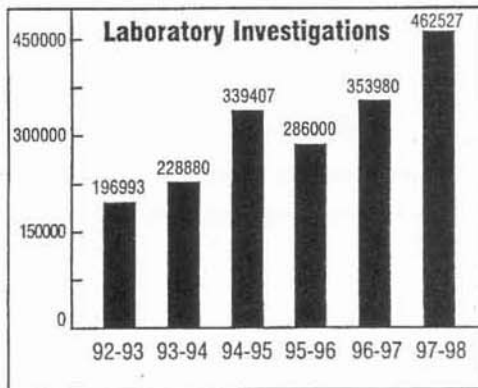
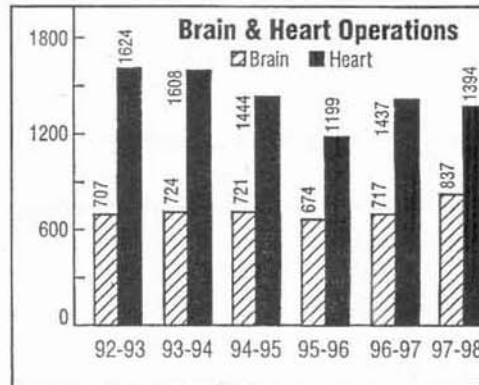
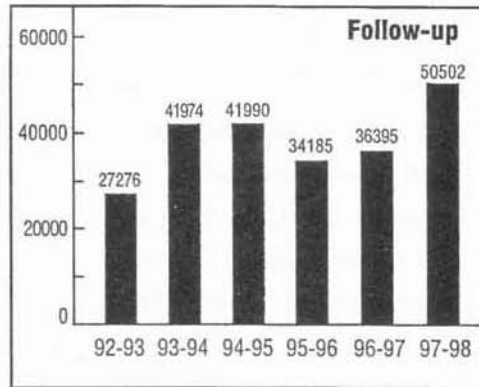
There was increase in the referrals from other states. Detailed monthly statistics were regularly placed before the hospital management committee. The Senior Medical Records Officer was authorised to

issue certificate to patients for applying for financial assistance from Prime Minister's and Chief Minister's funds. 24 students sponsored by the

School of Medical Education from Mahatma Gandhi University, Kottayam were trained in computerised medical records system.



CM : Cardiac Medicine
 CS : Cardiac Surgery
 NM : Neuro Medicine
 NS : Neuro Surgery
 TS : Thoracic Surgery
 NR : Neuro Radiology



Nursing Services

Smt. VIJAYAMMA HARIKRISHNAN RN, RM, BSc
(Nursing)
Nursing Superintendent

Smt. ROSAMMA EDWARDS RN, RM, PNA
Deputy Nursing Superintendent

The nursing services functioned with emphasis on patient care and in-service education. Monthly review meeting of ward sisters and orientation programme to new staff members contributed to optimal nursing care. The trained Nurses Association of India zonal conference was conducted on 7th August 1997 in the Institute.

Physiotherapy

Smt. M. MEENAKUMARI, BSc, DPT
Physiotherapist

Table : 4 Department-wise break up of patients referred for physiotherapy

Cardiology & Cardiac surgery	7357
Thoracic surgery	5154
Neurology	5634
Neurosurgery	3763
Grand Total	21908

Physiotherapy sessions were also conducted for patients following percutaneous laser disc decompression. Training programme in physiotherapy for the post basic nursing students in neurology and cardiology were carried out regularly in the unit.

Clinical Engineering

Sri. K. VIJAYAKUMAR, BSc (Engg)
Biomedical Engineer

Sri. KORUTHU P. VARUGHESE, BSc (Engg),
PGDCA, DISC
Engineer

Sri. G. MOHANLAL, BSc (Engg)
Engineer

Sri. B. MADHUSUDANAN PILLAI, BSc (Engg)
PGDCA, MBA
Scientist Engineer

Smt. DEEPA MATHEWS BTech
Engineer (Ad-boc)

Sri. N. SIVANANDAN
Junior Engineer

As in previous years, the Division was involved in activities relating to the maintenance of biomedical equipments. A number of imported equipments were installed during the year which included

- 1) A multichannel electro physiological recorder and a hemodynamic recorder.
- 2) A modern operating table and a wall mounting operating light for neuro surgery theatre.
- 3) Two portable X-ray machines and two film processors for Radiology Department.
- 4) A neuro imaging complex was established which will link spiral CT scan, Ultra sound and MRI scanners. All these three equipments are brought under a computer network and it will be possible to review the results of these procedure from the single TV monitor.

Computer Division

Smt. G. GEETHA, MTech (Computer Science)
Systems Manager

Routine activities involved software maintenance for all user departments. During the year, the following new installations were done.

- a) Two terminals in CCL for making the lab data on line
- b) Two terminals in Blood Bank for on line entry of donor details
- c) PC & printer in Pathology for entry of histopathology reports
- d) One terminal & printer in staff clinic with software for monitoring the issue of drugs to staff.
- e) Two multimedia units, 4 PCs and two servers in the library.
- f) Network at AMC 2nd floor with NT server and 16 nodes.
- g) VSAT Ku band installed.
- h) Upgradation of software for reporting coronary angiogram software awareness was enhanced by short term in-house course conducted for hospital and BMT wing staff in coordination with LBS Centre for Sciences and Technology. Efforts were also made to familiarise the faculty and staff with the optimal utilisation of the hardware and software.
- i) Upgradation of the system and software at Medical Illustration.

System expansion grouped towards more closer application in medical areas from increasing LAN interlinks.

Division of Academic Affairs

Dr. V. V. RADHAKRISHNAN, MD
Dean (from 1.12.97)

Sri. A. V. GEORGE, MA, BEd, MPhil
Registrar

Sri. SUNDAR JAYASINGH, MA, MBA, DLL
Assistant Registrar

Programmes on offer - 1998

Post Doctoral Programmes	Ph.D/Master's Programmes	Certificate Programmes	Diploma Programmes
<ol style="list-style-type: none"> 1. DM Cardiology 2. DM Neurology 3. MCh Cardiovascular & Thoracic Surgery 4. MCh Neuro Surgery (after M.S) 5. MCh Neurosurgery (after MBBS and 1 year residency in General Surgery) 6. Certificate course in Anaesthesia 7. Certificate course in Radiology 8. Certificate course in Vascular surgery 	<ol style="list-style-type: none"> 9. PhD 10. Master of Public Health 11. Post basic Cardiac Nursing 12. Post basic Neuro Nursing 13. Certificate in Blood Banking Technology 		<ol style="list-style-type: none"> 14. Diploma in Cardiac Laboratory Technology 15. Diploma in Neuro Technology 16. Diploma in Operation Theatre Technology 17. Diploma in Advanced Medical Imaging Technology

Award of PhD degree

The thesis entitled "Biochemical Correlates of Cardiac Fibrogenesis in response to magnesium deficiency and cerium" submitted by Sri. B. Prakash Kumar was accepted by the Institute and Sri. B. Prakash Kumar was declared qualified for the award of the Degree of Doctor of Philosophy of the Institute.

Student Enrolment

There were 65 students enrolled in various post doctoral degree, diploma and certificate programmes and 12 students for PhD programme during the academic year 1998.

Examinations

Table : 5 List of successful candidates for DM/M Ch

Name of Candidates	Degree	Speciality
Dr. Ravindra Singh Rathor	MCh	CVTS
Dr. Attawar Sandeep Gangaya	MCh	CVTS
Dr. Shipra Shrivasthava	MCh	CVTS
Dr. Sandeep Srivasthava	MCh	CVTS
Dr. Mohamed Akbar Bhat	MCh	CVTS
Dr. Manoj. S	DM	Cardiology
Dr. Natarajan K.U.	DM	Cardiology
Dr. P. S. Mathuranath	DM	Neurology
Dr. Joseph Cherian	DM	Neurology
Dr. Raghunath B	DM	Neurology
Dr. Sonal Thakker	MCh	Neurosurgery
Dr. Narendra Kumar Das	MCh	Neurosurgery
Dr. Sai Sudarsan	MCh	Neurosurgery

Table : 6 List of successful candidates - Post Doctoral Certificate programmes

Name of Candidates	Speciality
Dr. Sujatha P	Anaesthesiology
Dr. Jami Sridhar	Anaesthesiology
Dr. Nagaraja Gowda M	Anaesthesiology
Dr. Ganesan C	Anaesthesiology
Dr. Deepali Arvind Dalal	Anaesthesiology
Dr. Sabarad Jayashree Baburao	Anaesthesiology
Dr. Krishnamoorthy T	Radiology
Dr. Surekha K	Radiology

Table : 7 List of successful candidates - Diploma and Certificate courses

Name of candidates	Speciality
Benoj Mohan T	Cardiac Laboratory Technology
Shibu H	Cardiac Laboratory Technology
Rajesh P	Neuro Technology
Sapna L	Neuro Technology
Babu A. V.	Advanced Medical Imaging Technology
Shyma	Operation Theatre Technology
Manju. K. Nair	Blood Bank Technology
Sanjeev Kumar G	Blood Bank Technology

Table : 8 List of successful candidates for Post Basic Certificate programme

Name of Candidates	Speciality
Dipanwita Sen	Neuro Nursing
Anitha C. Puthoor	Neuro Nursing
Rachel Pappachan	Neuro Nursing
Susan Chacko	Neuro Nursing
Gisha B. Varghese	Neuro Nursing
Asha A. James	Neuro Nursing
Sindhu M. S.	Neuro Nursing
Shibi Kurias	Neuro Nursing
Sheeja Thomas	CVT Nursing
Shiji Augustine	CVT Nursing
Reena M. V.	CVT Nursing
Bindu C. Jacob	CVT Nursing
Rosy Antony	CVT Nursing
Bini Sebastian	CVT Nursing
Elizabeth Koshy	CVT Nursing
Shiney C. Alex	CVT Nursing
Joshi Varghese	CVT Nursing

Short Term Training/Observership

The demand for short term training/observership in various departments is shown in the table below.

Table : 9

Department/Division	No. of candidates
Anaesthesiology	13
Blood Bank	2
Cardiology	10
Microbiology	11
CVTS	5
Neurology	10
Neurosurgery	1
Radiology	52
MRD	20
MSW	10
Nursing	60
BME	3
Cath	3

National Science Day

National Science Day was celebrated in the Institute. Students from Model Polytechnic, Vadakara and VHSS, Valakom were taken on an educational tour of the Institute to introduce them to the concept of integrating biomedical science with technology for better patient care. All the departments/divisions of the hospital complex and the biomedical technology wing extended enthusiastic support for the success of the programme.

Library

Smt. R. PRASANNA KUMARI, MA, MLISc
Librarian cum Documentation Officer

Smt. S. JAYAPRABHA BA, BLISc
Librarian cum Documentation Officer GrII

Sri. JAYACHANDRA DAS, BSc, MLISc
Librarian cum Documentation Officer GrII

This year, the Institute Library was shifted to its new premises. The library continued to consolidate the development in information technology to improve the services. The library also continued to extend its services to staff and students of neighbouring institutions and universities. The computer-based information services consist of EMBASE-CD-ROM data bases on subjects like cardiology, cardiac surgery, neurology, neuro surgery, MEDLINE and internet services.

The library has a collection of 18,044 books and 15,430 bound journals. Library acquired 1,106 books during the year and subscribed to 273 journals. 50 journals were received as gratis. The major collection development related to books on public health was funded by Mac Arthur Foundation.

Nursing Education

Smt. P. P. SARAMMA, MSc (Nursing)
Instructor in Nursing

The tenth batch of Post Basic Certificate students in Cardiovascular and Thoracic Nursing and the sixth batch of Neuronursing students successfully completed their programme in December 1997. Currently 20 students are undergoing training in these two programmes.

Graduate and post graduate nursing students from institutions within the state and outside were provided clinical training in Critical Care Nursing.

Public Relations

Smt. T. V. HEMALATHA, MA, LLB, PGDJ
Public Relations Officer

Public relations section was responsible for the publication of News-letter, arranging "Meet the Press" programmes and monitoring the implementation of the official language.

Medical Illustration

Sri. G. LIJIKUMAR
Chief Technician

High quality projection slides and photographs were prepared for over 80 scientific papers published during the year and for papers presented in national and international conferences.

The computerised slide making machine significantly improved the quality of the multicoloured slides, texts and charts.

Achutha Menon Centre for Health Science Studies

Prof. N. KRISHNAJI, MA, Dip. Stat
Hon. Professor

Dr. V. RAMANKUTTY, MD, MPhil, MPH,
(On leave)
Associate Professor

Dr. R. S. VASAN, MD, DM, FACC
Associate Professor

Dr. K. R. THANKAPPAN, MD, MPH
Associate Professor

Dr. P. SANKARA SARMA, PhD
Assistant Professor

Dr. MALA RAMANATHAN, PhD
Assistant Professor

Dr. D. VARATHARAJAN, PhD
Assistant Professor

Two batches of students (Batch of 1997 and Batch of 1998) are currently undergoing the Masters programme in Public Health (MPH). The MPH curriculum comprising 16 teaching modules included modules on epidemiology, bio statistics, health policy, health management, health economics, field study methods and medical anthropology. The teaching format consisted of lectures, group discussions and problem solving exercises, journal club, student debates, seminars and computer-oriented programmes.

Research activity related to the public health aspects of the following areas was conducted by first batch of MPH students under the guidance of AMCHSS faculty.

These include :

- a. High Risk Pregnancies and their Clinical Outcomes.
- b. A study of the Prevalence for Dental Fluorosis and Associated Factors in Ambalapuzha Taluk in Alapuzha, Kerala.
- c. People's Campaign for Ninth Plan : An Analysis of Health Sector Projects Prepared

by Grama Panchayats of Thiruvananthapuram District.

- d. Morbidity Due to Chronic Diseases in the Aged Population - An Urban Rural and Coastal Comparison.
- e. A study of Gender Related and Rural-Urban differences in Knowledge and Attitude towards AIDS, Sexuality and related Gender Issues Among College Students in Kerala.
- f. Multipurpose Health Workers in Primary Health Care.
- g. Socio Economic and Demographic Factors Associated with Birth Weight.
- h. Inter-District Variations and Determinants of Health Status Indices in the State of Kerala.

Visiting Faculty

1. Dr. Mark Nichter, University of Arizona, USA visited the Institute between July to September 1997 and January and February 1998 and conducted a course on Medical Anthropology.
2. Dr. Richard A. Cash, Harvard School of Public Health, Boston, USA, visited the

- Institute in March 1998 and conducted a course on "Epidemiology of Infectious diseases".
3. Dr. Sajitha Bashir, New Delhi, visited the Institute between January to April 1998 and conducted a course on Health and Development.
 4. Dr. Rick Homans, from Durham, USA, visited in December 1997 and conducted a course on Health Economics.
 5. Dr. K. S. Reddy from AIIMS, New Delhi, visited the Institute in May 1997 and conducted a course on "Health and Development".
 6. Dr. A. V. R. Muralidharan IIT, Madras visited the Institute between May, June 1997 and conducted a course on "Introduction to Health Care and Delivery System".
 7. Dr. Oommen Philip, Director, Foundation for Health Management, visited the Institute in September 1997 and conducted a course on Health Management.
 8. Dr. William A. Reinke, Johns Hopkins University, USA, visited the Institute in November 1997 and conducted a course on Health policy and Management.

Departmental Reports

Department of Anaesthesiology

Dr. K. MOHANDAS, MD

Professor & Director of the Institute

Dr. R. C. RATHOD, MD

Professor & Head

Dr. (MRS) ROUT, MD

Additional Professor till 5.1.98

Dr. (MRS) RUPA SRINIVAS, MD, Dip. NB

Additional Professor

Dr. G. SURESH, MD

Associate Professor

Dr. THOMAS A. KOSHY, MD

Assistant Professor

Dr. SHRINIVAS V. GANHDINHLAJKAR, MD

Assistant Professor

Dr. PRASANTH KUMAR DASH, MD

Assistant Professor

Dr. RAGHUNATH SREEDHAR NALGIRKAR, MD

Assistant Professor

Dr. V. K. SATHYAJITH, MD, Dip. NB

Consultant (Ad-boc) till 1.9.97

Dr. RATHAN GUPTA, MD, Dip., NB

Assistant Professor from 17.11.97

Dr. C. SURESH, MD

Consultant (Ad-boc) till 1.9.97

Dr. P. K. NEEMA, MD

Assistant Professor from 30.12.97

Dr. M. G. PRAMOD, MD

Consultant (Ad-boc)

Dr. SUJATHA P, MD

Consultant (Ad-boc) from 6.1.98

Sri. GANAPATHY POTTI

Scientific Assistant

Candidates for post doctoral certificate course :

Dr. S. Mohan

Dr. Senthil Kumar

Dr. Pramila Shukla

Dr. Srinivas K.

Dr. T. Raj Mohan Rao

Dr. Prasad K

Table : 10 Anaesthetic support given during the year (1997-98)

Procedures	Number
Cardiovascular and thoracic surgery	1383
Neurosurgery	733

Anaesthetic services were provided for investigational and interventional radiological and cardiac procedures.

Postgraduate students in Anaesthesiology from the Medical Colleges at Goa, Belgaum and Calicut underwent short term training in the department.

Anaesthesiologists from Nagpur and various hospitals in Kerala spent short periods in the department as observers.

Division of Biochemistry

Dr. K. SUBRAMONIA IYER, PhD
Professor and Head

Dr. P. S. APPUKUTTAN, PhD
Additional Professor

Dr. N. JAYAKUMARI, PhD
Additional Professor

Smt. SHANTA A. GEORGE, MSc
Scientist

Smt. K. I. ANNAMMA, BSc
Scientific Assistant

Sri. B. SASIKUMAR, MSc
Scientific Assistant

Sri. BALU K. CHACKO, MSc
PhD Student

The Central Clinical Laboratory functioned round the clock providing investigative support in clinical chemistry, haematology and clinical pathology. The total number of procedures touched 4.49 lakhs which was 26.8% higher than the previous year. These included not only routine tests but also therapeutic drug monitoring and assay of enzymes like aryl sulfatase and B hexosaminidases (A&B). With the assistance of the computer division, terminals have been installed in the clinical laboratory so that the results of the investigations could be communicated faster to ICU, wards and OPD.

A specific method was developed for the purification of naturally occurring anti T-antibody from human plasma. This antibody recognises T-antigen which is characteristically present in the surface glyco-conjugate of tumour cells.

A density gradient, single spin ultra centrifugation technique was standardised for the reliable, rapid and relatively cost-effective fractionation of serum lipo-proteins, such as very low density lipo-proteins and high density lipo-protein and quantitation of their cholesterol content.

Division of Blood Transfusion Services

Dr. JAISY MATHAI, MBBS, DCP
Chief Blood Transfusion Officer

Dr. P. V. SULOCHANA, MBBS
Blood Transfusion Officer

Dr. S. SATHYABHAMA, MBBS
Blood Transfusion Officer

The Division continued to provide round the clock service to the hospital. 64% of the collected blood units were used for blood component separation. Blood components usage increased to 82% as against 75% in the previous year. Help was extended to nearby institutions also. The judicious utilisation of blood components facilitated better transfusion service and patient care.

Blood bank data base was extended for providing information to the hospital transfusion committee. Attempt is being made to enroll rare blood group donors in the panel list.

During the year, the Division conducted research in the following areas.

1. In house Red-cell panel preparation of Rh and subgroups of A & AB.
2. Comparison of antibody screening of the recipient by two sensitive techniques and its correlation with incompatibility testing.
3. Investigation of blood group discrepancy in a surgical patient.
4. Retrospective evaluation of transfusion practice by using audit criteria indicators.

The Division has a collaborative research project with Rajiv Gandhi Centre for Biotechnology to compare the ELISA positive Hepatitis C positive blood donors with the results of techniques PCR. In

collaboration with the Division of Thrombosis Research of BMT Wing, the antibodies specific for platelet activation were investigated. We continue to provide inputs, for raising monoclonal antibodies specific for the detection of platelet activation and for standardization and evaluation of fibrin glue preparation.

Important visitors to the department included:

1. Dr. Dipika Mohanty, Director, Institute of Immunohaematology, KEM Hospital, Mumbai.
2. Dr. Ambika Nanu, Head, Blood Transfusion Services, AIIMS, New Delhi.

The Department was the recipient of Indian Red Cross Society award for the third consecutive year for safe blood transfusion.

The Division published a booklet "Guidelines for transfusion practice-Users Manual, (editors)

Dr. Jaisy Mathai, Dr. P. V. Sulochana.

Department of Cardiology

Dr. K. G. BALAKRISHNAN, MD, DM, FAMS, FACC
Professor & Head (till 15.09.97)

Dr. JAGANMOHAN A. THARAKAN, MD, DM
Professor & Head

Dr. THOMAS TITUS, MD, MNAMS, DM
Additional Professor

Dr. RAMAKRISHNA PILLAI, MD, DM
Associate Professor

Dr. V. AJITH KUMAR, MD, DM
Associate Professor (on leave)

Dr. ANIL BHATT, MD, DM
Associate Professor

Dr. S. SIVASANKARAN, MD, DM, Dip. NB
Assistant Professor

Dr. BIMAL FRANCIS, MD, DM
Assistant Professor

Dr. K. R. SYAM SUNDER, MD, DM
Assistant Professor

Dr. P. KADER MUNEER, MD, DM
Assistant Professor (Ad-hoc)

Dr. P. K. JOSEPH, MD, DM
Assistant Professor (Ad-hoc)

Sri. VIJAYASENAN, BSc
Scientific Assistant

Candidates for DM:

Dr. G. Justin Paul, MD

Dr. Harikrishnan, MD

Dr. Nageswara Rao, MD

Dr. C. Rajiv, MD

Dr. K. Siva Kumar, MD

Dr. K. P. Balakrishnan, MD

Dr. Mahesh, MD

Dr. C. Mohammed, MD

Dr. M. Ravichandra, MD

Dr. R. Padmakumar, MD

Dr. T. G. Jayakumar, MD

Dr. Karthikeyan. G, MD

The routine clinical work included 5737 new registrations in the Cardiology department, 2448 admissions and 33, 156 reviews; With the commissioning of the 2 colour Doppler machines, the outpatient workup of patients has improved considerably.

The main thrust of the Department of Cardiology was in starting the programme for Electrophysiological studies and Radio frequency ablation for supraventricular tachycardia and idiopathic ventricular tachycardia. During the year, 24 RF ablation were carried out which included 15 patients with accessory pathway-related tachycardia, 4 patients with AV nodal reentrant tachycardia and 5 patients with idiopathic ventricular tachycardia.

The Department also organised a workshop on Coronary Rotablation and stenting on 18.10.1997 and Dr. Mathew Samuel, Cardiologist at Apollo Hospital, Madras, participated in the workshop. Subsequent to this workshp, the department offers state-of-the art coronary intervention.

Table : || Different Procedures Performed during the year

Procedure	Number
Coronary angiography	1098
Right and/or left heart catheterization and/or angio	540
Electrophysiological studies	28
PTCA and/or Stenting	82
PTCA and Rotablator and Stenting	3
Balloon mitral valvotomy	85
Balloon Pulmonary valvotomy	25

Pacemaker Implantation	80
Balloon Atrial Septostomy	26
PDA coil embolisation	5
Electrophysiological study with RF ablation	24
Balloon aortic Valvotomy	7

Department of Cardio Vascular and Thoracic Surgery

Dr. M. P. MOHAN SINGH, FRCS (ENG), FRCS (EDIN)

Professor & Head

Dr. K. S. NEELAKANDHAN, MS, MCh

Professor

Dr. R. SANKAR KUMAR, MS, MCh

Additional Professor

Dr. K. G. SHYAMKRISHNAN, MS, MCh

Additional Professor

Dr. M. UNNIKRISHNAN, MS, MCh

Additional Professor

Dr. S. R. KRISHNAMANO HAR, MS, MCh

Associate Professor

Dr. S. K. NAIR, MS, MCh

Associate Professor

Dr. AVINASH DAL, MS, MCh

Assistant Professor

Mr. THOMAS MALLIAKKAL

Scientific Assistant

Post graduate students

Dr. Avijith Basu, MS

Dr. Jayant Kumar Das, MS

Dr. Jigeesh Doshi, MS

Dr. Vijith Koshy Cherian, MS

Dr. N. Devananda, MS

Dr. Apurva Kumar Sarma, MS

Dr. Jacob James Raj, MS

Dr. Kalpesh Mallik, MS

Dr. Praveen Varma, MS

Dr. Raja Joshi, MS

Routine clinical work included management of 1361 patients who underwent a variety of surgical procedures (Table. 12). Of the 1357 surgical procedures, 800 were open heart operations. In 7 cases Intra Aortic Balloon pump was used. The number of closed heart cases were 557.

Table 12 List of cases done

Type of cases	Number
CABG	229
Valve replacement/repair	118
Complex congenital	35
Congenital heart operations	205
ASD closure	197
Miscellaneous	4
Vascular operations on CPB	11
Total	799

Table 13

Vascular Aneurysms	40
Vascular Operations (other)	46
General Thoracic Surgery	148
CMV	127
PDA	135
Coarctation	17
Closed heart congenital surgery	45
Miscellaneous	4
Total	562

Division of Cellular and Molecular cardiology

Dr. C. C. KARTHA, MD, FASc
Professor & Head

Dr. R. RENUKA NAIR, PhD
Scientist

Dr. K. SHIVAKUMAR, PhD
Scientist

Dr. JOHN T. EAPEN, PhD
Scientist

Students for PhD programme

Smt. Rajashree, MSc

Smt. Preetha Nair, MSc

Smt. Preeta R, MSc

Sri. Kumaran C, MSc

Experimental studies conducted in rabbits with magnesium-restricted diet and serially administered cerium through drinking water showed structural lesions and functional abnormality analogous to human endomyocardial fibrosis. These findings lend further support to the geo-chemical hypothesis on the causation of endomyocardial fibrosis. The Division has teamed up with the Centre for Health sciences to conduct community-based case-control study in areas of high prevalence of EMF in coastal Kerala for epidemiological validation of the hypothesis.

Biochemical mechanisms of cardiac fibrosis are delineated in a rodent model of cardiomyopathy induced by Mg deficiency. Present investigations are centred around the role of vasoactive factors. The focus is on angiotensin II, a vasoactive hormone known to play a key role in tissue repair. Radio

receptor binding assays are being done to study the expression of angiotensin receptors in the myocardium of Mg-deficient animals.

The Division collaborated with the Department of Paediatrics, Medical College, Trivandrum to investigate element status in malnourished children and also in children with diarrhoea and infection, in an attempt to correlate the relationship with nutritional cardiomyopathies.

Division of Microbiology

Dr. J. SHANMUGAM, MSc, PhD
Professor and Head

Smt. MOLLY ANTONY, MSc, DMV
Assistant Professor

Dr. MURALIDHAR K. KATTY, MSc, PhD
Assistant Professor

Sri. M. RAVINDRANATH, BSc
Scientific Assistant

Smt. K. NASEEMA, MSc (MLT)
Scientific Assistant

Smt. C. P. SINDHU, MSc
Ph.D Student

The routine laboratory investigations showed about 10% increase over the previous years. In virology, the number of investigations has increased two-fold due to the introduction of many ELISA tests for virus diagnosis.

Table : 14 Laboratory Investigations

Bacteriology	15,730
Immunology	7,111
Virology	1,371
Total	24,212

The study of the carrier state of potential pathogenic bacteria and its relation to wound infections among cardiac surgery patients showed increased carrier state of *Staphylococcus aureus* and the Coagulase negative *Staphylococci*.

Visitors to the Division included Dr. K. B. Sharma, WHO Consultant from New Delhi, who delivered a talk on "Quality Assurance in Laboratory Medicine in Relation to Microbiology, Biochemistry, Haematology and Blood Bank" on 23rd February 1998, Dr. H. Hariharan, Professor of Microbiology from King Edward Island University, Canada, January 1998, Dr. Manel K de S. Vijayasundera, Professor of Parasitology, University of Peradeniya, Sri Lanka, March 1998 and Dr. Vasant Pandit, Former Director of the Pasteur Institute, Coonoor, Nilgiris.

Department of Neurology

Dr. K. RADHAKRISHNAN, MD, DM, MNAMS
Professor and Head of the Department

Dr. C. SARADA, MD, DM
Additional Professor

Dr. M. D. NAIR, MD, DM
Additional Professor

Dr. SANJEEV V. THOMAS, MD, DM, Dip. NB
Associate Professor

Dr. ASHA KISHORE, MD, DM
Associate Professor

Dr. P. A. SURESH, MD, DM
Associate Professor

Dr. ABRAHAM KURUVILLA, MD, Dip. NB, DABN
DABN (Cl. Nph)
Assistant Professor

Dr. B. SANTHOSH KUMAR, MD, DM
Assistant Professor

Dr. S. MATHURANATH, DM
Assistant Professor (Adhoc)

Candidates for DM:

Dr. Laly Alexander, MD

Dr. P. N. Sylaja, MD

Dr. Sudeep Balakrishnan, MD

Dr. Jacob George, MD

Dr. Sujatha, MD

Dr. Jairaj D. Pandian, MD

Dr. Beena, MD

Dr. M. A. Joy, MD

Dr. Hari Prasad, MD

Dr. Robert Mathew, MD

Dr. Ahsan Moosa, MD

There was a steady increase in the number of referrals to the neurology services. The outpatient services included a variety of special clinics in addition to regular Neurology services.

Special Clinic	Day
Movement Disorder	Monday
Neuromuscular Disorders	Tuesday
Epilepsy	Wednesday, Friday
Behavioural Neurology	Thursday
Stroke	Friday

The major activities of the department in research and specialised care were channelised through various specialities of the department.

Epilepsy Programme :

The Comprehensive Epilepsy Programme set a new record on November 12, 1997 by completing 100 anterior temporal lobectomies for intractable epilepsies. In addition, 10 corpus callostomies were also performed. Data from the comprehensive epilepsy programme were presented at two international and three national conferences.

Epilepsy clinics were held twice a week and witnessed a record number of patients attending (5147). 2267 EEGs and 142 video EEG were performed during the year 97-98. The ongoing epidemiological study on epilepsy completed its phase II survey in October 97. In addition to the ongoing comprehensive epilepsy programme, a Kerala Registry of pregnant women with epilepsy was initiated.

Movement Disorder

The department launched a comprehensive care programme for Parkinson's disease. Besides providing specialised clinical care, additional facilities like counselling, group therapy and physiotherapy

were added to the services. The surgical treatment (pallidotomy) will be initiated next year. 1027 patients attended the movement disorder clinic.

Speech and Behavioural Neurology Services

958 patients attended the speech and behavioural Neurological clinic. The project on epidemiological survey of developmental language disorders funded by KRPLLD progressed well. A national conference on cognitive and language disorder was organised in January 1998.

Neuromuscular Services

The section collaborated with the BMT Wing in a project aimed at developing an immunoadsorption technique which has potential application in neuroimmunological diseases. 2247 patients attended the neuromuscular services.

Stroke Services

1080 patients attended the stroke clinic during the year. The role of selective intraarterial urokinase in acute occlusive stroke is being studied.

Dr. Thomas Chaly, Chief of Radiochemistry, PET Research Northshore City Hospital, NY, visited the Department and lectured on Radio pharmaceuticals in PET

Department of Neurosurgery

Dr. N. SURESH NAIR, MCh
Additional Professor and Head

Dr. DILIP PANIKAR, MS, MCh
Associate Professor

Dr. M. BHASKARA RAO, Dip. NB
Assistant Professor

Dr. UMA NAMBIAR, MS, MCh
Assistant Professor

Dr. RAJANEESH KACHHARA, MS, MCh
Assistant Professor

Dr. GIREESH MENON, MCh
Consultant

Candidates for MCh :

Dr. Prithvi Varghese, MS

Dr. Ravi Gopal Varma, MS

Dr. Parameswaran, MBBS

Dr. Jain George, MS

Dr. Anantha Babu, MS

Dr. Irfan Siddique, MS

Dr. Rakesh Goel, MS

Dr. Gurudatta Satyarthee, MS

There was an increase (20%) in the volume of operative surgery compared to the previous year. The department continued to cater to more complex intracranial and intraspinal lesions. Surgery for intracranial aneurysms, tumours of base of the skull, cranio vertebral junction anomalies, intra-medullary spinal cord tumours and temporal lobe epilepsy formed the major bulk of total surgical procedures.

Table : 15 Operative procedures performed during the year

Vascular	
Aneurysms (110 pts)	133
AVM	09
Cerebello Ponten Angle	
Acoustic neurinoma	28
Other Schwannomas	04
Epidermoid cyst	03
Haemangioblastoma	01
Meningioma	01
Base of skull (excluding CPangle)	
Meningioma	33
Chordoma	03
Schwannoma	04
Others	02
Epilepsy	
Anterior temporal Lobectomy and hippocampectomy	52
Callosotomy	02
Sellar/Suprasellar tumours	
Pituitary	41
Craniopharyngioma	14
Chiasm glioma	04
CV junction	
Chiari/syrinx	29
Atlanto Axial Dislocation	13
Orbit	05
Pineal	03
Intraventricular	
Colloid cyst	11
Lateral ventricle	01
Spinal lesions	
Extradural	21
Intradural	22
Intramedullary	23
Cervical disc	48
Lumbar disc	42
Supratentorial tumours	
Cliomas	59
Meningiomas	48
Posterior fossa tumours	
Astrocytomas	08
Medulloblastoma	15
Haemangioblastoma	05
Shunt - Ventriculo - peritoneal	100
Miscellaneous	73
Total	837

The department was engaged in the following research activities (A) Animal experiments were conducted to evaluate the role of indigenously prepared fibrin glue in preventing CSF leak. This was done in collaboration with the Division of Thrombosis Research of the Biomedical Technology Wing. (B) Significant progress was made in the research project "Effect of urokinase and papavarine in an animal model of subarachnoid haemorrhage".

During the year, Dr. Madhvan Pisharody, Neurosurgeon from Brownsville Pain Research Centre, Texas, USA, visited the department and conducted a workshop on Lumbar intervertebral disc stabilisation.

Dr. Prakash Sampath, from Department of Neurological Surgical, Johns Hopkins University, USA, visited the department.

Division of Pathology

Dr. V. V. RADHAKRISHNAN, MD
Professor & Head

Dr. S. SANDHYAMANI, MD
Additional Professor

Dr. ELIZABETH JOSEPH, MD, Dip. NB
Consultant (Adboc)

Dr. ANNAMA MATHAI, PhD
Scientific Assistant

Smt. SUMI MARY GEORGE
PhD Student

During the year 1997-98, more than 800 surgical and medical pathology specimens from Neuro and Cardiac diseases were subjected to histopathological examination. Intra-operative frozen-section diagnosis was carried out in 210 patients. Routine immunopathological investigations were undertaken

in 3000 patients. Muscle biopsies were conducted in 45 patients. As a part of the teaching programme for DM and MCh students, regular case demonstration, clinico - pathological conferences were conducted. The Division also helped the post graduate students in Neuro and Cardiac Sciences with their research protocols.

Long-term studies in a bonnet monkey model for mucoid vasculopathy showed advanced cardiovascular lesions. Histomorphological features showed marked atrophy in myocardium and the presence of large fresh and organising intra cardiac thrombi. These features resembled human endomyocardial fibrosis. This study also established the etiologic role of nutritional imbalance of low protein, high carbohydrate diet in endomyocardial fibrosis.

The ongoing DST project on "Development of a immunodiagnostic system for Tuberculous Meningitis suited to the laboratories in developing countries" has made progress. The IgG antibody in CSF specimens of culture positive patients with TBM was isolated by protein A-sepharose column. This human IgG to M tuberculosis was coupled with cynogen bromide sephose 4B and an immunoaborsbent column was made. Culture filtrate of M-tuberculosis was passed through this column. 14 kd antigen present in the culture filtrates of M tuberculosis was eluted. The immunochemical and physiochemical properties of 14 kd mycobacterial antigen are being investigated for potential appication in the laboratoy diagnosis for TBM.

Immunofluorescence technique was recently introduced to demonstrate anti-striated muscle antibody which can be applied in the diagnosis of muscular and neuro muscular diseases. Patients with

myasthenia gravis with thymome are found to have circulating immunecomplexes and these circulating immune complex contains specific antibody against striated muscle protein.

Department of Radiology

Dr. A. K. GUPTA, MD
Additional Professor and Head

Dr. SANTHOSH JOSEPH, DMRD, MD
Additional Professor

Dr. KESHAV DAS, MD
Consultant (Ad-hoc)

Dr. N. K. PRABHU
Consultant (Ad-hoc)

Dr. P. V. SANTHOSH
Consultant (Ad-hoc)

Dr. K. G. RAMAKRISHNAN
Consultant (Ad-hoc)

Dr. R. G. GOPINATH
Consultant (Ad-hoc)

Table : 16 Routine Procedures done

Procedures	Number
Plain X-rays	23430
CT Scan	359
MRI	2310
Ultrasound (during March '98 only)	62
Invasive Diagnostic Procedure	
Cerebral Angiogram	349
Spinal Angiogram	11
Aortogram/Peripheral angiogram	209
IVDSA	29
Other diagnostics	34
Interventional Procedures	
Cerebral Embolization	48
Balloon Embolization/Traping	5
Balloon Angioplasty	45
Vascular Stenting	4

Cerebral Thrombolysis	3
PLDD	2
WADA's Test	33
Bone Biopsy	5

Research activity in the department included (i) photosensitization of rat skin following aminolevulinic acid induced photodynamic therapy (ii) Impact of photodynamic therapy on induced carcinoma in mice (iii) Development of animal model of subarachnoid haemorrhage vasospasm to establish the role of papavarine and urokinase in vasospasm (iv) Evaluation of different drugs in the prevention of restenosis following angioplasty.

Biomedical Technology Wing

Dr. R. SIVAKUMAR
Head, BMT Wing

The Biomedical Science and Technology programmes are being developed with the following overall objectives :

- Product development with emphasis on innovation
- Competence build up through Team Effort and Training/exposure in relevant institutions
- Scientific studies to initiate new areas and answer specific questions arising out of the developmental programmes

In order to achieve the above, the following activities are being intensified :

- Design and Prototyping
- Materials and Processing
- Biological Evaluation

The laboratories are being expanded with additional facilities like Thermal Analyser, X-ray Diffraction, Gas permeability tester etc. for material characterization. Haematology Analyser, Epifluorescence microscope and Image Analyser have been added for evaluation of biochemical and pathological parameters of blood, soft and the hard tissues.

It is also proposed to carry out R&D activities in Project Mode with external-cum-internal funding support. The technology status of the project activities is given in Table - 1. Progress has been made in each area and we are in the process of establishing systems and support services to

accelerate the pace of development. We are also establishing a laboratory for Molecular Medicine with the objective of developing DNA based diagnostic methods for genetic and infectious diseases.

Details of specific activities are provided under each group/division.

Table- 1

Product/Process	Application & Status
Dental Composite	Material for dental filling, restoration & orthodontic bracket bonding. Efforts for Technology Transfer continued.
Hydroxyapatite	Material for bone augmentation. Lab scale process for porous granules developed ready for Technology Transfer.
Membrane Oxygenator	Disposable device in Open Heart/Heart Lung Bypass Surgery. Fabrication of prototypes & design validation are in progress.
Fibrin Glue	Augmentation of surgical haemostasis and tissue adherence. Applicator being developed.
Coating on Urinary Catheter	Reduction of friction and improved infection resistance. Lubricious hydrophilic coating and antimicrobial silver oxide coatings are under development.

Surface Modification of PVC	For PVC-based devices such as blood bags, two approaches are showing promise.
Molecularly Imprinted Polymer (MIP)	Sensors, Adsorbents. MIPS with multiple recognition sites synthesised.

Artificial Internal Organs

Dr. G. S. BHUVANESHWAR, MS, PhD
Engineer & Leader

Shri. C. V. MURALEEDHARAN, MTech
Engineer

Development of Membrane Oxygenator

The development of a hollow fibre membrane oxygenator in collaboration with SPIC Pharma Ltd., Chennai, made considerable progress. The major milestones were :

1. Fabrication of full prototypes
2. Process development for fibre potting and cutting
3. In-vitro test system for oxygen transfer rate and heat exchanger performance measurements.
4. Preliminary ex-vivo testing to correlate the measured gas transfer rates with the in-vitro system.
5. Design validation of the devices using Finite Element Analysis.
6. Freezing of the design.

Technical support was extended to M/s. TTK Pharma during the heart valve production at the

Institute. The design for valve sizes 19mm and 29 mm was completed and handed over to the industry.

New Proposal

The Indo-French collaborative project proposal for "Development of diamond like coatings for medical and other applications" was cleared by the IFCPAR and is awaiting final governmental clearance.

BMT Lan

Regular running and maintenance of the Local Area Network of personal computers of the BMT Wing (BMT LAN) was undertaken. The major software implementation, ISIS library information service and the local BMT Mail - internal e-mail system continued to be well utilised. The INTERNET access through the GIAS services of VSNL that the Division helped to set up in the library is being extensively used for information retrieval and internet e-mail.

Biomaterials

Dr. R. SIVAKUMAR, PhD

Leader

Dr. A. C. FERNANDEZ, PhD

Scientist

Dr. K. SREENIVASAN, PhD

Scientist

Dr. PRABHA D. NAIR, PhD

Scientist

Dr. T. RAMACHANDRAN, PhD

Scientist (on leave)

Shri. NIRANJAN D. KHAMBETTE, MTech

Scientist (on leave)

Dr. P. R. HARISHNA VARMA, PhD

Scientist (on leave)

Dr. ANNIE JOHN, PhD

Scientist

Shri. RAJESH R., MSc, MTech

Scientist (Temporary)

Shri. R. SREEKUMAR, BSc

Scientific Assistant

Shri. S. VIJAYAN, MSc

Scientific Assistant

Shri. P. R. HARI, BSc, AIE

Scientific Assistant

Ms. SHEELA GEORGE, MSc

Junior Research Fellow

Shri. ABHIRAMAN, MSc, MPhil

Junior Research Fellow

1.0 R&D Programmes

1.1 Ophthalmic Sponge

Consequent to the transfer of the technology of ophthalmic sponge to industry last year, the industry has been involved in a scale up of the technology.

The Institute has interacted with the industry

through standardisation of composition for scale up, fabrication of jigs and fixtures, evaluation of raw material and finished product and general trouble shooting. A batch of sponges prepared by the scaled up composition was evaluated by the Ophthalmic Dept. of MAHE, Manipal and found satisfactory.

1.2 Bioceramics and Glasses

Considerable effort was expended in standardising some of the unit processes like washing, mixing, pressing etc, that are required for converting product development into commercialisable technology. Both animal and clinical evaluation have shown expected bone regeneration in periodontal application.

In the study of osteoinduction, porous hydroxyapatite (HA) bioglass and HA-bioglass did not show any osteoinduction. Then some of the possible biological bone inductors like autologous bone, calf serum, fibrin glue and collagen were added to porous HA. The proliferation of differentiated cells was observed in porous granules.

The Technology profile document on HA granules is under preparation. It will be sent to prospective industries for further technology development with industrial partnership.

1.3 Molecular Imprinting

Techniques have been developed to modify monomers using metal ions and entities like cyclodextrins molecularly imprinted polymers (MIPs) based on the modified monomers were found to have improved absorption capacity compared to MIPs based on unmodified monomers. MIPs with recognition sites for more than one compound have been synthesised in the laboratory. Such polymers can be used in the construction of sensing elements capable of detecting multi components at a time.

1.4 Cyclodextrins

Research effort on cyclodextrins continued and it was seen that simple systems like indicator dyes - cyclodextrins combinations could be used as guest responsive colour change sensors. HPLC techniques have been developed to study the complexation of molecules with cyclodextrins.

1.5 Natural Products

A project namely "Screening of Nineteen Native Plants for Anti Viral compounds and other Bioactive substances" was submitted to Department of Biotechnology for financial assistance.

2.0 Testing and Evaluation

2.1 Analytical Laboratory

The analytical facilities of the laboratory have been extended to the various divisions of the Institute as well as to external organisations.

a) FTIR Spectrophotometer :

The newly installed FTIR spectrophotometer was extensively used for identification and characterisation of various samples. While over 1000 recordings have been carried out by FTIR for various Institute programmes, some samples have been run for external agencies such as Kerala State Forensic Lab, Hindustan Latex Ltd, Universities, etc. on payment basis. A new Thermal Analyser (TA Instrument) with SDT and DSC was installed in the laboratory. Around 50 samples were analysed as part of the installation training.

b) Gas Chromatography :

A gas chromatographic procedure has been developed to estimate the residual amount of ethylene oxide, ethylene glycol and epichlorohydrin in different matrices and a technical report has been prepared.

2.2 Microscopy

The SEM and TEM facilities were extended to internal research groups and to external requests on payment basis for the analysis of various samples in the field of biology, medicine, material science, geology, oceanography etc. In situ sample preparation of cultured cells like fibroblasts and myocytes and evaluation using SEM and TEM were carried out. Tissues like brain, blood vessels, tumours, insect tissues and polymer samples were processed. An Energy Dispersive Spectrometer was attached to the present SEM system for qualitative and quantitative analysis of materials.

3.0 Externally Funded Projects

3.1 "Development of an Interpenetrating Polymer Network (IPN) membrane for encapsulation of islet cells of Langerhans" (Prin. Investigator : Dr. Prabha D. Nair) DST project

As part of this project, several compositions of semi-IPNS of polyurethane and polyvinyl pyrrolidone or polymethyl methacrylate were prepared in porous and nonporous form. Some of the membrane compositions were selectively permeable and allowed the permeation of metabolites and nutrients within the physiological fluxes. The membranes were also impermeable to immunoglobulins. Similar membranes could also be prepared from polyvinyl alcohol and its blends as well as polyurethanes with varying hard segment and hydrophobic - hydrophilic balance. Studies on biodegradation, sterilisability and toxicology are ongoing.

3.2 "Biodegradation of Calcium phosphate-based ceramics in bone (Prin. investigator : Dr. Annie John) DST Project

The following Bone/Ceramic studies involving in vitro and in vivo experiments were carried out as part of the project.

- a. In vitro experiments involving dissolution studies with different buffers and using cells in direct contact with ceramics for evaluation in TEM, SEM and FTIR.
- b. In vivo experiments in soft tissue in muscle and in bone of rabbits for evaluation in TEM, SEM and FTIR.
- c. Fluorochrome labelling of bone to identify bone initiation sites and growth pattern.

Biosurface Technology

Dr. CHANDRA P. SHARMA, MTech, MS, ScD,
M.E.B.E

Scientist and Leader

Dr. THOMAS CHANDY, MSc, PhD

Scientist (on leave)

Ms. SINDHU C. V., MSc, MPhil

Senior Research Fellow

Hemoperfusion

Based on In vitro experimental data, polyvinyl alcohol microspheres were immobilised with phenylalanine and heparin as adsorbant. In-vivo experiments on goat are scheduled to be initiated shortly.

Prevention of Calcification

Attempts were made to study complement activation potential and the contribution of complement factors (biologic factors) on the calcification of PEG grafted bovine pericardium (BP) samples. PEG grafted BP activated using glutaraldehyde and carbodimide (EDC) exhibited relatively low complement activation and calcification. It was observed that the extent of calcification might be related to complement activation also.

Insulin delivery

Oral delivery of insulin is a more physiologically acceptable route than parenteral for the treatment of diabetes mellitus. Insulin encapsulated in alginate, cross-linked by a divalent cation in the presence of chitosan has a more desirable pattern of release of the drug in vitro. Oligomeric glucose compounds such as cyclodextrins and their derivatives have been found to increase the efficiency of absorption of peptide drugs. We have evaluated the release pattern of insulin in the presence of such compounds. More sustained release systems to carry the drug further to the intestine for absorption in that region are being attempted.

Engineering Service

Sri. O. S. NEELANKANTAN NAIR, BSc (Engg)

Engineer and leader

RAMESH BABU, BE

Engineer

Sri. K. P. R. BHAS, Dip. Engg.

Junior Engineer

This Division provided support to the various programmes of the Institute by way of fabrication of fixtures and machined components. Some of the notable ones include :

Two assembly fixtures for the concentric needle electrode alignment and arranging the set up for grinding the electrodes on continuous basis

A prototype model for the parallel flow cell chamber for treating the biomaterials with blood

Teflon mould for preparing the test specimens to study the compressive strength of epoxy resins

Moulds and Jigs for studying the tensile strength and shear strength of the dental composite.

In addition to the above, this Division also carried out the routine operation and maintenance activity of electric system, refrigeration & air-conditioning, plumbing and sanitation system, attendance data collection system, panbit, incinerator, telephone exchange and faculty hostel.

Microbiology

Dr. A. MAYA, MSc, PhD
Scientist

The microbiology laboratory facilities are being organised and modified to meet the R&D goals.

As modern medical and surgical practice have come to rely on prosthetic devices of various kinds, there has been an emergence of a new class of infections called implant-associated infections. The process of microbial colonisation of surfaces is sequential and involves a number of distinct stages. Each of these stages must be studied and understood in detail if suitable antiadhesive strategies have to be developed. Research activities have been initiated to understand the mechanisms of biofilm formation and antibiotic resistance and virulence of microorganisms isolated from implant-associated infections at the molecular level.

Pathophysiology

Dr. MIRA MOHANTY, MD
Scientist and Leader

DR. T. V. KUMARY, Ph.D
Scientist

Cell interaction studies of Hydroxyapatite (HA), Bioglass (BG) and Hydroxyapatite and Bioglass (HA-BG) Composite and EV-HAP composite were carried out. L929 mouse fibroblasts were found compatible with absence of cytotoxic effect by all these materials. Histological evaluation of tissue response to the above materials was carried out, following implantation in subcutaneous tissue in rats, intramuscular and intracranial implantation in rabbits for different time periods. All materials were biocompatible. Good repair and deposition of new bone was seen in response to HA and HA-BG composite.

Routine cytotoxicity studies were done on surface modified PVC and metal incorporated polyurethane.

The soft tissue response of fibrin glue was found satisfactory by histological evaluation of tissue response following sealing of wounds in skin, sclera, cornea, durameter and cranium in rats and rabbits. A commercially available imported glue was used as control.

Study on repair and formation of bone in periodontal cavities and mandibular cystic cavities in dogs, filled with hydroxyapatite granules and osteogen was completed. At the end of nine months in the periodontal study and one year in the mandibular cysts, good bone replacement was observed in both and the extent of repair was comparable.

Subcutaneous tissue response to radiopaque dental material over a period of 12 weeks and the oral toxicity study of various organs of that fed with extracts of the same material were also carried out.

Some of the other investigations include,

1. Morphological studies of osteoblasts and macrophages seeded on hydroxyapatite.
2. Development of an appropriate substrate for good transmission electron microscopic observation of morphological features of adherant cells without disturbing the pattern of adherence.
3. Laser interactions with intervertebral discs as part of the Laser Project of Department of Radiology.

Polymer

Dr. M. JAYABALAN, PhD
Scientist and Leader

Shri. VINOY THOMAS, MSc
Junior Research Fellow

“Process Optimisation in the development of high flex life polyurethane for cardiovascular applications” (Prin. Investigator : Dr. M. Jayabalan) DBT Project.

As part of the project, polyurethane ureas based on difunctional monomers 4,4 - dicyclohexyl methane diisocyanate - hydroxy terminated poly butadiene (HTPBD) - hexa methylene diamine / m-phenylene diamine were prepared in bulk using isocyanate index 1.08. Polyether urethane ureas were also prepared using mixed polyoles HTPBD and PTMG.

In vitro aging stability was evaluated using various media. The changes in weight and mechanical properties were investigated. No significant weight change was observed with any of these polymers during aging. However appreciable amount of absorption of lipid was observed, which could be

correlated with higher content of the polyol HTPBD. Aging under long-term bending stress in Ringer solution and PBS media. The samples subjected to permanent bending stress for 30 days in Ringer solution and PBS media exhibited high tensile strength with increase in aging time. However, polyurethane - ureas having higher percentage of diamine chain extender were found to retain the tensile properties without significant changes. The candidates polyurethane urea having tensile strength at break 15.75 ± 0.60 Mpa, % elongation at break 336.9 ± 15.2 and elastic modulus 6.841 ± 0.267 was subjected to accelerated flexural fatigue test. The polymer had completed 720×10^6 cycles at the time of failure.

Polymer Chemistry

Dr. A. JAYAKRISHNAN, PhD
Scientist and Leader

Sri. M. C. SUNNY, BSc., AIC
Scientific Assistant

Ms. LAKSHMI S., MSc
Junior Research Fellow

Surface Modification of PVC

The Division continued its research on the development of blood compatible and migration-resistant poly (vinyl chloride) by means of phase transfer catalyst mediated surface modification and also by chemical grafting of poly (ethylene glycol) onto the surface of PVC. Preliminary experiments revealed that the PVC surface modified using sodium sulphide showed considerably decreased adhesion of bacteria such as *S. Auras*. The modified PVC has potential as antimicrobial surface.

Using the phase-transfer-catalysis technique, an azide substituted PVC was prepared in the laboratory and characterised. This surface also was found to resist bacterial adhesion and growth compared to the unmodified PVC. However, the surface became highly coloured during the substitution of chlorine atoms on PVC using iodine under phase-transfer conditions was attempted in order to prepare surfaces resisting bacterial adhesion. Although the method led to good substitution in the case of PVC particles, the resultant product was found to be insoluble in most organic solvents. Attempts to prepare an iodinated PVC surface on the plasticized polymer did not succeed.

A state-of-art report on controlled drug delivery using microspheres, nanospheres and liposomes in coordination with the Faculty of Pharmacy, University of Paris Sud (XI), Paris under funding from Indo-French Council was completed.

Polymer Processing Group

Dr. R. SIVAKUMAR, PhD
Incharge

Dr. V. KALLIYANA KRISHNA, PhD
Scientist

Sri. ROY JOSEPH, MSc, MTech
Scientist

Dr. RAMESH P, MTECH, PhD
Scientist

DR. P. P. LIZYMOL, PhD
Scientific Assistant

Dental Composites

Effort continued to transfer the technology of visible light cured composites for orthodontic applications.

A dentine bonding agent is being developed as a part of the kit for dental composite. The shelf life of the bonding agent was studied at different temperature and depending on the performance, the formulation was optimised. Most of the recommended toxicological tests were carried out for the radiopaque composite and it was found non-toxic. The animal trials of the radiopaque composite is being carried out as per ISO guidelines.

A polyurethane based new formulation of dental composite was synthesised and characterised. Synthesis of the intermediate 1,3 bis (methacryloxy) x-hydroxy propane and the tetra methacrylate urethane adduct was carried out. The composite samples were prepared using this resin and the conventional BIS-GMA by varying proportions and their properties such as compressive strength, microhardness and aesthetics were studied.

Urinary Catheter development : Joint programme with Rubber Board, Kottayam

Latex formulations that passed the cell culture cytotoxicity tests were subjected to intracutaneous irritation tests. All the formulations caused tissue inflammation and failed in the test. The extracts on analysis showed the presence of accelerator residues. The additives were separately evaluated for their irritation potential and confirmed the above observation. The Rubber Board has agreed to find out various options for curing the latex. Many prototypes of urinary catheters were evaluated for dimensional variations, balloon performance and creep behaviour and compared the data with controls. The test catheter exhibited a high degree of creep, which needs to be rectified by proper latex formulation. Because of the manual dipping process employed for the production, there were

considerable variations in the dimension of catheters. This calls for development of an automated dipping unit. Because of the constraints of toxicity, creep, problems due to manual dipping, the scope of the project became different from what was initially envisaged.

Already two Indian manufacturers have started commercial production of urinary catheters. Keeping this in view, the above programme is not being pursued further. Based on the expertise generated so far, a new non-toxic latex formulation is under development.

Further, hydrophilic slippery coatings on latex rubber surfaces, a new programme to improve the surface characteristics of urinary catheters was initiated, which can add value to the commercially available catheter. The main aim is to develop lubricious hydrophilic coating to reduce friction. In one of the studies, the latex catheter was surface epoxidised and further grafted with a water soluble polymer having reactive carboxyl moieties. In another approach, maleic anhydride grafted surface was reacted with a tailor-made polymer having epoxide moieties. Even though the coefficient of friction values were reduced, there was a considerable deterioration in mechanical properties. Alternate methods to optimise the mechanical properties and friction were in progress.

Technical Co-ordination Cell

Sri. D. RANJIT, BE
Engineer

The Institute's activities related to INTELLECTUAL PROPERTY RIGHTS and co-ordination of the patent application from

various scientists were handled by the Technical Co-ordination Cell. This involved the liaisoning between the scientists and the patent attorney, M/s. L. S. Davar & Co., Calcutta.

Three new applications were filed for patent in India.

1. A process for the preparation of a urethane-based radiopaque, visible light-cured dental composites by Dr. V. K. Krishnan and P. P. Lizymol.
2. A method for fibrin glue preparation from single donor plasma unit - by Dr. Lissy K. Krishnan.
3. A process for the production of a modified biocompatible sponge for improved absorption of tissue fluids and surgical reconstruction - by Dr. Prabha D. Nair and Dr. R. Sivakumar.

The current status of the Institute's INTELLECTUAL PROPEERTY RIGHTS is as follows :

Patents sealed	24 Nos
Design held	12 Nos
Patents filed and pending	35 Nos

The Cell organised a three day science exposition from Oct. 15-17, 1997 (MEDISCAN-97) and a seminar on Hospital Management on Oct. 16, 1997 at Cochin in conjunction with Electronic Regional Testing Laboratory (South).

The Cell also co-ordinated the visit of various guests of the Institute and the students of different institutions.

Technology Proving Facility

Dr. G. S. BHUVANESHWAR, MS, PhD
Biomedical Engineer and Incharge

Shri. D. S. NAGESH, MTech
Engineer

Routine maintenance of the clean areas was carried out regularly and the facilities made available as and when required.

The main technical activity of the fabrication and assembly of prototype oxygenators was undertaken. About 23 prototypes have been fabricated and tested, leading to the freezing of the design. Development of the final design drawings of the oxygenator and venous reservoir was in progress. A centrifugal potting system also was developed for potting the hollow fiber and heat exchanger ends.

TPF continued to give support to the Industry sponsored programme on the production of Chitra Heart by M/s. TTK Pharma till Dec. 1997. Pilot plant production of Needle electrode under SPIC Pharma sponsored project is underway at the TPF.

Technology Transfer Cell

Sri. S. BALRAM, BTech
Scientist

The technology transfer cell continued to provide the necessary support for the various technology related activities. The formal memorandum of understanding with M/s. SPIC Pharma, Chennai for a joint technology standardisation programme for the Concentric Needle Electrode developed by the Institute was signed this year. The cell is coordinating the activities in connection with this programme. The first stage of the programme was completed by assembling and supplying 300 clinically usable electrodes to the industry partner.

The technology profile of Dental Composites for orthodontic application was advertised to attract industries for transfer of technology. The technology transfer activity for Hydroxyapatite porous granules has been initiated.

Regular follow up on the royalty payments from the various existing licences was carried out.

Thrombosis Group

Dr. LISSY K. KRISHNAN, MSc, PhD
Scientist and Leader

Mr. SANTHOSH KUMAR T. R., MSc
Senior Research Fellow

Ms. REŞMI K. R., MSc
Junior Research Fellow

Haematology Analyser

With the installation of a haematology analyser which can measure 12 blood parameters of human as well as various animal species, blood-material interaction can be evaluated more precisely. It is now possible to measure the mean platelet volume, platelet histogram of samples treated with biomaterials and correlate it to the material induced functional loss of platelets.

Development of Fibrin Glue

The effectiveness of Fibrin Glue was compared with the addition of aprotinin, which is an antifibrinolytic agent. Fibrin glue that was used to adhere skin patches in rabbit model was seen in the tissue seven days after the procedure, while the glue with aprotinin remained for 14 days. Wound healing was excellent in both the test and the control. The applicator is being developed to initiate clinical trials.

“Monoclonal antibodies against BTG and GMP-140, to detect clinical platelet activation” (Prin. Investigator : Dr. Lissy Krishnan), DST Project

Antibody producing hybridoma colonies were obtained against both P-thromboglobulin (P-TG) and granular membrane protein (GMP-140) antigens. The positive clones were under expansion and screening. The purification of antibodies from culture medium was carried out. The antibodies against GMP-140 cross reacted with few other membrane glycoproteins, as detected on immunoblot analysis. Therefore, subcloning of the hybridoma was also attempted to isolate the monoclonal antibodies that specifically recognize GMP-140.

Endothelial Cell Lining

Isolation of human umbelical cord vein endothelial cell (HUVEC) and its attachment to tissue culture plastic well using fibrin was standardized. Upto 4th passage of HUVEC seemed to attach and grow well on tissue culture plastic coated with fibrin glue. Attempts to seed HUVEC to polyester material used as vascular graft is in progress.

Clinical Research

Prothrombotic tendency of blood drawn from patients admitted for cardiopulmonary bypass was studied in collaboration with the Department of Cardiology. The parameters studied were response of platelet to physiological agonists, platelet count, platelet histograms, mean platelet volume, platelet crit, fibrinogen assay etc. Patients in the study group were off aspirin therapy for 10 days. 30 patients were investigated.

Toxicology

Dr. K. RATHINAM, MSc, PhD
Scientist and Leader

Dr. P. V. MOHANAN, MSc, PhD
Scientist

Toxicological tests such as systemic toxicity, intracutaneous irritation, haemolysis, sensitization, intramuscular implantation and subcutaneous implantation studies of different candidate material for the fabrication of various intra and extra corporeal devices and mandatory biological studies such as sterility and pyrogen tests on finished devices using International standard protocols were carried out.

Besides these, the group also managed the small animal facility which includes animals like guinea pig, rabbit, rat and mice required for the toxicological experiments.

A study on photosensitization of rat skin following aminoevulinic acid and haematoporphyrin-induced photodynamic therapy was undertaken in collaboration with the Department of Radiology.

Vivarium

Dr. G. ARTHUR VIJAYAN LAL, BVSc
Veterinary Scientist and Leader

Dr. P. R. UMASHANKAR, BVSc & AH
Veterinary Surgeon / Scientist

The group maintained laboratory animals like calf, sheep, goat, dog and poultry. They were procured as per requirement and used after preconditioning. An excellent infrastructure and expertise for executing experimental surgical procedures and relevant laboratory investigation were built up. Some of the

notable experiments carried out along with the surgeons of relevant disciplines included :

1. Mouse quadriceps assay for evaluation of osteoinductive materials
2. Craneoplasty experiments with HAP, BG and HAP-polymer composites for evaluating osteoconduction in rabbit model.
3. Effect of urokinase and papaverine on chronic vasospasm in an animal model of subarachnoid haemorrhage.
4. Standardisation of aseptic collection of neonatal calf serum.
5. Application of Fibrin glue during vascular graft surgery and neurosurgical application in rabbit model.
6. Animal studies on Laser ablation of intervertebral disc in dog model.
7. Renal embolisation using radiopaque microspheres in a dog model.
8. Osteocompatibility evaluation of BG and BG-HAP combination in a rabbit model.
9. Evaluation of Membrane Oxygenator prototype for gas exchange in a sheep model by CPB for one hour.

Visitors & Guest Lectures

1. Dr. R. Suryanarayanan of Laboratoire de Chimie des Solides, University of Paris-sud, France visited in Dec. 1997 for discussions on the implementation of the joint project : Development of Diamond like coatings for biomedical and other applications.
2. Prof. Gundu H. R. Rao, Department of Laboratory Medicine, School of Medicine, University of Minnesota visited from 27.10.97 to 24.10.97. He delivered a talk on "Platelet activation as a risk factor in cardiovascular diseases" at BMT Wing lecture Hall on 28.10.97.

Publications

I Books

1. Text Book of Medicine - Vasam R. S., Sudha Seshadri, 1998, First Edition, Orient Longman Madras (1387 pages)

II Chapter in Books

1. Bohnen N.I., Radhakrishnan K. 'O'Neill B.P. Kurland L T-Discriptive and analytic epidemiology of brain tumours. In cancer of the Nervous system, Black P M, Loeffler J S (eds) Blackwell Science, Cambridge, Massachusetts 1997, 3-24.
2. Kartha C. C. Cardiomyopathies in Madhavan M. (ed) Frontiers in Surgical Pathology, University of Madras, Chennai, 1997. 1-18.
3. N. Krishnaji - "Working mothers and child survival in rural India" in Ranabir Samddar (ed) Women in Asia, work, culture and Politics in South and Central Asia, Delhi, Vikas 1997.
4. Krishnaji N. : "Population Policy" in Terence Byres (ed). The Indian Economy - Major Debates since Independence, New Dlehi, Oxford University Press, 1998.
5. Krishnaji N. and Krishnan T. N. "Terms of Trade and Demand Patterns" - in Deepak Nayyar (ed) Economics as Ideology and Experience London, Frank 1998.
6. Vasam R. S., Levy D : Role of hypertension in the pathogenesis of heart failure in "controversies in the management of heart failure" edited by Andrew Coats, Churchill Communications, INC, First edition 1998.

III Scientific Publications:

1. Appukuttan P.S., Annamma K.I., Geetha M, Jaison P.L. Separation of bovine heart galactose lectin from endogenous glycoproteins copurified with the lectin during affinity chromatography J, Biosciences 1997; 23:137-141.
2. Ashokan K. K, Umashankar P.R, Lal A.V, Rathinam K. Observations of Proteus mirabilis from rabbit conjunctiva and its relation to Vitamin A deficiency, Ind. Vet. Jour, 1997, 74, 471-473.
3. Bhaskara Rao M, Rout. D, Radhakrishnan V. V Suprasellar Meningioma subsequent to treatment for a pituitary adenoma - A case report. Surgical Neurology, 1997; 47: 443-6.
4. Bhaskara Rao M, Radhakrishnan K, Thomas S.V: Epilepsy surgery in a developing country. Clinical Neurology and Neurosurgery 1997; 99, 53.
5. Bhaskara Rao M, Misra B.K, Rout D. : Spinal subdural abscess - Neurology India 1997; 45: 279-280.
6. Bhaskara Rao M : Surgery for intractable epilepsy : SCTINST experience. Neurol India; 1997, 45:3.
7. Calne DB, de la Fuente Fernandez R, Kishore A. Contributions of positron emission tomography to elucidate the pathogenesis of idiopathic, parkinsonism and dopa responsive dystonia. Journal of Neural transmission 1997, 50, 47-52.
8. Dalal Y, Nair S, Radhakrishnan V.V, Rajan B: Supratentorial high grade gliomas : A comparative analysis. Neurol India, 1997, 45, suppl 1, 41

9. Eapen J. T. : An electronic device for recording behavioural activities of bivalves. *Indian Journal of Experimental Biology* 1997, 35, 663-64.
10. Eapen J. T. "Elevated levels of cerium in Tubers from regions endemic for endomyocardial fibrosis (EMF); *Bull Environ Contum Toxicol* 1998 60:168-170.
11. Eapen J.T., Kartha C.C., Valiathan M.S. "Cerium levels are elevated in the serum of patients with Endomyocardial Fibrosis (EMF) : *Biol Trace Elem Res* 1997 59 (1-3) : 41-44.
12. Gupta A.K. Intravascular stent - "Past, Present nad Future" in *Vascular and Interventional Radiology* ed S. Sharma Springer-Verlag 1997 97-100.
13. Hari. P. R, Paul W. & Sharma C.P. : A die based system as heparin adsorbent, *Biomedicine*, 1997, 16, 57-60.
14. Jaisy Mathai, Sulochana P.V., Sathyabhama S. Para Bombay Phenotype - A case report. *Indian J. Pathol Microbiol* 1997, 40, 553-554.
15. Jayabalan M. : Tissue compatible and blood compatible poly urethane - current challenges and new developments, *Macro molecules - New Frontiers*, Vo. II, K.S.V. Sreenivasan (ed), Allied Pub. Ltd., New Delhi, 1998, 609-612.
16. Jayabalan M. : P. P. Lizymol and Vinoy Thomas : Synthesis and evaluation of aliphatic low elastic modulus polyurethane - urea for biomedical applications, *Macromolecul.ares - New Frontier*, Vol. II, K.S.V. Sreenivasan, Allied Pub. Ltd., New Delhi, 1998, 617-620
17. Jayabalan M and Lizymol P. P. : Effect of gamma-radiation sterilization on the stability of polyurethane potting compound based on castor-oil used for hollow fiber hemodialiser, *Bull. Mater. Sci.* 1997, 20 (5) : 727-735
18. Jayabalan M. and Lizymol P. P. : Chemical modification of surface of PVC materials for presentations of Plasticizer migration for blood contact applications, *Biomedicine*, 1997, 17 (1) : 41-47.
19. S. R. Jameela, N. Suma, A. Jayakrishnan : Protein release from poly (ε-caprolactone) microspheres prepared by melt encapsulation and solvent evaporation techniques : A comparative study, *Journal of Biomaterials Science*, 1997, 8, 457.
20. Jayakrishnan A., M. S. Latha : Therapeutic possibilities using bovine milk protein casein as a drug delivery matrix, *Macromolecules : New Frontiers*, K.S.V. Srinivasan, Ed., Allied Publishers, New Delhi, 1998, P.590.
21. Jayasekar P., Mohanan P. V., Rathinam K. : Hepatoprotective activity of ethyl acetate extract of *Acacia catechu*, *Ind. Pharmacol.* 1997, 29, 426-428.
22. Joseph P. K, Anil Bhat, Bimal Francis et al : Percutaneous transvenous mitral commissurotomy using Inoue balloon in children with rheumatic mitral stenosis. *International Journal of Cardiology* 9(1997) 62 19.
23. Kachhara R., Nair S., Gupta A. K. - Fenestration of the proximal anterior cerebral (AL) artery with aneurysm manifesting as subarachnoid haemorrhage. *Neurogia medico - chirurgica* 1997, 38, 7.
24. Kachhara R., Nair S., Kurian N. I., Bhaskara Rao M., Nambiar U., Menon G. : Surgery for

- ophthalmic segment (paraclonoid) aneurysms. *Neurol India* 1997, 45 suppl 1, 54.
25. Kalliyankrishnan V. : Composites in Restorative Dentistry in Polymers : Synthesis and Applications, P. Siongh, D. K. Vohra & D. Singh (Eds), Allied Publishers Ltd., New Delhi 247-252, 1997.
26. Kalliyankrishnan V., Manjusha K and Yamuna V. : Effect of diluent upon the properties of a visible light cured dental composite, *J. Materials Science, Materials in Medicine*, 1997, 8, 703-706.
27. Kannan V. M., Appukuttan P. S. : Relative affinities of bovine brain 14 K Da galactose lectin binding to individual endogenous gangliosides. *Indian J Biochem and Biophy* 1997, 34, 249.
28. Keshav Das C., Joseph S., Gupta A. K., Raghavan A., Mehta P - Magnetic Resonance Angiography in Axillobifemoral grafting. *J Cardiovascular Surgery*, 1998 Vol 40.
29. Kishore A. Turnbull IM, Snow B. J et al. Efficacy, stability and predictors of outcome of pallidotomy for Parkinson's disease. *Brain* 1997, 120, 729-737.
30. Kishore A. Posteroventral Pallidotomy. A treatment option for advanced Parkinson's disease (editorial) *Neurology India* 1997; 45 : 208-210.
31. Krishnaji N., "Human Poverty Index - A Critix" *Economic and Political Weekly*. Vol. 32 No. 35 2202-5.
32. Kurian N.I., Nair S., Parameswaran S. Bhaskara Rao M., Kachhara R., Menon G., Gupta A. K. : Lhermitte - Ducloss disease with Cowden's syndrome. *Neurol India* 1997, 45, 68-69.
33. Kurian N.I., Nair S., Kachhara R., Menon G. - Posterior circulation aneurysms : A surgical challenge. *Neurol India*, 1997, Vol. 45, 1, 55.
34. Lakshmi S., Jayakrishnan A. : Photo-crosslinking of dithiocarbamate - substituted PVC reduces plasticizer migration, *Polymer*, 1998, 39, 151.
35. Lakshmi S., Jayakrishnan A. : Grafting poly (ethylene glycol) onto plasticised poly (vinyl chloride) via Williamson ether synthesis : A simple novel route to improve the blood compatibility of PVC, *Artificial organs*, 1997, 21, 483.
36. Lissy K. Krishnan, : Shape change and hypotonic shock response measurement to assess functional efficacy of platelets. *Current Science*, 1998, 74, 25.
37. Manu S., Usha U., Jyothi S., Kalliyankrishnan V. and Pal S. N. : Effect of silanation of filler particles on the physical properties of a dental composite, *Ind. J. Engg. Mater Sci.* : 1998, 5, 28-32.
38. Mohanan P. V., Rathinam K., Devi. K. S. : Effect of Sobatum on ultraviolet induced damage and superoxide production, *Indian J. Den. Res.*, 1997, 95.
39. Mohanan P. V., Devi K. S. : Effect of Sobatum on radiation induced toxicity in mice, *Cancer Letts (UK)*, 1998, 123, 141-145.
40. Mohanan P. V., Devi K. V. : Mutagenicity and Antimutagenicity evaluation of Sobqatum by In Vitro method, *J. Biomedicine*, 1997, 17 (1), 9-15.

41. Mohanan P. V., Rathinam K. and Devi K. S. : Effect of Sobatum on ultraviolet induced damage and superoxide production, *Ind. Pharmacol*, 1997, 29 (2), 129-131.
42. Nair R. R., Hari P. R., Doherty P. J & Sharma C. P. : Surface Modification - Changes in cell adhesion - A Report, *Trends Biomateri. Artif. Organs*, 1998, 12, 1.
43. Nair S., Pai K. M., Menon G., Kachhara R., Kurian N. I. : Management of intramedullary lesions - progress in clinical neurosciences 1997, 12, 331 - 343.
44. Nair S., Thakker S., Ignatious K., Joseph S. - Syringomyelia Chiari complex A newly proposed grading system with clinicoradiological correlation. *Clinical Neurology and Neurosurgery* 1997, 99, suppl 1-177, 1997.
45. Nair S., Varma R. G., Kachhara R., Kurian N.I, Menon G. Haemangioblastomas of the Neuraxis : operative outcome *Neurol India* 1997, 45, 1, 57-58.
46. Nair S., Prithvi V., Menon G., Kurian N.I., Kachhara R., Nambiar U. : Distal anterior cerebral artery neurysms : operative outcome. *Neurol India* 1997, 45, 1, 55.
47. Nair S., Kurian N. I., Kachhara R., Menon G., Misra B. K. : Ependymomas of the third ventricle. *Neurol India* 1997, 1, 45, 76, 1997.
48. Nair S., Rajneesh K. - Rare intracranial schwannomas. *Neurol India*, 1997 45, 30.
49. Nair S., Parameswaran S., Menon G., Kurian N.I., Kachhara R. Symptomatic Chiari malformation. *Neurol India*, 1997, 45, 1, 12-13
50. Narayanan S. K., Kuruvilla A., Shanmugam J., Radhakrishnan V.V. Fast-wave periodic complexes in a mentally retarded child who later developed subacute sclerosing panencephalitis : a modification of a classic EEG by preexisting brain damage? *Developmental Medicine and child Neurology* 1997, 39, 766-769.
51. Nayak S.D., Nair M.D., Radhakrishnan K., Sankara Sarma P. : Ischemic stroke in the young adult :, Clinical features, risk factors and outcome. *National Medical Journal of India*. 1997, 10, (3) 107-112.
52. Nayak S.D., Radhakrishnan K. Ictus emeticus *JANEI*, 1997, 2, 154-156.
53. Paul W. & Sharma C. P. : Infection Resistant Hydroxyapatite/Alginate Plastic Composite, *J. Mater. Sci. Letters*, 1997, 16, 2050-2051.
54. Prabha D. Nair, A. Deepa, C. Radhakumary, Permeation characteristics on non porous semi IPN membranes of polyurethane for immunoisolation, *Macromolecules - New Frontiers*, Vol. 1, 507-510, 1998, Allied Science Publishers.
55. Prabha D. Nair, Doherty P. J., Williams D.F. : Influence of steam sterilization induced surface changes of polyester material on its biocompatibility, *Bull. Mat. Sci.* 1997, 20, 7, 991-1000.
56. Prabhu N.K.K., Joseph S., Gupta A.K., Gayathri, Keshay Das C. Syringomyelia with van Recklingham disease. *AJNR*, 1997, 18.
57. Prakash Kumar B., Shivakumar K., Depressed anti oxident defense in rat heart in experimental magnesium deficiency. *Biological Trace Element Research* 1997, 60, 139-144.

58. Preetha Nair and Renuka Nair. Selective use of calcium enhances the yield of calcium - tolerant myocytes from adult heart. *Indian Journal of Experimental Biology* 1997, 35, 451-456.
59. Radhakrishnan V.V., Nair M.D., Kuruvilla A., et al. Inflammatory myopathies - A clinicopathological study. *Indian Journal of Pathology and Microbiology* 1997; 40 (3) 315-320.
60. Radhakrishnan V.V., Nair M.D., Kuruvilla A. et al. Spinal muscular atrophy - A clinicopathological analysis. *Indian Journal of Paediatrics* 1997, 64; 687-691.
61. Radhakrishnan V.V., Saraswathy A., Radhakrishnan N.S., Kuruvilla A., Radhakrishnan K. : Mitochondrial Myopathies. A clinicopathologic study. *Indian J. Pathological* 1998; 44:5-10.
62. Ranjit. A, Kishore A., Botton C.F., et al. Dopa responsive non progressive, Juvenile. Parkinsonism Report of a case. *Movement Disorders* 1997, 12 (3) 453-456.
63. P. Ramesh, *Elastomers for Biomedical Applications : Proceedings of the National Seminar on Elastomeric Materials - Manufacture and Characterisation, Chennai, Elastomers* 98, 98-101.
64. Rathinam K., Shelly Oommen, J. Madhusudana Rao : Effect of herbal tribal preparation RRL-12 in reducing blood sugar level, *J. Biomedicine*, 1997, 17, 49-52.
65. Renuka Nair. Association of dermatoglyphics and hand clasping with epilepsy *Biomedicine* 1996, 16, 53-56.
66. Sandhyamani S. : Vasculopathic and Cardioomyopathic changes induced by low-protein high carbohydrate cornstarch based diet in bonnet monkey : *Annals of the National Academy of Medical Sciences (India)*, 1997, 33, : 61-67.
67. Sanjeev V. Thomas, Pradeep Kumar S., Rajmohan. First ever seizure in the elderly : a seven year follow up study. *Seizure* 1997, 6; 107-110.
68. Santhosh Kumar B., Shenoy K. T., Radhakrishnan K., Radhakrishnan V.V Mitochondrial Neurogastro intestinal Encephalomyopathy : a South Indian family with two affected siblings. *Neurology India* 1997; 42; 87-90.
69. Santhosh Kumar B., Alexander A., Sarma P.S., Radhakrishnan K. A clinical trial of Ginkgo biloba in refractory partial epilepsy. *Journal of Association of Physicians of India*. 1997; 45 : 759-762.
70. Santhosh Joseph, Gupta A.K., Nandakumar K., Rao S., Chazoor T.A., George J., Sharma S.R., Prabha M. K. - Comparative study of analog and digital images in the setting of picture archival and communication system (PACS), 1997, *IJRI Vol.3* 203-209.
71. Sarada C. : Inflammatory demyelinating polyneuropathies. *Recent trends in rehabilitation medicine* 1997; 66-70.
72. Sharma C.P. : Biomedical polymers - blood compatibility, *Macromolecules New Frontiers*, Vol. II, Proceedings of the IUPAC International Symposium on Advances in

- Polymer Science & Technology, MACRO-98 (Ed. K.S.V. Srinivasan), 1998, 556-559.
73. Sharma C.P. : Bacterial adhesion on polymers, Trends Biomaterials Artif. Organs, 1997, II, 18-19.
 74. Shanmugham J. : Research with medicinal plants in India, Editorial, Biomedicine 1996, 16 IV 1996.
 75. Shiva Kumar K. and Prakash Kumar B. Magnesium deficiency enhances oxidative stress and collagen synthesis invivo in the aorta of rats. International Journal of Biochemistry and cell Biology 1997, 29, 1273-78.
 76. Shrivastava G., Krishna Manohar S.R Leutic Aneurysm of ascending aorta with aorta to right atrial fistula. Asian cardiovascular and Thoracic Annals 1997, 5, 186-187.
 77. Sindhu C.V., Chandy T. & Sharma C.P. : Influence of polyethylene glycol grafting on the in vitro degradation and calcification of bovine pericardium, J. Biomat. 1997, II, 430-452.
 78. Sindhu C.V. & Chandy T. : Effect of alternative crosslinking techniques on the enzymatic degradation of bovine pericardium and their calcification, J. Biomed. Mater. Res. 1997, 35, 357-369.
 79. SO EL, Radhakrishnan K., Silbert P.L., Casino G.D., Sharbrough F.W., O'Brein P.C. Assessing changes over time in temporal lobectomy : outcome by scoring seizure frequency Epilepsy Res 1997; 27 : 119-25
 80. Sreenivasan K., : Absorption characteristics of a membrane based on Beta cyclodextrin towards testosterone and progesterone, J. Applied. Polym. Sci., 1997, 64, 1811.
 81. Sreenivasan K., A note on the selectivity of gamma radiation polymerised molecularly imprinted polymer, polymergels and Networks, 1997.
 82. Sreenivasan K., : Synthesis and evaluation of Beta cyclodextrin - 2 hydroxy ethyl methacrylate copolymer as a novel absorbent, Polym. Internationa, 1997, 42, 22.
 83. Sreenivasan K., : on the feasibility of using molecularly imprinted poly (HEMA) as a sensor components, Talanta, 1997, 44, 1137.
 84. Sreenivasan K. and Sivakumar R. : Interaction of molecularly imprinted polymers with creatinne, J. Appl. Polym. Sci., 1997, 66, 2539.
 85. Sreeja K. K. and Kalliyanakrishnan V. : Studies on poly (methyl methacrylate) / Polyestylene copolymers for potential bone cement applications, Metals, Materials and Processes, 1996, 8, 315-322.
 86. Syam Sunder K. B., Sudha Laxmi, Bimal Francis, Jaganmohan Tharakan : Atherosclerotic coronary artery disease in hypertrophic cardiomyopathy : JAPI, 1999, Vol. 45, No. 6.
 87. Thakker S., Nair S., George A.J., Menon G., Kachhara R., Kurian N.I. Brain abscess in congenital cyanotic heart disease. Neurol India, 1997, 45, 1, 57.
 88. Thakore V., Unnikrishnan M., Neelakandhan K. S. Hepatorenal bypass by renovascular hypertension Journal Neurol 1997, S. 1, 5, 62-64.

89. Usha Kandaswamy, Jaisy Mathai, Sulochana P.V., Sathyabhama S. A study on knowledge and attitude of blood donors towards transfusion transmitted diseases *Biomedicine* 1997, 17, 53-56.
90. Valiathan A. and Kalliyankrishnan V. : Development and clinical evaluation of Chitra visible light cure composite, *Proceedings of Rocky Mountain Biomedical Engineering Conference, USA, April 11-13, 1997, 447-452, Abstract in J. Long Term Effects of Medical Implants, 7(2), 195-96, 1997.*
91. Vasana R.S. Is a 'lot' necessarily better than a 'little'? Impact of aggressive cardiac revascularisation strategies. *National Medical Journal of India* 1998; II; 18-19.
92. Vasana R. S., Community health works in tuberculosis control *National Medical Journal of India* 1997, 10:283-284.
93. Vasana R.S., Larson M.G., Levi D., Evans J.C. Benjamin E. J. Distribution and prognostic significance of echo cardiographic values in exceedings reference limits. *Circulation* 1997, 96, 1853-1873.
94. Vasana R. S, Larson M.G., Benjamin E. J, Evans J. C, Levi. D - Left ventricular internal dimensions and risk of congestive heart failure in subjects free of myocardial infarction at baseline. *N Eng J Med* 1997 336, 1350-1355.
95. Xavier J, Attawar S, Krishna Manohar S. R. Pentology of cantrell a case report *Indian Heart Journal* 1997, 49, 547-548.

Patents Filed This Year

1. A process for the preparation of urethane based radiopaque, visible light-cured dental composites by Dr. V. Kalliyana Krishnan and P. P. Lizymol.
2. A method for fibrin glue preparation from single donor plasma unit - by Dr. Lissy K. Krishnan.
3. A process for the production of a modified biocompatible sponge for improved absorption of tissue fluids and surgical reconstruction - by Dr. Prabha D. Nair and Dr. R. Sivakumar.

Patents Granted This Year

1. A process for the development of biocompatible hydroxyapatite
Dr. Chandra P Sharma, Willi Paul and Dr. R. Sivakumar
Application Date : 2-8-93
2. A process for manufacture of spherical, highly porous beads of polymers of 2-Ohydroxyethyl methacrylate (PHEMA)
Dr. A. Jayakrishnan, Dr. B. C. Thanoo
Application Date : 2-7-90
3. A process for the preparation of calf serum for tissue culture
Dr. Lissy Krishnan and Dr. Arthur Vijayan Lal
Application Date : 9-1-95

Externally Funded Research Projects

1. Title :

Characterization of glycoconjugates containing tumour-related epitopes, terminal alpha-gal and T-antigen in normal neoplastic tissue using Jacalin.

Principal Investigator :

Dr. P. S. Appukuttan

Funded by :

Council for Scientific and Industrial Research, New Delhi.

Duration : 3 years

Status : Ongoing

2. Title:

Interaction of human serum anti-galactoside antibody (anti-gal) with autologous brain glycoconjugates bearing corresponding epitopes.

Principal Investigator :

Dr. P. S. Appukuttan

Funded by:

Science, Technology and Environment Committee, Government of Kerala.

Duration : 3 years

Status : Ongoing

3. Title:

Stimulation of Cardiac fibroblast proliferation by lanthanides.

Principal Investigator:

Dr. R. Renuka Nair

Funded by:

Indian Council of Medical Research, New Delhi.

Duration : 3 years

Status : Ongoing

4. Title:

Mechanism of cardiac fibrogenesis in experimental magnesium deficiency.

Principal Investigator:

Dr. K. Shivakumar

Funded by:

Department of Science and Technology, Government of India.

Duration : 3 years

Status : Ongoing

5. Title :

Psychosocial interventions in a group of intractable epilepsy patients.

Principal Investigator :

Dr. Dinesh Nayak

Funded by:

Science, Technology and Environment Committee, Government of Kerala

Duration : 1 year

Status : Ongoing

6. Title :

Surgical treatment for intractable complex partial epilepsy.

Principal Investigator:

Dr. K. Radhakrishnan

Funded by:

Science, Technology and Environment Committee, Government of Kerala.

Duration : 2 years

Status : Ongoing

7. Title:

Comprehensive care programme for Parkinson's disease.

Principal Investigator:

Dr. Asha Kishore

Funded by:

Kerala Transport Development Finance Corporation

- Duration : 3 years
Status : Ongoing
8. Title :
An epidemiological survey of developmental language disorders and learning disability among school children in Kerala.
Principal Investigator:
Dr. P. A. Suresh
Funded by:
KRPLLD, CDS and Department of Health, Government of Kerala
Duration : 2 1/2 years
Status : Ongoing
9. Title:
A comparative study of free radicals in stroke, TIA, Dementia of Alzheimers type and migraine with aura.
Principal Investigator:
Dr. P. A. Suresh
Funded by:
Science, Technology and Environment Committee, Government of Kerala.
Duration : 3 years
Status : Ongoing
10. Title :
Local intraarterial urokinase therapy for acute ischemic stroke in the carotid territory.
Principal Investigator:
Dr. K. Radhakrishnan
Funded by:
Indian Council of Medical Research, New Delhi
Duration : 2 years
Status : Ongoing
11. Title:
A randomised, double-blind, placebo controlled cross over add-on clinical trial to define the safety and efficacy of Ginkgo-Meckel among patients with medically intractable complex partial epilepsy.
Principal Investigator:
Dr. B. Santhosh Kumar
Funded by :
German Pharmaceuticals
Duration : 1 year
Status : Ongoing
12. Title:
Prognostic indicators for Neuropsychological dysfunction in Epilepsy.
Principal Investigator:
Dr. Sanjeev Thomas
Funded by:
Indian Council of Medical Research, New Delhi.
Duration : 2 years
Status : Ongoing
13. Title:
Seizure; An artificial intelligence programme for diagnosis of Epilepsy.
Principal Investigator:
Dr. Sanjeev V. Thomas
Funded by:
Department of Electronics, Government of India.
Duration : 2 years
Status : Ongoing
14. Title:
Kerala Registry of Subacute Sclerosing Panencephalitis
Principal Investigator:
Dr. K. Radhakrishnan
Funded by:
Science, Technology and Environment Committee, Government of Kerala.
Duration : 3 years
Status : Ongoing
15. Title:
Epidemiological survey of epilepsy

Principal Investigator:

Dr. K. Radhakrishnan

Funded by:

Indian Epilepsy Association and SCTIMST

Duration : 2 years

Status : Ongoing

16. Title:

An open-label study on the safety & efficacy of long term Tiagabine administration in patients with epilepsy unsatisfactorily controlled with other antiepileptic medications.

Principal Investigator:

Dr. K. Radhakrishnan

Funded by:

Novo Nordisk

Duration : 2 years

Status : Ongoing

17. Title:

Studies on Mucoïd vasculopathy in Kerala.

Principal Investigator:

Dr. S. Sandhyamani

Funded by:

Department of Science and Technology, New Delhi.

Duration : 3 years

Status : Ongoing

18. Title:

Development of an immunodiagnostic system for tuberculous meningitis to laboratories in developing countries.

Principal Investigator:

Dr. V. V. Radhakrishnan

Funded by:

Department of Science and Technology, New Delhi

Duration : 3 years

Status : Ongoing

19. Title:

The effect of urokinase and papavarine on chronic vasospasm in an animal model of subarachnoid haemorrhage.

Principal Investigator:

Dr. Santhosh Joseph

Funded by:

Department of Science and Technology, New Delhi.

Duration : 3 years

Status : Ongoing

20. Title:

Study of the carrier state of potential pathogenic bacteria in the nose, throat and sternal skin of the patients undergoing cardiac surgery and its relation to wound infections during their post-operative periods.

Principal Investigator:

Dr. J. Shanmugam

Funded by:

Science, Technology and Environment Committee, Government of Kerala

Duration : 3 years

Status : Ongoing

21. Title:

Identification and Characterisation of protective antigens of Myco-tuberculosis with the potential practical benefits of identifying as vaccine candidate and as reagents for diagnostic tests.

Principal Investigator:

Dr. Muralidhar K. Katty

Funded by:

Science, Technology and Environment Committee, Government of Kerala

Duration : 3 years

Status : Ongoing

22. Title:

Participatory approach to augment voluntary blood donation in the community.

Principal Investigator:

Smt. Usha Kandaswamy

Funded by:

KRLLPD and Centre for Development Studies.

Duration : 2 years

Status : Ongoing

23. Title:

Development of hollow fibre-based membrane oxygenator

Principal Investigator:

Dr. G. S. Bhuvaneshwar

Funded by:

SPIC Pharma Ltd., Madras

Duration : 2.5 years,

Status : Ongoing

24. Title :

Monoclonal antibodies against BTG and GMP-140, to detect clinical platelet activation

Principal Investigator:

Dr. Lissy K. Krishnan

Funded by:

Department of Science & Technology,
New Delhi

Duration : 3 years,

Status : Ongoing

25. Title:

Development of an Interpenetrating Polymer Network (IPN) membrane for encapsulation of islet cells of Langerhans

Principal Investigator:

Dr. Prabha D. Nair

Funded by:

Department of Science & Technology, New
Delhi

Status : Ongoing

26. Title:

Process optimisation in the development of high flex life polyurethane for cardio vascular applications

Principal Investigator:

Dr. M. Jayabalan

Funded by:

Department of Biotechnology, New Delhi

Status : Ongoing

Duration : 3 years

27. Title :

Biodegradation of Calcium phosphate based ceramics in bone

Principal Investigator:

Dr. Annie John

Funded by:

Department of Science & Technology, New
Delhi

Status : Ongoing

Duration : 3 years

28. Title :

Technology standardisation of Concentric Needle Electrode

(A joint programme with industry leading to Technology Transfer)

Principal Investigator :

Dr. R. Sivakumar

Funded by:

SPIC, Chennai

Duration : 18 months

Status : Ongoing

29. Title:

Bioprosthetic associated calcification :

Prevention via surface modifications and target drug delivery

Principal Investigator:

Dr. Thomas Chandy (on leave since July 1996)

Principal Co-investigator:

Dr. Chandra P. Sharma

Funded by:

Department of Biotechnology, New Delhi

Duration : 3 years

Status : Completed

Visits by Academic Staff Abroad

1. Abraham Kuruvilla, Assistant Professor, attended the 16th World Congress of Neurology at Buenos Aires Argentina, September 1997.
2. Asha Kishore, Associate Professor, attended the 49th American Academy of Neurology at Boston, USA in 1997, the 12th International Symposium on Parkinsons disease at London, 1997 and visited Neurodegenerative disorders centre, University of British Columbia, Canada.
3. Bhaskara Rao, Assistant Professor, visited the Department of Neurosurgery of the University Hospital, Umea, Sweden, July 1997.
4. Gupta A. K., Additional Professor, attended 83rd Annual Scientific Meeting of Radiological Society of North America on November 30-December 5, 1997 at Chicago, USA.
5. Jaganmohan Tharakan, Professor, participated in a seminar on "Interventional Cardiology conducted by the Department of Cardiology, Hospital Charles Nicolle, ROUEN, France, from 29.09.97 to 07.10.97.
6. Mohandas K., Director of the Institute, participated in the 14th Annual Scientific Sessions of the College of Anaesthesiologists of Sri Lanka at their invitation during 23-25 January, 1998 and delivered a guest lecture on "Multiple organ dysfunction syndrome in ICU" on 24.1.98. He visited Mexico during 14-28 February, 1998 to participate in the Global meeting of INCLIN.
7. Radhakrishnan. K, Professor, participated in the 22nd International Epilepsy Congress, Dublin, Ireland July 1997. He also visited epilepsy section of Mayo Clinic, Rochester, July 1997. Visited epilepsy section, Childrens hospital, Madison, USA, July 1997.
8. Radhakrishnan. V. V, Professor, (a) visited the Department of Pathology, John Mc Cillan Memorial Hospital University of Arkansas Medical Sciences Little Rock, USA, April - June 1997. (b) Visited the Department of Molecular Biology University Hospital, Singapore in February 1997. (c) Department of Neurology University Hospital, Sydney, October 1997.
9. S. Sandhyamani, Additional Professor, attended the Annual Congress of the International Academy of Pathology (South African Division) at Cape Town and conducted a slide seminar on cardiovascular pathology July, 1997. She also gave lectures at 7 medical centres in South Africa in July 1997.
10. Sanjeev. V. Thomas, Associate Professor, underwent short training in the epilepsy services at the Institute of Epileptology and King's College, London 1997 and short term training in epilepsy services at Bethel Epilepsy Centre, Bielefeld, Germany, 1997. Further he attended 16th World Congress of Neurology at Buenos Aires, Argentina, September 1997.
11. Suresh Nair, Additional Professor, participated in the 4th Asian Oceanian International Congress of skull base surgery at Islamabad,

Pakistan, November 1997. He also attended the workshop on functional and stereotactic surgery at Karolinska Hospital, Stockholm, Sweden, October 1997.

12. Thankappan. K. R, Associate Professor, attended a workshop on "Using burden of disease and cost effectiveness to define national control priorities and essential packages of care" during December 1997 at Stowe Vermont, USA.
13. Uma Nambiar, Assistant Professor, visited the Department of Paediatric Neurosurgery of Necker Enfants Malades, Paris and the Department of Neurosurgery of New York University of Medical centre during June to September 1997.

STATEMENT OF ACCOUNTS 1997-98



SREE CHITRA TIRUNAL
INSTITUTE FOR MEDICAL SCIENCES AND TECHNOLOGY
Thiruvananthapuram, Kerala

Contents

Balance Sheet	60
Income & Expenditure Account (General)	62
Income & Expenditure Account (Hospital Wing)	64
Income & Expenditure Account (Bio Medical Technology Wing)	66
Receipts and Payments Account	68
Schedule of Fixed Assets	70
Audit Certificate	71

Balance Sheet As at 31st March 1998

Figures for the previous year		GENERAL FUND AND LIABILITIES	Amount	
Rs	Ps		Rs	Ps
GENERAL FUND :				
604874118.24		Balance as per last Balance Sheet	722070068.24	
		Additions out of		
		(a) Grant from Govt. of India for		
114500000.00		Plan Expenditure	128730000.00	
		(b) Donations for Specific purposes		
2695950.00		utilised during the year	2929598.00	
722070068.24			853729666.24	
875049.96		Less : Capital Investments written off	944549.96	
		Less : Excess of Expenditure over Income		
120343225.37		adjusted out of General Fund upto 31.03.1997	158456635.80	
38113410.43		Less : Excess of Expenditure over Income for the current year	57280424.11	
562738382.48			637048056.37	
27813434.00		Sinking Fund	27813434.00	
10561386.00		Technology Development Fund	11734984.00	
12519589.68		Unutilised Grants for Research Projects	9924553.34	
48245849.35		Employee's Benefit Funds	95226076.55	
Current Liabilities & Provisions				
4926701.72		Sundry Creditors for expenses	6477865.52	
11562553.13		Other Liabilities	21825283.98	
678367896.36		Total	810050253.76	

Note (1) Changes suggested by the audit were incorporated in the above statement.

Note (2) Grant receivable from Govt. of India shown as Rs. 80.30 lakhs, in the balance sheet represents funds released by Govt. of India during March 98 and received by Institute during April 98.

sd/

**Financial Adviser &
Chief Accounts Officer**

Figures for the previous year		ASSETS	Amount		Amount	
Rs	Ps		Rs	Ps	Rs	Ps
480420788.52		FIXED ASSETS	599209691.83			
875049.96		Less : Assets written off	944549.96			
479545738.56					598265141.87	
		Current Assets				
6804471.72		General Stores	12883593.76			
1641086.40		Tools	1485743.64			
2338533.32		Instruments	3851989.01			
850429.60		Glasswares	1136858.08			
1966461.00		Medicines	4349141.91			
2000.00		Investment in shares of Employees co-operative Society	2000.00			
					23709326.40	
1257548.28		Deposits			1525298.28	
		<i>Deposit with Banks</i>				
46525057.26		For Staff Benefits			94519998.46	
86272459.58		For Specific Purposes			43035644.58	
		Loans and Advances				
		Advances Recoverable in Cash or in kind or for Value to be recovered				
		Unsecured considered good				
22723999.60		For purchases	13065580.91			
15907527.46		To staff	15268436.46			
5703055.27		Other Advances	1765145.13			
0.00		Grant receivable from Govt. of India	8030000.00			
1154061.78		Amount receivable from sponsors of Projects	1106590.26			
					39235752.76	
		Cash & Bank Balances				
245402.24		Cash and stamps in hand	278288.53			
5430064.29		Balance with Banks	9480802.88			
					9759091.41	
678367896.36		Total			810050253.76	

sd/
Director

Income and Expenditure Statement Account for the year ended 31st March 1998

Figures for the previous year		EXPENDITURE	Amount	
Rs	Ps		Rs	Ps
		Excess of Expenditure over Income		
86601371.52		Hospital Wing	106035570.64	
13348059.36		Bio Medical Technology Wing	13504601.37	
271863.65		Expenses for Committee Meetings	136543.00	
42050.00		Legal Expenses	117750.00	
85550.00		Travelling Expenses	84339.00	
6445235.80		Expenses for Academic Programmes	7234369.00	
361482.00		Travelling expenses for Seminars and Conferences	955106.30	
157358.00		Expenses of Achutha Menon Centre	230671.00	
107312970.33		Total	128298950.31	

sd/
**Financial Adviser &
 Chief Accounts Officer**

Figures for the previous year		INCOME	Amount	
Rs	Ps		Rs	Ps
66000000.00		Grant received from Govt. of India	68700000.00	
292332.90		Rent	292837.00	
717768.00		General Receipts	547292.20	
80220.00		Fees collected-AMC		
1824912.00		Interest received	1170947.00	
196875.00		Application & Examination fee from P G Students	237950.00	
87452.00		Income from Sale of Assets	69500.00	
38113410.43		Excess of expenditure over income transferred to General Fund Account	57280424.11	
107312970.33		Total	128298950.31	

sd/
Director

Income and Expenditure Account for the year ended 31st March 1998 Hospital Wing

Figures for the previous year		EXPENDITURE	Amount	
Rs	Ps		Rs	Ps
15787205.58		Medicines	18118776.38	
1357736.58		Chemicals	1885235.68	
3422018.00		Medical Gases	3281183.00	
2240738.00		Films & Chemicals for Radiology Dept.	2325657.52	
450267.75		Uniforms & Hospital linen	735717.85	
51773501.88		Hospital Items	55724154.39	
597868.00		Hospital Expenses	725746.15	
2348973.55		Inpatient Diet expenses	2194324.40	
227642.40		Laboratory Expenses	1369991.10	
55347935.75		Salaries & Allowances	73029827.14	
130694.00		Honorarium to Visiting Faculty	180364.00	
1070475.00		Medical benefit to staff	1715290.40	
519405.00		Contribution to Provident Fund	1011971.00	
224585.80		Travelling Expenses	93072.00	
103664.00		Expenses for visiting faculty	31150.00	
368066.00		Home travel & Leave travel concession	256481.00	
594750.75		Postage, Telephone and Telegrams	815425.95	
1206679.20		Printing & Stationery	1398677.25	
767596.00		Advertisements	610310.00	
507553.00		Recruitment Expenses	126288.00	
5893142.65		Electricity & Water Charges	8141453.55	
195699.50		Freight, Insurance & Handling charges	199569.35	
372999.37		Vehicle Maintenance Expenses	414512.89	
457550.08		Bank charges and commission	521964.21	
1335.00		Agricultural Expenses	75.00	
278787.00		Taxes & Licence	91054.40	
		Repairs and Maintenance		
6245222.40		Equipments	15068211.45	
1641463.35		Buildings	1370109.32	
631151.32		Others	456797.40	
9703.00		Staff Training Expenses	25559.00	
672171.00		Research-In House Projects	33532.00	
222061.95		Other Expenses	142517.50	
1029934.00		Bonus & Festival Allowences	0.00	
931427.66		Tools, Glassware & Instruments - consumed	1295334.44	
3186273.00		Contribution to Pension Fund	2199085.00	
8245930.00		Contribution to Sinking Fund	4724066.00	
		Contribution to Gratuity Fund	400000.00	
169062207.52		Total	200713484.72	

sd/
Financial Adviser &
Chief Accounts Officer

Figures for the previous year		INCOME	Amount	
Rs	Ps		Rs	Ps
		Hospital Collections		
63698843.00		Inpatient Charges	75251504.08	
18755993.00		Investigation & Registration Charges	19230315.00	
6000.00		Overhead Charges Collected from Projects	196095.00	
86601371.52		Excess of expenditure over Income transferred to Income & Expenditure Account - General	106035570.64	
169062207.52	Total		200713484.72	

sd/
Director

Income and Expenditure Account for the year ended 31st March 1998 - Biomedical Technology Wing

Figures for the previous year		EXPENDITURE	Amount	
Rs	Ps		Rs	Ps
309673.66		Chemicals	435360.84	
102068.45		Consumable Stores	57830.00	
280812.60		Laboratory Expenses	421192.83	
9314354.75		Salaries & Allowances	11127226.35	
107944.00		Medical benefits to staff	245518.00	
200878.00		Travelling Expenses	67771.00	
52344.75		Uniforms to Staff	16546.00	
8107.00		Expenses for Visiting Faculty	4222.00	
143259.00		Postage, Telephone & Telegrams	206873.00	
92623.70		Printing & Stationery	95582.15	
72800.00		Advertisements	59600.00	
765635.00		Electricity & Water Charges	1132390.00	
64475.00		Freight, Insurance & Handling Charges	62921.50	
103336.00		Bank Charges & Commission	147335.04	
102152.00		Garden & Estate Expenses	98208.50	
		Repairs & Maintenance Expenses		
498443.00		Equipments	471780.57	
74580.00		Buildings	78364.00	
94300.00		Others	29370.00	
386421.95		Animal Research Lab Expenses	298217.35	
156875.60		Other Expense	136211.70	
342300.72		Workshop & Tool room expenses	253592.55	
9000.00		Honararium	750.00	
93234.25		Seminar & Conference expenses	148364.50	
21670.00		Legal Charges	10365.00	
5649.00		Exhibition expenses	23361.50	
143065.00		Home travel & Leave travel expenses	76999.00	
42735.30		Vehicle maintenance expenses	27908.20	
140514.00		Taxes & Licences	140514.00	
276084.68		Tools, Glassware and Instruments written off	323313.24	
244570.00		Staff Training expenses	36836.00	
1617468.40		Contribution to Technology Development Fund	1173598.00	
156583.95		Research expenses - In house projects	11423.90	
45691.00		Technology Development expenses	0.00	
0.00		Committee meeting expenses	43242.50	
16069650.76		Total	17462789.22	

sd/
Financial Adviser &
Chief Accounts Officer

Figures for the previous year		INCOME	Amount	
Rs	Ps		Rs	Ps
1388168.40		Premium & Royalty received	1173848.00	
833725.00		Facility charges received	692270.00	
196117.00		Overhead charges collected from projects	0.00	
15409.00		Interest received	15391.00	
4236.00		Income from Garden & Estates	19067.70	
53970.00		Sundry receipts	42322.75	
229966.00		Interest from technology fund	1990238.40	
		Rent collected from staff	20408.00	
		Sale of tender forms	4642.00	
13348059.36		Excess of expenditure over income transferred to general income and expenditure account	13504601.37	
16069650.76		Total	17462789.22	

sd/
Director

Receipts and Payments Account for the year ended 31st March 1998

Figures for the previous year		RECEIPTS	Amount
Rs	Ps		Rs Ps
		Opening Balance	
250670.76		Cash in hand	245402.24
28242986.02		Balance with banks for G.P.	5430064.29
0.00		Balance with banks for S.P.	0.00
		Hospital Collection	
63559734.00		Inpatient deposit	79781479.85
18528235.00		Investigation and Registration charges	18766775.00
		Research and Development Wing	
1388168.40		Royalty received	1173848.00
4236.00		Income from estate	19067.70
24505.00		Sundry receipts	28702.00
12085.00		Interest on bank deposits	11565.00
0.00		Interest on special deposit	1990238.40
829965.00		Facility hire charges	680620.00
		General Receipts	
437490.80		Sundry receipts	500746.20
61840.40		Rent	37213.00
1734932.00		Interest received	1039923.00
180950.00		Application & Examination fee from PG students	237950.00
127229.00		Notice pay received	33193.00
		Grant received from Govt. of India	
66000000.00		For recurring expenses	68700000.00
114500000.00		For capital expenses	120700000.00
		Grant for specific research	
13160077.00		Projects	8007935.00
3015482.00		Receipts for specific purpose	2192774.00
504370.15		Deposits received	574456.90
88673.50		Receipts from sale of Assets	69500.00
10938459.70		Receipt for PF & Pension Fund	42264953.70
0.00		Donation for specific purpose	1500000.00
		Temporary over draft (Bank)	6011918.00
		Deposit refunded	40000000.00
323590089.73		Total	399998325.28

Note (1) Payments for fixed assets includes advances granted for procurement.

sd/
Financial Adviser &
Chief Accounts Officer

Figures for the previous year		PAYMENTS	Amount	
Rs	Ps		Rs	Ps
		Expenses for Hospital Wing		
58227232.20		To staff	82821404.39	
101324201.67		To others	121924027.47	
		Expenses for BMT Wing		
9819276.20		To staff	11730921.00	
3984491.93		To others	6025542.31	
866669.60		Expenses for general purpose	792925.60	
6360222.80		Expenses for Academic purpose	1077336.60	
147828.00		Expenses for Achutha Menon Centre	211401.00	
58204227.21		Payment for fixed assets	109806678.35*	
4928.00		Payments for tools	13796.65	
599999.85		Payment for glasswares	735887.00	
176184.00		Payment for Instruments	1776338.00	
6388459.70		Payment for PF & SBF	0.00	
5676789.64		Payment for Projects	6087263.30	
365354.00		Deposits Refunded	933488.00	
65768758.40		Deposit for specific expense	46302365.20	
		Closing balance		
245402.24		Cash in hand	278288.53	
5430064.29		Balance with banks for cash with banks	9480661.88	
323590089.73		Total	399998325.28	

sd/
Director

Schedule of Fixed Assets

Particulars of Assets	As on 1-4-1997		Additions during the year		Total		Assets disposed off		Net Block	
	Rs.	Ps	Rs.	Ps	Rs.	Ps	Rs.	Ps	Rs.	Ps
Land	1463299.63		0.00		1463299.63				1463299.63	
Land development	122543.88		0.00		122543.88				122543.88	
Buildings	81285706.18		1527309.00		82813015.18				82813015.18	
Satelmond	2166170.00		0.00		2166170.00				2166170.00	
Compound Walls	1096559.68		0.00		1096559.68				1096559.68	
Equipments	285929907.81		84075760.81		370005668.62		505410.00		369500258.62	
Gas plant installations	401512.09		206218.00		607730.09				607730.09	
Air conditioners & refrigerators	12175390.91		1076157.00		13251547.91		25000.00		13226547.91	
Cold room installation	341700.00		0.00		341700.00				341700.00	
Sub-station installations	1349552.25		0.00		1349552.25				1349552.25	
Electrical installations	5849824.52		3591989.00		9441813.52				9441813.52	
Water coolers	62866.50		0.00		62866.50				62866.50	
Lift installations	2530134.10		47499.00		2577633.10				2577633.10	
Canteen Equipments	71417.44		7987.40		79404.84				79404.84	
Office Equipments	758363.54		55635.00		813998.54				813998.54	
Furniture & Fixtures	10507945.96		4251824.65		14759770.61		54107.00		14705663.61	
Motor vehicles	2078204.30		637585.00		2715789.30		356614.89		2359174.41	
Telephone installation	1117858.94		535307.00		1653165.94		0.00		1653165.94	
Library books	39636288.69		5289881.45		44926170.14		3338.07		44922832.07	
Kitchen Utincils	392188.82		2900.00		395088.82				395088.82	
Murale Paintings	271757.63		0.00		271757.63				271757.63	
Cycles	6135.33		0.00		6135.33		80.00		6055.33	
Roads	647080.04		0.00		647080.04				647080.04	
Animal House & Cages	360596.70		14586.00		375182.70				375182.70	
Oxygen cylinders	203362.42		0.00		203362.42				203362.42	
Live stock	3298.00		0.00		3298.00				3298.00	
Borewells	174615.00		0.00		174615.00				174615.00	
Building-ACM	29416508.16		17468264.00		46884772.16				46884772.16	
Total	480420788.52		118788903.31		599209691.83		944549.96		598265141.87	

Audit Certificate

I have examined the Receipts and Payment Account, Income and Expenditure Account for the year ended 31 March, 1998 and the Balance Sheet as on 31 March, 1998 of the Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram. I have obtained all the information and explanations that I have required and subject to the observations in the appended Audit Report, I certify, as a result of my audit, that in my opinion these Accounts and Balance Sheet are properly drawn up so as to exhibit a true and fair view of the state of affairs of the Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram according to the best of information and explanations given to me and as shown by the books of the organisation.

New Delhi
Dated : 28 Oct. 1998

Sd/
Principal Director of Audit
Scientific Departments

**Audit Report on the Accounts
of the Sree Chitra Tirunal Institute
for Medical Sciences & Technology,
Thiruvananthapuram for the year
1997-98**

Replies to the Audit Report

1. Introduction:

The Sree Chitra Tirunal Institute for Medical Sciences and Technology (Institute) Thiruvananthapuram, is governed by the provisions of "The Sree Chitra Tirunal Institute for Medical Sciences & Technology, Trivandrum Act, 1980 (No.52 of 1980)". The Institute is financed mainly by grants received from the Central Government. During 1997-98 the Institute received a sum of Rs. 18.94 crores as grants from the Central Government.

The accounts of the Institute are audited by the Comptroller and Auditor General of India under section 19(2) of the Comptroller and Auditor General's (Duties, Powers and Conditions of Service) Act 1971 read with section 18(2) of the "The Sree Chitra Tirunal Institute for Medical Sciences & Technology, Act, 1980.

Comments on Accounts

2. Revision of Accounts

(i) Grants from Govt. of India

Grant to the extend of Rs. 80.30 lakhs was released at the last day of the financial year by the Dept. of Science & Technology and the amount was received by the Institute at the next financial year ie. April 1998. The amount of Rs. 80.30 was not accounted for by the Institute in the Balance sheet and it was done at the instance of Audit. Revision of accounts resulted in increase in assets and liabilities to this extend.

Since Rs. 80.30 lakhs was received by Institute during April 98 only vide DD Nos. 28728/2-4-98 & 28794/4-4-98, the Grant amount was not accounted during 1997-98. However at the instance of Audit, adjustment entries were made in the accounts for the Grant amount (Rs. 80.30 lakhs) during, 1997-98 itself.

(ii) Uncovered Deficit

The liabilities to be discharged by the Institute at the close of the financial year including the provisions accounted for in current year as well as the previous years was to the extent of Rs. 1474.30 lakhs. As against this, the investments and deposits made were to the extent of Rs. 1375.56 lakhs only. Hence there is an uncovered deficit of Rs. 98.74 lakhs in the investments. This needs to be made good.

3. Funds receivable from employees provident fund organisation

The Employees Provident fund organisation has transferred an amount of Rs. 350.89 lakhs to the GPF account of the employees maintained by the Institute during 1997-98 out of Rs. 422.25 lakhs accumulated in the PF account. An amount of Rs. 71.36 lakhs is yet to be transferred, which has not been accounted for by Institute in the accounts as receivable resulting in understatement of assets.

During the year Institute had incurred additional expenditure for meeting liabilities due to implementation of Pay revision. Since the Grant amount released was not sufficient to meet the additional expenses, on account of Pay arrears certain investments were to be deferred during 1997-98. This will be regularised during 1998-99.

Institute was maintaining its Provident Fund account with the Regional Provident Fund Commissioner of Trivandrum upto 31-3-89 and there after separate GPF accounts are maintained by Institute as per the SCTIMST Regulations, to which all receipts are credited. The balance amount receivable from PF Commissioner is expected to be released during 98-99. The amount will be included in GPF account of Institute during 1998-99.

sd/
Pr. Director of Audit (SD)

Director
SCTIMST

Place : New Delhi
Date : 28th October 1998

Place : Thiruvananthapuram
Date : 30th October 1998

Administrative Bodies

Institute Body

Dr. N. H. WADIA

President

1. Prof. N. Appaji Rao, Department of Biochemistry, Indian Institute of Science, Bangalore - 500 012
2. Dr. S. P. Agarwal (Ex-officio), Director General of Health Services, Government of India, New Delhi - 110 011
3. Dr. N. Babu, (Ex-officio) Vice Chancellor, University of Kerala, Thiruvananthapuram
4. Dr. D. D. Bhawalkar, Director, Centre for Advanced Technology, Government of India, Department of Atomic Energy, Indore - 452 013
5. Shri. Budhsel R. Patel, Member of Parliament (Lok Sabha) 22, South avenue, New Delhi - 11
6. Shri. P. P. Chauhan, Secretary, Ministry of Health and Family Welfare, Nirman Bhasvan, New Delhi - 110 011
7. Dr. A. D. Damodaran, Chairman, State Committee on Environment Science and Technology, Government of Kerala, Thiruvananthapuram
8. Shri. P. R. Dasgupta, Secretary, Ministry of Human Resources Development, Shastri Bhavan, New Delhi - 110 001
9. Prof. P. J. Kurien, Member of Parliament. (Lok Sabha), AB-77, Shahjahan Road, New Delhi.
10. Dr. S. K. Mahajan, Head, Molecular Biology & Agri. Division, BARC, Trombay, Mumbai - 400 085
11. Dr. K. Mohandas, (Ex-officio) Director, Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram
12. Dr. V. R. Muthukkaruppan, 4, G, B-Block, ALS Garden, Dhanalakshmi Colony, No. 8, Natarajan Salai, Vadapalani, Chennai - 600 026.
13. Shri. Rahul Sarin, IAS, Joint Secretary & Financial Adviser to The Government of India, Department of Science and Technology, Technology Bhavan, New Delhi - 110 016.
14. Dr. K. N. Raj, Dhalavakunnu, Kumarapuram, Thiruvananthapuram - 695 011.
15. Dr. S. Ramachandran, (Ex Secretary, DBT, DST) 1, Playground View Street, Nandanam Extension, Chennai - 400 035.
16. Prof. V. S. Ramamurthy, Secretary to the Government of India, Ministry of Science and Technology, Technology Bhavan, New Delhi - 110 016.
17. Dr. R. Sivakumar, (Ex-officio) Head, Biomedical Technology Wing, Sree Chitra Tirunal Institute for Medical Sciences & Technology, Thiruvananthapuram - 695 012.
18. Dr. K. K. Talwar, Prof. of Cardiology, All India Institute of Medical Sciences, New Delhi - 110 029
19. Shri. Vayalar Ravi, Member of Parliament (Rajya Sabha) 15, Pandit Pant Marg, New Delhi.
20. Dr. Vijay Kak, Director, Principal & Secretary, Medical Education and Research, Government Medical College, Chandigarh - 160 036.
21. Shri. V. Vijayachandran, Secretary to the Government of Kerala, Health and Family Welfare, Sports and Youth Affairs.

Governing Body

Dr. N. H. WADIA

Chairman

1. Dr. S.P. Agarwal, Director General of Health Services, Government of India, New Delhi - 110 011.
2. Dr. A. D. Damodaran, Chairman, State Committee on Environment Science and Technology, Government of Kerala, Thiruvananthapuram.
3. Dr. S. K. Mahajan, Head, Molecular Biology & Agri. Division, BARC, Trombay, Mumbai - 400 085.
4. Dr. K. Mohandas, Director, Sree Chitra Tirunal Institute, Thiruvananthapuram.
5. Prof. V. S. Ramamurthy, Secretary to the Government of India, Ministry of Science and Technology, Technology Bhavan, New Delhi - 110 016.
6. Dr. K. Radhakrishnan, Professor of Neurology, Sree Chitra Tirunal Institute, Thiruvananthapuram.
7. Dr. R. Sivakumar, Head, Biomedical Technology Wing, Sree Chitra Tirunal Institute, Thiruvananthapuram.
8. Dr. K. K. Talwar, Prof. of Cardiology, All India Institute of Medical Sciences, New Delhi - 110 029.
9. Sri. Rahul Sarin IAS, Joint Secretary and Financial Advisor to the Government of India, Department of Science & Technology, New Delhi 110 016.

Standing Committees

Academic Committee

1. Dr. K. Mohandas, Director of the Institute, (Chairman)
2. Dr. R. Sivakumar, Head, Biomedical Technology Wing, Sree Chitra Tirunal Institute, Thiruvananthapuram.
3. Dr. A. K. Gupta, Additional Professor of Radiology, Sree Chitra Tirunal Institute, Thiruvananthapuram.
4. Dr. G. S. Bhuvaneshwar, Scientist, Sree Chitra Tirunal Institute, Thiruvananthapuram.
5. Dr. N. Babu, Vice Chancellor, University of Kerala, Thiruvananthapuram
6. Dr. Srinath Reddy, Professor of Cardiology, AIIMS, New Delhi - 29.
7. Dr. S. K. Mahajan, Head, Molecular Biology and Agri. Division, Babha Atomic Research Centre, Mumbai - 400 085.
8. Prof. S. Ranganathan, Emeritus Professor, Regional Research Laboratory, Thiruvananthapuram.
9. Dr. K. Radhakrishnan, Professor of Neurology, Sree Chitra Tirunal Institute, Thiruvananthapuram.

Building Committee

1. Dr. K. Mohandas, Director, Sree Chitra Tirunal Institute, (Chairman)
2. Dr. R. Sivakumar, Head, BMT Wing, Sree Chitra Tirunal Institute, Thiruvananthapuram.

3. Sri. V. Vijayachandran, Secretary to the Government of Kerala, Health Family Welfare, Sports and Youth Affairs.
4. The Civil/Construction Engineer, Vikram Sarabhai Space Centre, Thiruvananthapuram.
5. Sri. P. Vijaykrishnan, Financial Advisor & Chief Accounts Officer, Sree Chitra Tirunal Institute (Convenor).
4. A nominee of the Secretary, Department of Science and Technology, Government of India, New Delhi.
5. A Senior Professor of SCTIMST, Thiruvananthapuram.
6. An outside Expert.

Finance Committee

1. Dr. K. Mohandas, Director of the Institute (Chairman)
2. Prof. V. S. Ramamurthy, Secretary to the Government of India, Department of Science and Technology, Technology Bhavan, New Delhi - 110 016.
3. Dr. A. D. Damodran, Chairman, State Committee on Environment, Science and Technology, Government of Kerala, Thiruvananthapuram.
4. Shri. P. Vijaykrishnan, Financial Advisor & Chief Accounts Officer, Sree Chitra Tirunal Institute, Thiruvananthapuram (Convenor).

Senior Staff Selection Committee

1. Dr. K. Mohandas, (ex-officio-Chairman) Director, Sree Chitra Tirunal Institute, for Medical Sciences & Technology, Thiruvananthapuram.
2. Dr. V. R. Muthukkaruppan, (Former Vice Chancellor, Bharatidasan University, Chennai)
3. Dr. R. Sivakumar, (ex-officio member), Head, BMT Wing, SCTIMST, Trivandrum.

Junior Staff Selection Committee

Dr. P. R. N. Menon, (Ex-officio), Medical Superintendent, Sree Chitra Tirunal Institute, Thiruvananthapuram.

Dr. R. Sivakumar (Ex-officio), Head, BMT Wing, Sree Chitra Tirunal Institute, Thiruvananthapuram.

Three nominees of the President

A representative of Academic Staff of the Institute nominated by the Director.

Ethics Committee

Mr. Justice S. Sankarasubban (Chairman), Judge, High Court of Kerala, Kochi.

Dr. K. A. Kumar, Professor of Psychiatry, Medical College, Thiruvananthapuram..

Head, BMT Wing, Sree Chitra Tirunal Institute, Thiruvananthapuram.

Director of the Institute

Technology Development Committee

1. Dr. K. Mohandas, Director of the Institute (Chairman)
2. Dr. N. Appaji Rao, Department of Biochemistry, Indian Institute of Science, Bangalore - 560 012.

3. Dr. Arthur Vijayan Lal, Scientist Sree Chitra Tirunal Institute, Thiruvananthapuram.
4. Dr. A. P. Chaukar, Prof. and Head of CVTS, Dept. of CVTS, LTM Medical College, Sion, Mumbai - 400 022.
5. Dr. A. D. Damodaran, Chairman, State Committee of Environment Science and Technology, Government of Kerala, Thiruvananthapuram.
6. Dr. Meera Mohanty, Scientist, Sree Chitra Tirunal Institute, Thiruvananthapuram.
7. Dr. Placid Rodriguez, Director, Indira Gandhi Centre for Atomic Research (IGCAR) Kalpakkam - 603 102 Tamil Nadu.
8. Dr. S. Ramachandran (Ex. Secretary, DBT, DST, Govt. of India) 1, Playground View Street, Nandanam Extension, Chennai - 400 036.
9. Dr. R. Sivakumar, Head, Biomedical Technology Wing, Thiruvananthapuram.
5. Head, BMT Wing (Ex-officio member), Sree Chitra Tirunal Institute, Thiruvananthapuram.
6. FA & CAO of the Institute (Ex-officio)
7. S. Balaram, Scientist-in charge, Technology Transfer Cell (Ex-officio).

Technology Transfer Committee

1. Dr. S. Varadarajan (Chairman), President, Indian National Science Academy, New Delhi 110 002.
2. Dr. S. Sivaram, Dy. Director, National Chemical Laboratory, Pune 411 008.
3. Sri. S. B. Krishnan, Secretary, Technology Development Board, Dept. of Science & Technology, New Delhi 110 016.
4. Mr. C. Venugopal, Head, Technology Transfer Division, V.S.S.C., Thiruvananthapuram.

SREE CHITRA TIRUNAL INSTITUTE FOR
MEDICAL SCIENCES AND TECHNOLOGY
Thiruvananthapuram - 695 011