ANNUAL REPORT 1998-99

SREE CHITRA TIRUNAL INSTITUTE FOR
MEDICAL SCIENCES AND TECHNOLOGY
THIRUVANANTHAPURAM

Annual Report
1998-99

SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES AND TECHNOLOGY
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Cover:

Photomicrographs of cardiac fibroblasts isolated from neonatal and adult rats. The deoxyribonucleic acid strand depicts institute's first step into the realms of molecular medicine. Designed by research fellows of the Division of Cellular and Molecular Cardiology.

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Contents

Highlights of the year

1. First industry-sponsored R & D programme - the Membrane Oxygenator-reached prototype stage
2. First Indo-French R & D project on diamond-like carbon coating commenced
3. Technology for fibrin glue transferred for commercial production
4. A novel technique to prevent plasticizer migration from PVC devices published in Nature
5. Madhavan Nair Centre for Comprehensive Epilepsy Care inaugurated
6. A comprehensive care service for movement disorders commenced
7. Significant strides in Interventional Cardiology
8. International Seminar on emerging public health issues in South Asia held
9. Rockefeller Foundation awarded consultancy to Achuta Menon Centre
10. DM in Neuroradiology started
11. A protocol for the isolation and culture of cardiac fibroblasts from adult rats set up
12. Hindi fortnight celebrated jointly with TOLIC

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

Closer interaction with industry and international agencies, fresh advances in biomedical research, unique strides in patient care activities and new academic initiatives marked the progress of the Institute during the year under review.

The R & D activities of the Institute were reorganized in project mode to ensure that identification and development of appropriate health care technologies will meet the requirements of the profession and the industry in a globally competitive environment. Mechanisms for effective collaboration with medical devices industry and technology transfer were streamlined even as commercialization of the technologies continued at a statisfactory pace. Establishment of a laboratory for molecular medicine, modification and consolidation of the facilities for the evaluation of biomaterials and devices and patenting of 5 devices and designs were accomplished during the year. The commencement of the Indo-French R & D project on diamond-like carbon coating heralded the beginning of the era of global co-operation in biomedical technology development.

Patient care services were maintained at a high standard, while several new initiatives were begun during the current year. In tune with the recent trends in evolving non-surgical management of patients with cardiovascular diseases, several interventional management protocols were established for the treatment of heart ailments.

A comprehensive care service for movement disorders and the inauguration of the first Centre for Comprehensive Epilepsy Care in the country were some of the important achievements of the year. These and the Institute's Outreach Programmes further reemphasised its commitment to ensure that advances in health care were made available and accessible to all sections of the public.

The Achutha Menon Centre acquired international status with overseas students and scholars flocking to it for formal training and collaborative research in public health, as well as the work of our MPH graduates being recognised by international organizations. An international seminar organised by the Centre attracted public health experts from India and abroad. The Centre was also recruited as an active member of the global programme - Public Health Schools Without Walls. In the short span of its existence - barely 3 years - Achutha Menon Centre became an internationally acclaimed Centre for training, research and consultancy in public health.

Biomedical research, innovative academic programmes and notable achievements in scientific journalism contributed to the Institute's continued relevance in academia.

The activities and accomplishments of the Institute in the penultimate year of the 20th century were a reflection of the Institute's ability and commitment to fulfil the mandate given to it by the Parliament.

Patient Care

Dr. P. R. N. MENON MS
Medical Superintendent

Dr. S. K. JAWAHAR MBBS
Assistant Administrative Medical Officer

High quality services were provided to patients and their relatives.

An infection prevention seminar was organized in the month of November 1998 to create awareness about infection prevention among the staff and to motivate infection prevention activities. Separate sessions for doctors, nurses, technical staff, unit helpers and cleaners were arranged. Competitions were organised for the best maintained ward and I.C.U, best suggestion and best poster for infection prevention.

Trainees in hospital administration from M. G. University, Kottayam and Madurai Kamaraj University were given appropriate orientation and guidance in their project work.

Studies were conducted on the following topics.

1. Satisfaction level of outpatients attending Sree Chitra Tirunal Institute for Medical Sciences and Technology
2. Hospital waste management
3. Hospital security system
4. Effectiveness of Nursing Care
5. Material Management
6. Effectiveness of communication among various departments

Observer trainees in Dietary and Physiotherapy and medico-social worker trainees attended the respective departments.

Medico-social Work

Medico-social workers continued to play a vital role in income assessment and registration of outpatients, counselling patients, liaison with patients and various departments and motivation of blood donors. They also helped in arranging financial assistance for poor patients and arranging food and accommodation for those from charitable institutions.

Medical Records

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

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

The MRD provided valuable information to all the departments and divisions. The bed strength of the hospital was enhanced to 217 with the addition of the Epilepsy Ward. As per a policy decision, the charts were pruned and inactive charts were collected and kept separately.

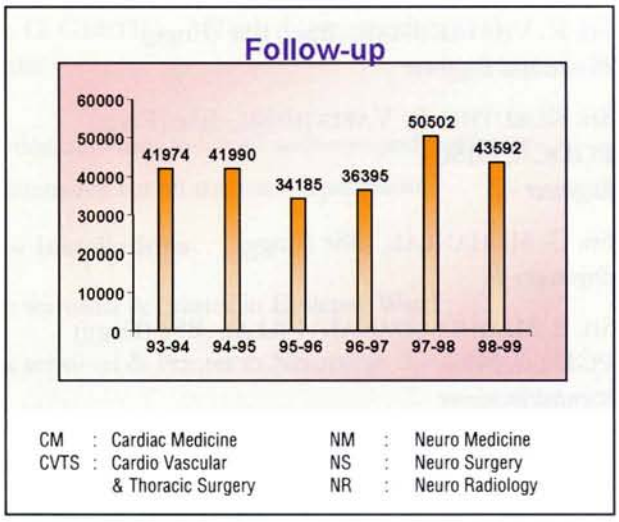
Table 1 Number of charts retrieved

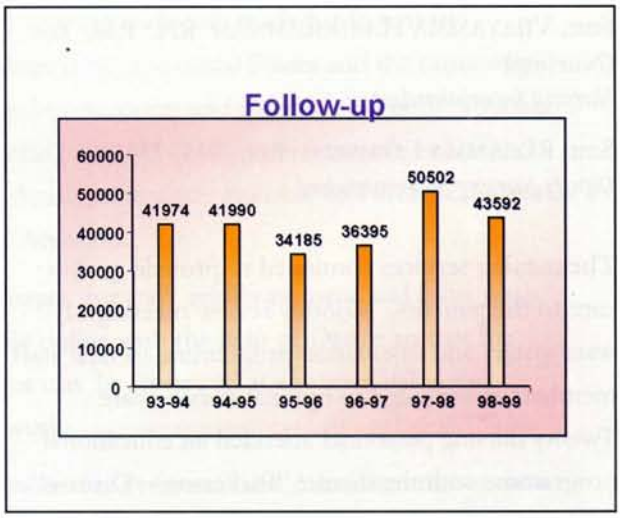
Follow up in special clinics	43,592
Correspondence of patients	12,464
Analytical studies	7,400
Pruning of charts	7,720
Internal audit	200
Cardiac Surgery scrutiny	844
Total	72,220

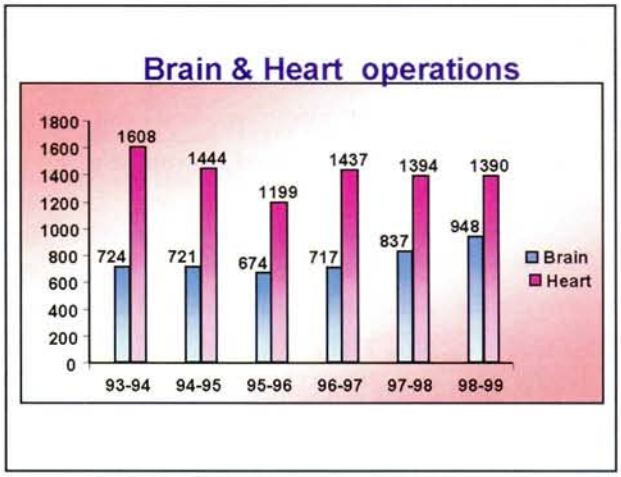
Detailed monthly statistical bulletin was issued to all heads of departments. Medical Documentation Students from Mahatma Gandhi University did their project work in different topics of medical records management. A 2 year training programme was started in January 99.

Table 2 Important Statistics

Sanctioned Bed	217
Cardiac Surgery	1,390
Perfusion	864
Neuro Surgery	904
New Registration	10,155
Repeat Cases	43,592
Admissions	6,253
Discharges	6,292
Deaths	216
Paying (%)	81
Non paying (%)	19
Average length of stay	10
Bed turn over rate	29
Mortality Rate (%)	03
Operative Mortality (%)	04
Autopsy rate (%)	06
Sophisticate Investigations	13,276
Lab Investigations	5,27,080
X-ray	22,117
Physiotherapy	25,237
ECG	12,538
ECHO	17,944
Pacemaker	74
TMT	1,588
Holter	154
CAG	823
Cath + Angio	539
PTCA	75
PTCA + Stent	71
EPS	16
BMV	121
BPV	19
BAV	09
Baloon Dilation of COA	02
BAS	16
RF Ablation	29
PDA Coil Embolisation	17
ASD Device closure	05
Aortogram	110
CT Scan	3,265
MRI Scan	2,487
EEG	2,290
VEEG	164
EMG	832
Thrombolysis	03
Cerebral Angiogram	363
Spinal Angiogram	15
Radio Angioplasty	49
Embolisation	72


Follow-up
60000
50000
40000
30000
20000
10000
0
41974
41990
34185
36395
50502
43592
93-94
94-95
95-96
96-97
97-98
98-99
CM : Cardiac Medicine
CVTS : Cardio Vascular & Thoracic Surgery
NM : Neuro Medicine
NS : Neuro Surgery
NR : Neuro Radiology


Follow-up
60000
50000
40000
30000
20000
10000
0
41974
41990
34185
36395
50502
43592
93-94
94-95
95-96
96-97
97-98
98-99


Brain & Heart operations
1800
1600
1400
1200
1000
800
600
400
200
0
724
1608
721
1444
674
1199
717
1437
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948
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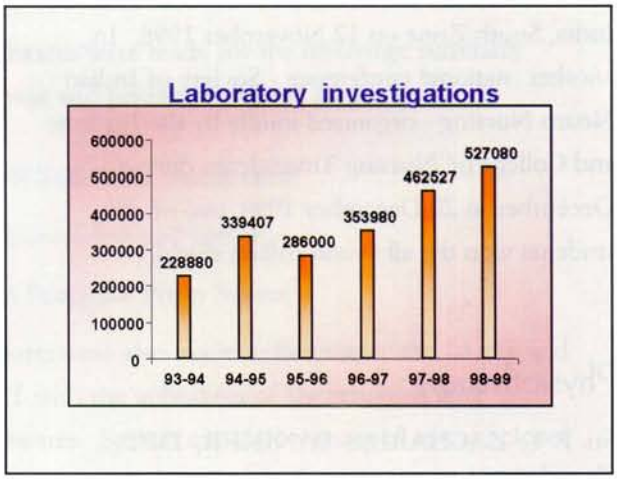
96-97
97-98
98-99
Brain
Heart


Laboratory investigations
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500000
400000
300000
200000
100000
0
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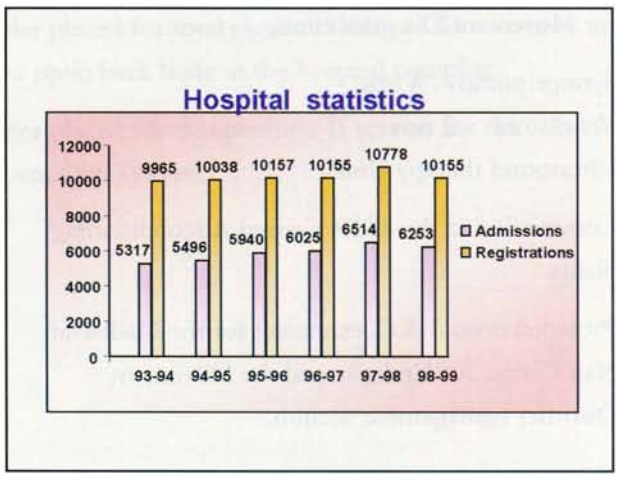
353980
462527
527080
93-94
94-95
95-96
96-97
97-98
98-99


Hospital statistics
12000
10000
8000
6000
4000
2000
0
5317
9965
5496
10038
5940
10157
6025
10155
6514
10778
6253
10155
93-94
94-95
95-96
96-97
97-98
98-99
Admissions
Registrations

Nursing Services

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

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

The nursing services continued to provide quality care to the patients. Monthly review meeting of ward sisters and orientation programme to new staff members contributed to optimal nursing care . Twenty nursing personnel attended an educational programme with the theme: "Parkinson's Disease" organised by the Trained Nurses Association of India, South Zone on 12 November 1998. In another national conference - Society of Indian Neuro Nursing - organised jointly by the Institute and College of Nursing Trivandrum during 17 December to 20 December 1998, two of the students won the all round rolling shield.

Physiotherapy

Sri. P. T. ZACHARIAS PANIKER, DPT
Physiotherapist

Smt. M. MEENAKUMARI, BSc, DPT
Physiotherapist

Sri. P. C. VINCENT, MA, BT, DPT
Physiotherapist

Smt. DEEPA G. NAIR, BPT
Physiotherapist

Medical and surgical patients were given therapy with the specific objective of restoring optimal functional status in the quickest possible time.

Clinical Engineering

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

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

Sri. G. MOHANLAL, BSc (Engg)
Engineer - E

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

Smt. DEEPA MATHEWS BTech
Engineer - B (Ad-hoc)

Sri. N. SIVANANDAN
Junior Engineer

Routine maintenance of electro-medical equipments and utilities with the reduction of downtime to a minimum.

Addition to new equipments included Audiovisual system for the Achutha Menon Centre Auditorium, Elisa reader - 2 Nos, Holter Monitoring system, Mobile C-,arm Image intensifier, X-ray system, Nerve stimulator, Operating Microscope, Platelet Agitator with centrifuge, Steriotactic system for Movement Disorder clinic,

Syringe pumps - 4 nos.
Ventilators - 2 nos.
Ultrasound therapy Unit

Commissioned the 48TR Central Airconditioning plants.

Provided central A.C. extension for the Madhavan Nair Centre for Epilepsy and the Movement Disorder management section.

Computer Division

Smt. G. GEETHA, MTech (Computer Science)
Scientist

Routine activities involved software and hardware maintenance for all the user departments.

New Installations

One terminal & printer in Epilepsy Ward

One terminal & Printer in Neurology Speciality Clinic

PC & Printer at Neuro Surgery Ward, Cardiac Surgery Ward, Thoracic Ward, Cardiology Ward for discharge Summary typing

One terminal & printer at General Stores for monitoring issues

Proxy server and mail server installed and email/ internet service started.

Provision for remote access to check mails were introduced.

PC Celeron 300 MHz 11 numbers were installed -
2 at Purchase Section, 2 at Accounts,
2 at Administration, 1 at BME,
1 at Computer Division and 3 at AMC.

Order placed for total gigabit cabling at floors with a fiber optic back bone at the hospital complex.

Order placed for two pentium II servers for the information system.

New Software Development

Software in Oracle was made for Inventory Management at General Stores and the same was linked to Accounts and Purchase Section. Voucher checking and Bill Checking were made online and the details were made available to Purchase, Stores and Accounts.

Software for staff reimbursement and leave was made online with the help of Oracle so that the status can be reviewed at any terminal in the network.

Software for Personnel and Administration section was made in Oracle.

Softwares were made for the discharge summary storage and printing in Visual Basic.

New Softwares Purchased

Mdeamon for mail server

Win Proxy for Proxy Server

Efforts were also made to familiarize the faculty and staff with the utilisation of the machine and softwares. System expansion grouped toward closer application in medical areas from increasing LAN interlinks.

Division of Academic Affairs

Dr. V. V. RADHAKRISHNAN, MD
Dean

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

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

Programmes on offer - 1999

Post Doctoral Programmes

1. DM Cardiology
2. DM Neurology
3. DM Neuro Radiology
4. MCh Cardiovascular & Thoracic Surgery
5. MCh Neuro Surgery (after M.S)
6. MCh Neurosurgery (after MBBS and 1 year residency in General Surgery)
7. Certificate course in Anaesthesia
8. Certificate course in Radiology
9. Certificate course in Vascular Surgery

Ph.D/Master's Programmes

10. PhD
11. Master of Public Health

Certificate Programmes

12. Post basic Cardiac Nursing
13. Post basic Neuro Nursing
14. Certificate in Blood Banking Technology

Diploma Programmes

15. Diploma in Cardiac Laboratory Technology
16. Diploma in Neuro Technology
17. Diploma in Operation Theatre Technology
18. Diploma in Advanced Medical Imaging Technology
19. Diploma in Clinical Perfusion
20. Diploma in Medical Records

Student Enrolment

The student strength for DM/MCh degree and Post Doctoral Certificate Courses during the year was 50.

The Master of Public Health degree programme had 15 scholars including 2 from Bangladesh.

The Institute has, as of now, 12 scholars for the Ph.D Programme, 19 scholars enrolled for the Post Basic Nursing Certificate Programme and 24 scholars for the various diploma programmes.

Ph.D Programme

Table : 3 Candidates awarded Ph.D Degree

Scholar's Name	Thesis title	Guide
Ms. Jameela S R	Cross linked chitosan as a carrier for controlled drug delivery	Dr. A Jayakrishnan
Ms. Latha M S	Studies on bovine case in as a carrier matrix for controlled drug delivery	Dr. A Jayakrishnan
Ms. Sindhu C V	Studies on pericardial calcification prevention via surface modification and drug delivery	Dr. C P Sharma

Table : 4 Candidates who have submitted Ph.D thesis

Scholar's Name	Thesis title	Guide
Ms. Lakshmi S	Surface modification of plasticized poly (Vinyl-chloride) to retard plasticizer migration and enhance biocompatibility.	Dr. A Jayakrishnan
Ms. Rajasree S	Role of Vitamin D in Arterial calcification	Dr. C.C Kartha

Examinations

Table : 5 List of successful candidates for DM/MCh

Name of Candidates	Degree	Speciality
Dr. Nageswara Rao K	DM	Cardiology
Dr. Harikrishnan S	DM	Cardiology
Dr. Rajiv C	DM	Cardiology
Dr. Sudeep Balakrishnan	DM	Neurology
Dr. Lally Alexander	DM	Neurology
Dr. Sylaja P N	DM	Neurology
Dr. Atri Chakrabortti	DM	Neurology
Dr. Vijit Koshy Cherian	MCh	CVTS
Dr. Jayanta Kumar Das	MCh	CVTS
Dr. Jigeesh N. Doshi	MCh	CVTS
Dr. Avijith Basu	MCh	CVTS
Dr. Ravi Gopal Varma	MCh	Neuro Surgery
Dr. Prithvi Varghese	MCh	Neuro Surgery

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

Name of Candidates	Speciality
Dr. Srinivas K	Anaesthesiology
Dr. Pramila Shukla P	Anaesthesiology
Dr. Mohan S	Anaesthesiology
Dr. Prasad S	Anaesthesiology
Dr. Raj Mohan Rao T	Anaesthesiology
Dr. Senthil Kumar D	Anaesthesiology
Dr. Joy Thomas Aluvila	Radiology
Dr. Bejoy Thomas	Radiology

Table : 7 List of successful candidates for Master of Public Health

Name of candidates
Dr. V Mohanan Nair
Dr. S S Lal
Ms. S Suneetha
Mr. T Radhakrishnan
Mr. P Gopalakrishnan
Dr. Joy Elamon
Dr. M C Kalavathy
Dr. Aysha Beegom

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

Name of Candidates	Speciality
Ms. Sindhu Cherian	Neuro Nursing
Ms. Rajani Ramachandran	Neuro Nursing
Ms. Lailamma K T	Neuro Nursing
Ms. Lilly P D	Neuro Nursing
Ms. Saira George	Neuro Nursing
Ms. Minimol P Abraham	Neuro Nursing
Ms. Binu D	Neuro Nursing
Ms. Elizabeth Mamman	Neuro Nursing
Ms. Saji Gopinath	Neuro Nursing
Ms. Shinta P Vincent	CVT Nursing
Ms. Lija Maria Antony	CVT Nursing
Ms. Seema Thomas	CVT Nursing
Ms. Bindu E K	CVT Nursing
Ms. Bindu Paul	CVT Nursing
Ms. Deepa Jose	CVT Nursing
Ms. Deepa Jose J	CVT Nursing
Ms. Sindhu K George	CVT Nursing
Mr. Viswanathan G	CVT Nursing

Table : 9 List of successful candidates - Diploma and Certificate

Name of Candidate	Speciality
Ms. Rasmi Mohan	Cardiac Laboratory Technology
Ms. Sindhu Kumari O T	Cardiac Laboratory Technology
Mr. Gopakumar G G	Neuro Technology
Ms. Sajitha C R	Neuro Technology
Mr. Joseph Sunith George	Advanced Medical Imaging Technology
Mr. Alex Jose D	Advanced Medical Imaging Technology
Mr. Rapheal K K	Advanced Medical Imaging Technology
Mr. Saleem Babu U P	Operation Theatre Technology
Mr. Unnikrishnan M	Operation Theatre Technology
Mr. Kishore Lal M C	Blood Bank Technology
Ms. Remya Devi K C	Blood Bank Technology

Table : 10 Faculty Forum Activities

Programme	Date	Speaker
Autoimmunity in health & disease	July 20, 1998	Prof. Joy Philip
Publish or Perish	Sep. 26, 1998	Prof. V V Radhakrishnan
Motivation and Demotivation	Nov. 12, 1998	Prof. G Balachandran Thampi
Dedication in Professionals	Dec. 12, 1998	Prof. G Balachandran Thampi
Current Status of research in our country	Jan. 16, 1999	Dr. A D Damodaran
Medical Profession today & public image	Feb. 6, 1999	Dr. V C Velayudhan Pillai
AZQ Drug therapy for Primary brain tumour	March 6, 1999	Dr. Hameed Khan
Pain and Palliative care-Experience of setting up a community oriented programme	March 6, 1999	Dr. M R Rajagopal
Self confidence: A key to success		Dr. Krishna Prasad Sreedhar

National Science Day

National Science Day was celebrated on 1st March 1999 in the Institute. Students from the Departments of Polymer Chemistry in the State were specially invited to visit the Institute on that day and given an overview of the activities in the Bio-Medical Technology Wing.

Library

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

Smt. S. JAYAPRABHA, BA, MLISc
Librarian cum Documentation Officer Gr. II

Sri. JAYACHANDRA DAS, BSc, MLISc
Librarian cum Documentation Officer Gr. II

During the year, the library started functioning in the new premises. In order to support the research and academic programs of the Institute, the library augmented its traditional services with modern technology intensive services. The facilities and services of the library were extended to doctors, scientists and students of neighbouring institutions also.

During the year, the library acquired 771 books and added 938 bound journals to its collection bringing the total collection to 18,777 books and 16,369 bound journals. The library subscribed to 267 journals and received 50 journals as gratis.

Upgradation of the Information Technology capability of the library was completed, giving the necessary impetus to the Information Services of the library. Two computers were installed in BMT Wing for upgrading the IT facility. The library network was connected to the FTDMA VSAT for Internet connection.

Software used

LIBSYS for library automation

Win Tel for disk less node access with Windows NT

MDAEMON for email server

Win Proxy for proxy server

The TCP/IP access to INTERNET made considerable impact on the information services of the library. This facility equipped the library to navigate Cyberspace effectively, access important scientific and medical databases and to download valuable information. It also made an impact on the very character of scholarly and scientific communication. The database searched during the year included EMBASE on neurological Sciences and Cardiac Sciences in CD ROM and current contents on diskette on three subjects - Life Sciences, Engineering and Technology, Physical, Chemical and Earth Sciences. Library continued to provide MEDLINE searches to the library members.

Nursing Education

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

The eleventh batch of Post Basic Certificate students in Cardiovascular and Thoracic Nursing and the seventh batch of Neuronursing students successfully completed their programme in December 1998. Currently 20 students are undergoing training in these two programmes.

Nursing students from Institutions all over the country were provided clinical training for periods varying from two weeks to one month. Ten post graduate students from two Institutions and 138 graduate students from 5 Institutions utilised the clinical field of this institute for their study purpose. The details are given below.

Table : 11

Institution	Programme	Duration	No. of Students
P.G.I. Chandigarh	MSc (N)	2 wks	2
College of Nursing Kozhikode	MSc (N)	2 wks	8
College of Nursing Kozhikode	BSc (N)	4 wks	35
College of Nursing Kottayam	BSc (N)	4 wks	35
College of Nursing Thiruvananthapuram	BSc (N)	2 wks	8
IGNOU	BSc (N)	1 day	21
Jamia Hamdard University New Delhi	BSc (N)	1 day	17
College of Nursing Thiruvananthapuram	BSc (N)	1 wks	4
Total			148

Inservice Education thro' quiz - a new venture

A weekly Quiz Contest for the nursing staff was held as part of inservice education from January, 1999. Conducted by the Nursing Instructur, the quiz proved to be a major attraction.

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, promotion of official language implementation activities. The section organised a workshop on 13 November 1998 which marked the beginning of Joint Hindi fortnight celebrations by the Town Official Language Implementation Committee.

Medical Illustration

Sri. G. LIJIKUMAR
Chief Technician

High quality prints and slides were prepared for scientific papers published during the year and for papers presented at various national and international fora. The recent acquisition of Multi Media Video Projection system significantly improved the performance of the section.

Achutha Menon Centre for Health Science Studies

Prof. N. KRISHNAJI, MA, Dip. Stat
Hon. Professor (Till October 98)

Dr. R. S. VASAN, MD, DM, FACC
Associate Professor (Till September 98)

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

Dr. SAJITHA BASHIR, PhD
Honorary Fellow (until Jan. 99)

Routine activity

The activities during the year included teaching and research related to running the Master of Public Health (MPH) degree programme. Two batches of students (1998 and 1999 admissions) were undergoing the programme.

The MPH course was opened up for students from South Asian countries from this year. Two students from Bangladesh were enrolled in the program.

Research on public health aspects were carried out by the second batch of MPH students. These included

a. Cancer prevention knowledge: Attitudes and practices among high-school college students in Kerala, India.

b. A study on the self-reported reproductive morbidity in the context of contraceptive use and analysis of the service related determinants of reproductive morbidity.

c. Consumption of tobacco products in a rural community in Kerala.

d. Preventive measures against hospital-acquired infections: Awareness and compliance by health care delivery staff with special emphasis on AIDS.

e. Antimicrobial usage in animals and practices associated with antimicrobial therapy of bovine mastitis in Kozhikode district, Kerala.

f. Animal slaughter practices in rural Kerala: A descriptive study.

International Seminar

An international seminar on 'Emerging Public Health Issues in South Asia' was held on May 22-23, 1998. About 80 public health experts from countries like Bangladesh, Sri Lanka, Nepal, Zimbawe, Uganda, USA and India participated in the Seminar. 30 papers were presented in the seminar on (1) Gender and Reproductive Health, (2) Emerging infections, Chronic diseases & Environmental Health, (3) Health Policy, Planning & Health Care Financing and (4) Curriculam and Research priorities of Public Health Schools. MPH students of the Centre presented posters based on their individual research work.

Global Inclen Meeting

All the MPH scholars of the batch of 1997 were invited to attend global INCLEN meeting at Bangkok during March-14, 1999. They presented papers, based on the research work done as part of their MPH Course.

Ms. Laura Talarsky from the Department of Anthropology, University of Arizona, U.S.A. was an Overseas visiting scholar during 27-5-98 to 18-1-99.

Consultancy

AMCHSS was requested by the Rockefeller Foundation, New York, U.S.A. for compiling a report on the existing training programme in Public Health in Nepal and Bangladesh. This consultancy work was taken up by the Centre and a report prepared was submitted in January 1999 to the Rockefeller Foundation.

Visiting Faculty

1. Prof. William Reinke from The Johns Hopkins University, baltimore, USA visited the centre during October and November 1998 and conducted a course on 'Management in Public Health'.
2. Prof. Richard A. Cash from the Harvard University School of Public Health, Boston, USA visited the centre during February 1999 and conducted the courses 'Infections Diseases epidemiology' and 'Ethical issues in public health'.
3. Prof. Arthur Reingold from the University of California at Berkeley, USA visited the centre between May and June 1998 and conducted a course on 'Advanced Epidemiology'.
4. Dr. Arnab Acharya from Harvard University School of Public Health, Boston, USA visited the centre between April and May 1998 and during March 1999 and conducted a courses on 'Cost effectiveness Analysis'.
5. Dr. Jayaprakash Muliyil from Christian Medical College, Vellore visited the centre during January 1999 and conducted a course on 'Principles of Epidemiology'.
6. Prof. Joan Mencher from the City University of New York, USA visited the centre during August 1998 and conducted a course on 'Anthropological perspectives of Public Health'.
7. Dr. Madhukar Pai from Sundaram Medical Foundation, Chennai visited the centre during March 1999 and conducted a course on 'Introduction to Epidemiology'.
8. Dr. Sundari Ravindran from New Delhi visited the centre between June and July 1998 and conducted a course on 'Gender Issues in Public Health'.
9. Prof. I. S. Gulati from the Kerala State Planning Board visited the centre during November 1998 and gave a seminar on 'Centre-State Fiscal Transfers'.

Departmental Reports

Department of Anaesthesiology

Dr. K. MOHANDAS, MD
Professor & Director of the Institute

Dr. R. C. RATHOD, MD
Professor & Head

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. P. K. NEEMA, MD
Assistant Professor

Dr. RATHAN GUPTA, MD, Dip. NB
Assistant Professor

Dr. K. GANDHIMATI, MD, FRCA
Consultant (Ad-hoc)

Dr. SUJATHA P, MD
Consultant (Ad-hoc)

Sri. GANAPATHY POTTI
Scientific Assistant

Candidates for post doctoral certificate course :

Dr. Rijil Deepak A.

Dr. Vijayakumar L. Shetty

Dr. Ajoy S. Pandit

Dr. Jiju John

Dr. Neeraj B. Sharma

Dr. Ashish B. Pathak

Table : 12 Anaesthetic support given during the year as follows

Procedures	Number
Cardiovascular and thoracic surgery	1361
Neurosurgery	814
Investigational & Interventional Radiological and Cardiac Procedures	407

Dr. (MRs) Jayawickramma from Sri Lanka joined for Post MD training for a period of 1 year. The first Dr. Surendran Memorial CME was conducted on December 15, 1998.

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
Junior Scientific Officer

Sri. B. SASIKUMAR, MSc
Scientific Assistant

Sri. BALU K. CHACKO, MSc
PhD Student

Research Activities

As a reduction in plasma high density lipoprotein cholestrol has negative implication for coronary artery disease, attention was focussed on mechanisms whereby HDL provides protection against atherosclerosis. A study was initiated on the role of HDL - associated paraoxonase, a peroxide hydrolyzing enzyme, in detoxifying active lipids.

Investigations on atherosclereosis, with focus on the contribution of LP(a), a genetically - controlled independent risk factor, were in progress. LP(a) particle was successfully isolated from blood using a preparative ultracentrifugation technique. The composition of LP(a) particle was found to differ with respect to not only the protein moiety but also the number of cholesterol and carbohydrate molecules per particle. In addition to this a method to quantitate LP(a) cholestrol was developed, which makes it an alternative to LP(a) immuno assays and also opens a new avenue to explore clinical and epidemiological implications of LP(a) particle heterogeneity. Studies on the role of dietary fats and oils in coronary artery disease were also initiated during the year.

Further, the Division made contributions in the area of glycobiology and neuroimmunopathology as detailed below:

Three carbohydrate-binding human serum immunoglobulins, namely, the anti-galactoside antibody, the lactose-binding IgG and the anti-T-antibody were purified to homogeneity by novel procedures, using their peroxidase conjugates. These antibodies were shown to recognise the oligosaccharide groups on soluble and extracellular matrix glycoproteins in human brain grey matter.

Sugar-specific recognition of oligosaccharides on human heart glycoproteins was observed by enzyme-labelled anti-galactoside from human serum on western blots. Since the titre of this antibody increases consequent to infections, such recognition may contribute to infection-mediated cardiac immune damage.

Galactose-binding lectin (galectin), ubiquitous in human tissues, was shown to agglutinate desialylated human RBC and lymphocytes by binding to the newly exposed T-antigen groups on the latter. Since desialylation is a hallmark of many bacterial and viral infections, such recognition may contribute to post-infection deposition of immune cells and immune complexes in tissues.

Though terminal-galctoside and T-antigen are two confirmed markers of tumour tissues elsewhere, their presence in brain tumours has not been demonstrated so far. Studies carried out in this laboratory, however, showed that, when the tissue glycoproteins were extracted by affinity chromatography on peanut agglutinin and probed with enzyme-labelled lectin and antibodies, brain tumour tissue contains several-fold higher amounts of both these antigens.

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 give round the clock service to meet the increasing demand for transfusion support in surgical procedures and medical management. 77% of collected blood units were processed as components only. Utilization of blood components were in the order of 88% for concentrated cells and 92.3% for plasma and platelets.

Intra operative blood salvage for cardiac surgical patients and small volume plasma exchange for neurological patients continued as before, though to a lesser extent.

Predonation counselling for blood donors was started from January 1999 to wean out high risk donors for transfusion transmitted diseases (TTD). This served as an educative exercise to make them aware of the modes of transmission of TTD.

Review and recommendations of the Hospital Transfusion Committee were useful in improving transfusion services. As a part of ongoing research activities, prevalence of transfusion transmissible infections among blood donors was studied. Comparative analysis of blood utilization in the last two decades was done using transfusion indices. Factors deterring women from donating were studied in 100 potential women donors through questionnaire.

Platelet agitator with incubator and a blood bank refrigerator (US make) from the National AIDS control organisation were important additions as equipment.

Joint collaborative research activity in progress included, providing input for the evaluation of fibrin sealant which is undergoing clinical trial. Input was also provided for raising antibodies specific for platelet activation.

With the Rajiv Gandhi Centre for Biotechnology, the Division continued to have collaborative research activity in the correlation of Hepatitis C Virus positive samples by the PCR technique.

Dr. Jaisy Mathai was nominated member of the technical resource group on blood safety and transfusion services for HIV/AIDS Control Programme by the Government of India.

Department of Cardiology

Dr. JAGAN MOHAN A. THARAKAN, MD, DM
Professor & Head

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

Dr. V. AJITH KUMAR, MD, DM
Associate Professor

Dr. ANIL BHATT, MD, DM
Associate Professor

Dr. S. SIVASANKARAN, MD, DM, Dip. NB (Card)
Assistant Professor

Dr. BIMAL FRANCIS, MD, DM
Assistant Professor

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

Dr. K. JAMES, MD, DM
Consultant Cardiologist (Adhoc)

Dr. HARIKRISHNAN, MD, DM
Consultant Cardiologist (Adhoc)

Dr. NAGESWARA RAO, MD, DM
Consultant Cardiologist (Adhoc)

Sri. VIJAYASENAN, BSc
Junior Scientific Officer

Candidates for DM Cardiology:

Dr. K. Sivakumar, MD
Dr. K. P. Balakrishnan, MD
Dr. K. Mahesh, MD
Dr. C. Mohammed, MD
Dr. M. Ravichandra, MD
Dr. R. Padmakumar, MD
Dr. T. G. Jayakumar, MD
Dr. M. D. Syamkumar, MD
Dr. Santhoshkumar Dora, MD
Dr. K. G. Rajeev, MD
Dr. Rakesh P. Gopal, MD
Dr. B. R. J. Kannan, MD

During the year 4805 new patients were registered in the Department of Cardiology. 2264 patients were treated as inpatients and of these, 1800 patients underwent various invasive and interventional procedures. The noninvasive Cardiac Laboratory performed 1587 treadmill stress tests, 164 Holter analysis and over 10,000 echo Doppler studies including more than 300 Trans Exophageal Echo studies.

Table : 13 Invasive and Interventional procedures:

Invasive Procedures:	
Right and Left heart cath study	490
Coronary Angiography	872
Electrophysiology study	16
	1,378
Interventional Procedures:	
Balloon Atrial Valvotomy	16
Balloon Pulmonary Valvotomy	19
Balloon Aortic Valvotomy	9
Balloon Mitral Valvotomy	68
Mitral Valvotomy with metal Valvulotome	53
PTCA with or without stenting	146
PDA Coil Occlusion	17
Device Closure	5
ASD	333
Pacemaker Implants	48
Pacemaker Pulse Generator Change	26
	74
Radio Frequency Ablation for Supraventricular and Ventricular Arrhythmias	29

The Department of Cardiology continued to introduce several interventional techniques for the treatment of various heart diseases.

A workshop on Atrial Septal Defect Closure using an Amplatzer device was organised on 19th November 1998. Dr. Ramesh Arora, Director Professor, Department of Cardiology, GB Plant Hospital, New Delhi participated in the Workshop as the principal

operator. 3 Patients underwent successful closure of the atrial septal defects. During the Workshop, a new technique of percutaneous mitral commissurotomy using a metal valvulotome was introduced. The procedure was performed on 4 patients with severe Mitral Stenosis, with excellent results.

Another Workshop on Atrial Septal Defect closure, using the Amplatzer device was organised by the Department on 13th March 1999, and Dr. George Joseph, Cardiologist from C.M.C. Vellore was the principal operator. Two patients had successful Atrial Septal Defect closure, using the Amplatzer device.

On 31-03-1999, Professor Alain Criber from Charles Nicolle University Hospital, Rourn, France who is a pioneer in the field of percutaneous valvotomies visited the Department and demonstrated the technique of percutaneous mitral commissurotomy using Cribier's Mitral Valvulotome in 5 patients. He was accompanied by Ms. Helene Eltchanioff, Cardiologist at Charles Nicolle Hospital, Rouen, France.

The three Workshops conducted by the department gave tremendous boost to the already active interventional programme. During a short span of 3 months, the Department performed 55 percutaneous mitral valvotomies, using Cribiers metal valvulotome.

17 patients underwent coil occlusion of ductus arteriosus successfully during the year.

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 (on leave)

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. KRISHNAMANOHAR, MS, MCh
Associate Professor

Dr. S. K. NAIR, MS, MCh
Associate Professor

Dr. AVINASH DAL, MS, MCh
Assistant Professor

Mr. THOMAS MALIAEKAL
Scientific Assistant

Candidates for M.Ch Course in CVTS

Dr. N. S. Devananda, MS

Dr. Jacob James Raj, MS

Dr. Apurvakumar Sarma, MS

Dr. Raja Joshi, MS

Dr. Kalpesh S. Malik, MS

Dr. Praveen K. Varma, MS

Dr. Bishnu K. Deka, MS

Dr. Sameer Diwale, MS

837 open-heart procedures and 346 closed procedures were carried out during the year. 114 patients underwent vascular surgery.

Table 14. List of cases done

Type of cases	Number
Coronary Revascularisation	290
Valves	86
ASD closure	152
Complex congenital	302
Vascular aneurysms	47
Vascular operations on CPB	13
Vascular operations without CPB	34
Closed Mitral Valvotomy	70
Pulmonary and General Thoracic	125
Patent Ductus	92
Blalock Taussig Shunt	17
Miscellaneous	42

Vascular Graft Prosthesis: Chitra Vascular Graft Prostheses were successfully implanted in six patients as part of the limited trial, preceding multi-centric clinical trials.

Division of Cellular and Molecular Cardiology

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

Dr. R. RENUKA NAIR, PhD
Scientist

Dr. K. SHIVAKUMAR, PhD
Scientist

Dr. JOHN T. EAPEN, PhD
Scientist

Students for PhD programme

Smt. S. Rajasree, MSc

Smt. Preetha Nair, MSc

Smt. Preeta R, MSc

Sri. Kumaran C, MSc

The highlight of the year was the discovery of the possible role of vitamin D in the development of atherosclerotic coronary artery disease and aortic aneurysms. In a case control study involving 143 men with coronary artery disease and 70 control subjects, serum levels of vitamin D3 were found to be significantly elevated in patients with coronary artery disease. In an experimental study, intramuscular injections of vitamin D resulted in increased serum levels of vitamin D3 in rabbits and some animals also developed aortic aneurysms. These findings support the hypothesis that Vitamin D3 is involved in the development of aortic aneurysms. Our results have important implications in that earlier studies suggest (i) a causal link between vitamin D and atherosclerosis, and (ii) that the tropical population is susceptible for hypervitaminosis D.

Studies on the role of cerium and magnesium deficiency in the causation of endomyocardial fibrosis made further progress. Low levels of cerium (0.5 micromolar) were found to stimulate proliferation of cardiac fibroblasts: superoxide anions were identified as the mediator of the response, which is tissue-specific.

Experiments using a rodent model of acute magnesium deficiency have provided evidence of depressed antioxidant defense, altered rates of collagen turnover and cellular hyperplasia in heart and aorta. While serum magnesium levels were significantly reduced in these animals, cardiac and aortic tissue levels of magnesium were preserved, implying that the changes at the molecular level are unrelated to an alteration in tissue levels of magnesium. A model of cardiovascular injury in magnesium deficiency has been proposed that envisages a role for circulating vasoactive, pro-oxidant and mitogenic factors in the pathogenic cascade of events in the heart and aorta, even as cardiac and aortic tissue magnesium levels remain unaltered.

Investigations on age-dependent variations in the contractile response of cardiomyocytes to ion channel modulators in cardiomyocytes from adult rats of different age groups showed the response to calcium channel blockers to increase with age. The response to the isotropic agent oubain was affected by age. The response to ion-channel inhibitors was dependent on the levels of extra cellular magnesium.

Division of Microbiology

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

Smt. MOLLY ANTONY, MSc, DMV
Assistant Professor

Dr. MURALIDHAR K. KATTI, 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 Division provided diagnostic facilities in Bacteriology, Virology and Immunology. Several ELISA techniques were introduced for the diagnosis of viral diseases.

Important additions of equipment were

a. CARBONDIOXIDE INCUBATOR : Sheldon (USA) and

b. ELISA Reader with printer : Anthon (Austria)

A project in collaboration with the Department of Cardiac Surgery on the relation between the carrier state and genesis of wound infections among cardiac surgery patients was in progress.

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. P. JOSEPH CHERIAN, MD, DM
Assistant Professor (Adhoc)

Dr. P. N. SYLAJA, MD, DM
Assistant Professor (Adhoc)

Candidates for DM Neurology:

Dr. Jacob George, MD

Dr. P. Sujatha, MD

Dr. Jairaj D. Pandian, MD

Dr. V. Beena, MD

Dr. M. A. Joy, MD

Dr. K. V. Hari Prasad, MD

Dr. Robert Mathew, MD

Dr. N. V. Ahsan Moosa, MD

Dr. P. Mahalakshmi, MD

Dr. M. Bobby Varkey, MD

Dr. R. Rajesh, MD

Dr. Anu Jacob, MD

	Number of Patients
In-patients	1344
Out-patients services	
General Neurology	3619
Speciality Clinics	
Behavioral Neurology Clinic	366
Botox Clinic	35
Epilepsy Clinic	1470
Neuromuscular Clinic	316
Movement Disorder Clinic	577
Stroke Clinic	333

The major activities of the Department of Neurology were channelized through various specialties of the Department. A new speciality clinic- Dementia Clinic-started functioning from July 1998. There was a steady increase in the services offered through the general Neurology OPD as well as the speciality clinics.

Epilepsy Programme :

Two epilepsy clinics, conducted weekly at the Institute, had attendance ranging from 250 to 325 every month. A total of 1470 patients attended the epilepsy clinic in the one year period. The outreach epilepsy clinics, conducted at Changarankulam in Malappuram district and Perumpilavu in Thrissur district twice a month, had an attendance of approximately 100 every month.

Seventy-two patients underwent epilepsy surgery for medically refractory seizures. Sixty-seven of them were anterior temporal lobectomies with amygdalohippocampectomy for temporal lobe epilepsy. Two patients had extratemporal resections, one patient had a modified hemispherectomy and 2 underwent corpus callosotomy. Video EEG monitoring was done in 188 patients over the one year period.

The R. Madhavan Nayar Centre for Comprehensive Epilepsy Care was inaugurated by H.E. Ms.Justice Fathima Beevi, Governor of Tamil Nadu on August 9, 1998. The President of Institute, Dr.N.H.Wadia, presided over the function. The Centre houses a state-of-the-art 3-patients video EEG monitoring facility, a 6-bedded ward, 2-bedded ICU and an operation theatre.

Movement Disorders Programme

The comprehensive care programme for movement disorders, established by the Movement Disorder section of the Department in 1997, expanded its existing activities in collaboration with the departments of Neurosurgery and Radiology by including stereotactic and functional neurosurgery for various movement disorders. Medically intractable cases of Parkinson's disease and various tremor disorders selected from the Movement Disorder clinic were extensively evaluated and subjected to surgery under close intraoperative neurological monitoring. Twenty-five patients were treated effectively with pallidotomy (18 cases) and thalamotomy (7 cases) since September 1998. All patients were under systematic follow-up with periodic assessments using international research protocols in order to study the efficacy and long-term effects of these procedures. Intra-operative microelectrode guidance will be available for the first time in Asia in this program from July 1999. The highly advanced technique of Deep Brain Stimulation for the management of Movement disorders will be performed from June 1999.

The section hosted the 5th National Movement Disorders Workshop in August 1998. Eminent national and international faculty attended the Workshop. The international faculty included Dr. Donald Calne, Director, Neurodegenerative Disorders Centre, Vancouver, Canada, and Dr. Andreis Bosch, Professor of Neurosurgery, University of Amsterdam, The Netherlands. Dr. M.S.Valiathan inaugurated the conference and patient education booklets were released by the Director of the Institute at the function. A Parkinson's disease support group was organized and the first meeting was held in the Institute in August 1998. The first volume of the News Letter of the support group was circulated among the patients in January 1999.

Speech and Behavioural Neurology Services

Three hundred and sixty-six patients attended the Speech and Behavioral Neurological Clinic. The project on epidemiological survey of developmental language disorders funded by KRPLLD progressed well.

Neuromuscular Services

The section collaborated with the BMT Wing in a project aimed at developing an immunoadsoption technique which has potential application in neuroimmunological diseases. Three hundred and sixteen patients attended the neuromuscular services.

Stroke Services

Three hundred and thirty-three patients attended the stroke clinic during the year. The role of selective intraarterial urokinase in acute occlusive stroke was being studied.

Kerala Registry of Epilepsy and Pregnancy

The Kerala Registry of Epilepsy and Pregnancy was formed on 1 April 1998. There were 148 patients in

the registry of which nearly a third were in the preconception state. This registry, was set up to address the medical issues related to fertility, pregnancy and childbirth among women with epilepsy. It was jointly organized by the Department of Neurology , and the Department of Obstetrics and Gynaecology, Medical College, Trivandrum. A number of specialists from the fields of Neurology, Obstetrics, Genetics , Ultrasonography, Biochemistry, statistics serve on the panel. The following services were provided.

Pre-conception counselling and assistance in optimizing the treatment of epilepsy, optimal care of epilepsy during pregnancy, prenatal screening for drug-related teratogenic effect, coordination with the treating obstetrician in the management of pregnancy & delivery and following up babies in infancy for any epilepsy or neuropsychological impairment.

A Workshop on "Fertility and Pregnancy Among Women With Epilepsy"was conducted on May 30 1998 to address issues related to epilepsy and pregnancy and develop a consensus protocol on the management of epilepsy during pregnancy. Over seventy five doctors drawn from Neurology, Gynaecology, Internal Medicine, Genetics, Biochemistry and Pediatric Neurology participated in the Workshop.

Department of Neurosurgery

Dr. R. N. BHATTACHARYA, MS, MCh
Professor and Head

Dr. N. SURESH NAIR, MCh
Professor

Dr. DILIP PANIKAR, MS, MCh
Associate Professor

Dr. MALLA BHASKARA RAO, Dip. NB
Assistant Professor

Dr. RAJNEESH KACHHARA, MS, MCh
Assistant Professor

Dr. RAVIMOHAN RAO, MS, MCh, Dip. NB
Assistant Professor

Dr. R. GIRISH MENON, MCh, Dip. NB
Assistant Professor

Candidates for MCh Neurosurgery:

Dr. S. Parameswaran, MBBS

Dr. P. Jain George, MS

Dr. Satyendrakumar, MS

Dr. P. S. Anantha Babu, MS

Dr. Irfan Siddique, MS

Dr. Rakesh Goel, MS

Dr. Anudath, MS

Dr. B. J. Rajesh, MS

Dr. H. V. Easwer, MBBS

There was substantial increase in the volume of operative work compared to previous years. The Department continued to cater to more and more complex intracranial and intraspinal lesions. Surgery for intracranial aneurysms, other vascular malformations, tumours of base of skull, CV junction anomalies, intramedullary spinal cord tumours and

temporal lobe epilepsy formed major bulk of the total surgical procedures (Table 16). Stereotactic surgery for movement disorders commenced in October '98. 24 patients underwent the procedure successfully. Stereotactic biopsy was also started in September'98 and it is being done routinely now. Spinal instrumentation, surgery for peripheral nerve injuries and craniofacial anomalies also got underway for the first time during the last year.

Table : 16

Vascular Aneurysms (109 pts)	119
Angiomas	21
CP Angle Lesions (excluding Meningiomas)	
Acoustic	33
Other Schwannomas	04
Epidermoid	03
MVD	06
Base of Skull Meningioma	
Suprasellar/sph wing	15
Tentorial	04
Petrous	06
Petroclival	01
Foramen Magnumm	01
Olfactory Groove	02
Chordoma	05
Schwannomas	02
Others	03
Epilepsy	
ATL	64
Callosotomy	02
Hemispherectomy	01
Sellar/Parasellar	
Pituitary	47
Craniopharyngioma	20
Chiasm glioma	03
Epidermoid cyst	01
Teratoma	02
CV Junction	
Chiari/syrinx	26
AAD	30
Orbit	07
Pineal	07
Intraventricular	
Colloid cyst	04
Lateral Ventricle	06
Others	01
Spinal lesions	
Extradural	13
Intradural	33
Intramedullary	08
Cauda Equina	05
Cervical disc	46
Lumbar disc	28
Dorsal Canal stenosis	02
Supratentorial tumours Gliomas	69
Meningiomas (excluding basal)	32
Posterior fossa tumours	
Astrocytomas	14
Medulloblastomas	08
Haemangioblastoma	03
Ependymoma	02
Others	02
Shunt - Ventrioculo - Peritoneal	76
Miscellaneous	118
Total	905

Research activity

Immunocytochemical studies of pituitary tumors and investigations on the role of mucoid vasculopathy in the etiopathogenesis of cerebral aneurysms began in collaboration with Dept. of Pathology.

Clinical trial of indigenously prepared fibrin glue in preventing CSF leak in collaboration with thrombosis group and vivarium of BMT Wing.

Important additions of equipment included.

1. Mobile C - arm image intensifier (GE stenoscop 6000)
2. Operating microscope-
   a. OPMI PROMAGIS ZEISS Microscope on S3 floor stand
   b. upgradation of OPMI 6 Microscope.

Division of Pathology

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

Dr. S. SANDHYAMANI, MD
Additional Professor

Dr. ELIZABETH JOSEPH, MD, Dip. NB
Consultant (Ad-hoc)

Dr. ANNAMA MATHAI, PhD
Scientific Assistant

Smt. SUMI MARY GEORGE
PhD Student

About 950 surgical and medical pathology specimens from neuro and cardiac diseases were subjected to routine histopathological examination. Intra-operative frozen - section diagnosis were carried out in 250 cases. Immunopathological investigations were performed in over 3500 patients. Muscle biopsies were conducted in 50 patients. As a part of teaching programme for DM and MCh students, regular case-demonstration, and clinico pathological conferences were conducted. The Department also helped the post graduate students in neuro and cardiac sciences with their research protocols.

The Department standardised immunohistochemical techniques to demonstrate hormonal activity for pituitary tumors as well as in bronchial carcinoma. These helped in making accurate histopathological diagnosis.

The ongoing Project on 'Development of an immunodiagnostic system for Tuberculous meningitis suited to the laboratories in developing countries' made rapid progress. A simple, inexpensive, rapid laboratory system was established. Multi-centric trials with the system were initiated.

Long-term studies in a bonet monkey model showed association of mucoid vasculopathy and advanced lesion of cardiomyopathy resembling endomyocardial fibrosis and pancreatopathy. This could serve as an animal model for nutritional disorder.

For investigation of mucoid vasculopathic vascular disease, a quantitative test for serum glycosaminoglycans was standardised, as part of an ongoing DST project.

In autopsy studies at Sree Chitra Tirunal Institute for Medical Sciences and Technology, coronary arteries were found to have features of mucoid vasculopathy with premature arteriosclerosis or narrowing. They showed occlusion by mucoid intimal plaques and fibro-calcific organised thrombi. Unexpected and unusual complications of acute thrombosis , dehiscence of sutures and post-operative transmural discetion were noticed in some of the arteries affected by mucoid vasculopathy. Atheromatous plaques were uncommon in coronary arteries , a feature that correlated with the serum lipid profiles of these patients.

Collaborative studies to delineate various etiological factors for coronary artery disease, stroke and cerebral aneurysms were initiated with the departments of cardiology, neurology and neurosurgery.

i) In collaboration with the Department of Neurology, SAT Hospital, Trivandrum, a study on neuromuscular and muscular disease in Kerala State was undertaken

ii) In collaboration with the Medical College, Trivandrum, a study of chronic meningitis - and its aetiology was being carried out.

Department of Radiology

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

Dr. SANTHOSH JOSEPH, DMRD, MD
Additional Professor

DR. T. R. KAPILAMOORTHY, MD
Associate Professor

Dr. KESHAV DAS, MD
Associate Professor

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

DR. K. P. SREEKUMAR
Consultant (Ad-hoc)

DR. S. GAYATHRI
Consultant (Ad-hoc)

Candidate for DM (Neuroradiology)

Dr. Krishnamoorthy
Candidate for PDCC

Dr. H. N. Raveesh

Research activity in the Department included studies on effect of photodynamic therapy on induced carcinoma in mice. Two beds were added for post - interventional procedure observation.

The first Annual Conference of Indian Society of Vascular and Interventional Radiology was held at the Institute.

Table : 17 Routine Procedures done

Procedure	Number
Plain X-rays	29059
CT Scan	2905
MRI	2273
Ultrasound	1317
Invasive Diagnostic Procedured	
Cerebral Angiogram	363
Spinal Angiogram	15
Aortogram/Peripheral angiogram	193
IVDSA	4
Other diagnostics	58
Interventional Procedures	
Cerebral Embolization	64
Spinal AVM Embolization	9
Balloon Embolization/Traping	8
Balloon Angioplasty	27
Vascular Stenting	22
Cerebral Thrombolysis	2
PLDD	3
WADA's Test	32
Biopsy Procedures	11
Laser Ablation of Esteoid Osteoma	2

Biomedical Technology Wing

Dr. R. SIVAKUMAR
Head, BMT Wing

The Biomedical Technology Wing continued to focus on the development of Biomaterials and Biomedical Devices which can be converted into commercialisable technologies in collaboration with industries. The R & D activities were oriented in the project mode to ensure adequate timely inputs that are needed to complete them on time. A mechanism for approval and monitoring of the projects was worked out as recommended by the Technology Development Committee and approved by the Governing Body.

The establishment of Laboratory for Molecular Medicine was nearly complete. PCR work station, Gradient Robocycler for PCR and DNA synthesizer were procured and commissioned. PCR-based diagnosis of Tuberculous meningitis was standardized.

The following table summarizes the R & D status of selected programmes:

Table- I

Product/Process	Status
Dental Composite (Restorative Material)	Discussions with companies were on-going for Technology Transfer.
	Radio-opaque dental composites and dentine bonding agent were being developed.
Hydroxyapatite (Bone graft material)	Discussions with companies were on-going for Technology Transfer.
	Clinical evaluation for dental applications continued.
Membrane Oxygenator (Artificial lung for open heart surgery).	Design Validation Completed.
	Development of Injection moulding dies and centrifugal potting machine were in progress.
Fibrin Glue (Surgical Hemostatic agent)	Clinical Trial was initiated in the Institute (Cardiac and Neurosurgeries).
	Identification of industrial partner was on-going.
Coating on Urinary Catheter (Infection resistance)	Antimicrobial silver oxide coated urinary catheter showed reduced bacterial adhesion and was non-toxic. Further in-vitro evaluation was in progress.
Coating on Heart-Valve Components (Improved Blood Compatibility)	An Indo-French project was initiated. Sample preparations and coating by the industry in France were in progress.
Vascular Graft (Artificial large diameter blood vessel)	Clinical Trial was on-going.
	Looked for an industrial partner for further development.
Hydrogel (Therapeutic Embolization agent)	Looked for an industrial partner.

In addition to the above, 1800 Concentric Needle Electrodes were fabricated as part of the Joint Technology Development with SIDD/SPIC, Chennai, and the licensing process for Technology Transfer was initiated.

The research activities were being consolidated to address problems related to material-tissue interactions pertaining to the biomaterials and devices mentioned above, with the objective of achieving improved biocompatibility and biofunctionality. The research also encompassed toxicological evaluation of materials, design of experiments (both in vitro and in vivo animal models) for functional evaluation prior to clinical studies.

During this period, 4 patents and one design registration were filed reflecting one aspect of

technology development. Efforts were on to bring together the industry and the medical personnel to identify and address technical issues for selection and execution of projects that can blossom into affordable and relevant technologies.

Artificial Internal Organs

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

Shri. C. V. MURALEEDHARAN, MTech
Engineer

Shri. C. V. MURALEEDHARAN, DIP. MECH. ENGG.
Scientific Assistant

Membrane Oxygenator

The development of a hollow fibre membrane oxygenator in collaboration with SPIC Pharma Ltd., Chennai, made further progress. The milestones crossed during this year were:

(a) Further In-vitro testing for oxygen transfer rate and heat exchanger performance - validation of design by achieving target performance values with the final prototypes.

(b) Design of a centrifugal potting machine for production use.

(c) Identification of vendors for Plastic injection moulding die development and for the fabrication of the centrifugal potting system .

(d) With our strong support, the project sponsors SPIC/SIDD obtained financial assistance of Rs.40 Lakhs for pilot production tooling and clinical evaluation from the Technology Development Board.

Carbon Coating

An industrial research project "Development of Diamond like coatings for Biomedical and other applications" was sanctioned by the Indo-French Centre for Promotion of Advanced Research, New Delhi, in August 1998. The project is a joint collaborative venture involving a French industry, University of Paris-Sud and the Division of Internal Organs of the Institute.

Biomaterials

Dr. R. SIVAKUMAR, PhD
Leader

Dr. K. SREENIVASAN, PhD
Scientist

Dr. PRABHA D. NAIR, PhD
Scientist

Dr. T. RAMACHANDRAN, PhD
Scientist (on leave)

Shri. B. AJITHKUMAR, MTech
Scientist (on leave)

Shri. NIRANJAN D. KHAMBETTE, MTech
Scientist (on leave)

Dr. P. R. HARIKRISHNA VARMA, PhD
Scientist

Dr. ANNIE JOHN, PhD
Scientist (on leave from March 99)

DR. MANOJ KOMATH, PhD
Scientist (Temporary)

Shri. R. SREEKUMAR, BSc
Junior Scientific Officer

Shri. S. VIJAYAN, MSc
Scientific Assistant

Shri. P. R. HARI, BSc, AIE
Scientific Assistant

SMT. C. RADHAKUMARI, MSc
Scientific Assistant

SMT. SHEELA GEORGE, MSc
PhD Student

Shri. ABHIRAMAN, MSc, MPhil
PhD Student

1.0 R & D Programmes

1.1 Bioceramics and Glasses

Clinical evaluation of Porous Hydroxyapatite granules was on in a few Dental Colleges for periodontal applications. The granules were prepared in various size ranges to suit different applications. The technology profile document on HA granules was prepared.

The preparation of bioactive glasses and Hydroxyapatite bioactive glass composites granules were standardised. Animal bone implantation study was initiated.

1.2 Molecular Imprinting

Research efforts on molecular imprinting and metal containing polymers were continued. Molecularly imprinted polymers based on metal containing monomers were synthesised and the preliminary results indicated the feasibility of optimising these polymers as selective adsorbants for proteins.

1.3 Cyclodextrins

Spectrophotometric methods based on cyclodextrin polymer were developed to detect clinically relevant molecules like heparin.

2.0 Testing and Evaluation

2.1 Analytical Laboratory

The analytical facilities consisting of equipments such as FTIR spectrophotometer, HPLC, GC, Thermal Analysis (DSC and SDT), Instron etc., were extended to external organisations for analysis of various samples in the field of material sciences and biology, besides internal programmes.

The DST funded external project on "Development of an IPN membrane for encapsulation of islet cells of Langerhans" was completed. Selectively permeable membranes of polyurethane, IPNs could be formulated and characterised. Several compositions were found to have adequate

permeation for the metabolite in addition to being impermeable to immunoglobulin. The membranes were also nondegradable and biocompatible.

2.2 Microscopy

The Scanning Electron Microscope (SEM) facility was extensively used for analysis of various samples in the field of biology, medicine, material science etc. The New Energy Dispersive X-ray analysis (EDS) attachment to SEM for qualitative and quantative analysis of elements was installed.

Transmission electron microscopy facility was used to observe different biological tissues. These included examination of blood vessels, endocrine glands and neural tissue. Students from Universities and Institutes visited the facility during the year for demonstration of various Electron Microscopy procedures.

Biosurface Technology

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

Dr. THOMAS CHANDY, MSc, PhD
Scientist (Till May 4, 1998)

SMT. SINDHU C. V., MSc, MPhil
PhD Student

Theoretical model to explain the adhesion of cells, bacteria and proteins onto the substrates was developed based on the surface free energy parameters of the substrate and adhering component.

Pericardial modification to inhibit calcification through covalent bonding of heparin and Poly Ethylene Glycol (PEG) in multiple crosslinked pericardium using glutaraldehyde and carbodiimide was examined. It was observed that the inactivation of the unpaired aldehydic moieties in pericardium by PEG and heparin after exposure to glutaraldehyde is the key step in preventing calcification.

Oral insulin delivery system based on chitosan / calcium alginate matrix having different release kinetics for a variety of diabetic conditions was attempted. It was found that insulin complexed with B-cyclodextrin for different periods has different release kinetics in vitro. In vivo experiments in diabetes-induced rabbits, using one of these complexes encapsulated in a chitosan / calcium alginate matrix, yielded promising results. Studies on optimization of the size of microspheres for improved loading and efficiency in anti-diabetic activity were in progress.

Engineering Service

Shri. O. S. NEELANKANTAN NAIR, BSc (Engg)
Engineer and leader

Shri. RAMESH BABU, BE
Engineer

Shri. K. P. R. BHAS, Dip. Electl. Engg.
Junior Engineer

Shri. E. B. MOHANRAJ, Dip. Mech. Engg.
Foreman

Various programmes of the Institute were supported by this Division by fabrication of fixtures and mechanical components.

The notable ones fabricated included :

Fabrication of assembly fixtures and grinding and support for completion of 1800 Concentric Needle Electrodes under sponsored project.

Dental composite delivery system.

Shearing fixtures for membrane oxygenator component.

Machining of Titanium coins for the DLC project and parallel flow cell chambers for treating the biomaterials with blood.

Machining of shunt connectors to M/s. HLL and 6 Nos. Shunt

Diapragam moulds on chargeable basis to M/s. HLL.

Machining of 2 nos. Vial holder for the lyophilizer unit.

Moulds for setting calcium phosphate cements.

Extended machine shop facility for machining different components related to the Membrane Oxygenator project.

In addition to the above, the Division carried out the work of:

Setting up a Tissue Culture lab.

Setting up a Dark room facility for SEM lab.

Setting up a clean polishing room for the DAIO lab.

Routine operation and maintenance of electric system, refrigeration & Air conditioning, plumbing and sanitation system, attendance data collection system, incinerator, panbit, telephone exchange and Faculty hostel.

Microbiology

Dr. A. MAYA, MSc, PhD
Scientist

Implant-associated infections is an adverse side effect of the increasing use of indwelling prosthetic devices. Catheter- associated urinary tract infection comprises a vast reservoir of infectious organisms. They were studied in detail to develop effective anti-microbial surface for implants.

Evaluation of antimicrobial silver oxide coating for latex:

Antimicrobial property of silver and its compounds and its low toxicity to mammalian cells make it an ideal candidate for development of appropriate coating for catheters. A chemical method to coat surface with silver oxide was developed and patented. The coating for latex materials developed by the Biomaterials units was evaluated for its biocompatibility and antimicrobial efficacy for use in Folley's catheter.

Molecular Medicine

Dr. ANOOP KUMAR. T., Ph.D
Scientist & Leader

Molecular biology laboratory facilities were set up to conduct research on molecular defects in epilepsy and to develop DNA/RNA based diagnostic kits for genetic and infectious diseases.

Surgically resected hippocampal tissues from the anterior temporal lobe of epilepsy patients were studied for gene defects by candidate gene approach. This approach is based on the working hypothesis that neurotransmitter release machinery in epileptic neurons is defective. Genes of two functionally

important proteins in the neurons were studied. The tissues were also analyzed for ultra structural changes to identify secondary molecular defects in the diseases. Additionally, differential display technique to analyze gene expression variations in epileptic hippocampus was being standardised.

As a part of developing new diagnostic tools, a Polymerase Chain Reaction (PCR)-based technique to identify the presence of Mycobacterium tuberculosis in cerebral meningitis was being set up. The lab acquired an advanced gradient thermal cycler.

Pathophysiology

Dr. MIRA MOHANTY, MD
Scientist and Leader

DR. T. V. KUMARY, PhD
Scientist

Routine histological evaluation of tissue response to different implanted biomaterials was carried out. This evaluation included gross and light microscopic observation of tissues processed by standard and special methods.

Histological evaluation of pulp response to dental composite implanted in canine teeth for specific time periods.

Autopsy studies on devices, as and when required.

Cytotoxicity tests using direct and indirect contact methods were carried out on 110 samples. These materials included differently modified polymers, metals and ceramics. Cytotoxicity tests were also carried out on different solvent extracts of plant products.

Histological assessment of all organs of rats and dogs in sub-chronic and chronic oral toxicity testing of "cholesterol lowering drug" was carried out.

Completed the histological studies in the project entitled "Effect of Urokinase and Papaerine on chronic vasospasm in an animal model of sub-arachnoid haemorrhage".

Completed the histological studies in the experimental study of "photosensitization of rat skin following aminobeulinic acid and HPD induced photodynamic therapy": as part of the project on "Lasers in Medicine".

Evaluated the cytocompatibility of ceramic materials with fibroblasts and osteoblasts for the project entitled "Biodegradation of calcium phosphate-based ceramic in bone".

Polymer

Dr. M. JAYABALAN, PhD
Scientist and Leader

Shri. VINOY THOMAS, MSc
PhD Student

In continuation of the work on the DBT project "Process optimisation and development of high flex-life polyurethane for use in cardiovascular devices", studies on mechano-chemical degradation were carried out to understand the combined effect of permanent strain and hydrolytic enzymes. Polyurethane-urea (dicyclo hexyl methane diisocyanate-hydroxy terminated polybutadiene-hexa methylene diamine based polymers) was tested. Ageing of strain-induced (20% strain) polymers was carried out in papain enzyme at 37°C. Tensile tests on the aged samples reveal an increase in elastic

modulus due to uni-directional reorganisation of polymer chains during ageing. The effect of papain enzyme in this mechano-chemical degradation was not significant. Accelerated chemical degradation tests reveal no weight loss or dimensional change in the candidate poly urethane - ureas though degradation, weight loss and dimensional changes were observed remarkably in polyether urethane-urea. Therefore the candidate polyurethane-urea, is highly stable even in harsh chemical environment. These were found to be non-cytotoxic.

Polymer Chemistry

Dr. A. JAYAKRISHNAN, PhD
Scientist and Leader

Sri. M. C. SUNNY, BSc., AIC
Scientific Assistant (Till 18-6-98)

Ms. LAKSHMI S., MSc
PhD Student

A surface modification technique to enhance the blood compatibility of plasticized poly (vinyl chloride) was developed by aminating the surface followed by chemical immobilization of poly (ethylene glycol). Also attempted was the immobilization of antiplatelet drugs such as aspirin on the surface of the matrix polymer.

Attempts were also made to prepare a rapidly gelling polymer system based on gelatin and alginic acid dialdehyde. This system has potential to be used as a drug delivery matrix, as a wound dressing and as a possible surgical adhesive.

Attempts were made to prepare microspheres of proteins such as gelatin, albumin and casein using polymeric aldehydes based on alginic acid and starch. The idea was to overcome the toxicity of aldehydes such as glutaraldehyde used extensively in protein crosslinking during the preparation of microspheres.

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

SRI. M. C. SUNNY, BSc, AIC
Scientific Assistant (From 19-6-98)

The animal trials of newly developed radio-opaque dental composite were successfully completed. The test material was used as a restorative and its reponse to pulp and dentine in dogs was monitored upto 70 days and compared with an imported control.

Considerable work was carried out on dentine bonding agents. Third generation bonding agents based on BIS-GMA and Urethane resin matrices were prepared and properties studied. BIS-GMA based bonding agent underwent toxicity studies and was used in animal trials along with radio-opaque composite. Other studies conducted using bonding agents include shear strength evaluation, marginal leakage evaluation, carrier standardisation and thermocycling effects.

Alternate resin matrices based on urethanes were used successfully for preparing composites. These were developed as an alternative to BIS-GMA.

A comparative study of the shear and tensile bond strength at the interfaces of ionomer/dentine and ionomer/composite using two dentile bonding agents was carried out.

Clinical evaluation of light cure composite was carried out in 50 patients.

The research on natural rubber latex products was continued with a view to reduce toxicity and to give a hydrogel coating. For this purpose the procedures of compounding of natural rubber latex were established. A number of formulations with various types of dithiocarbonate accelerators were prepared. The mechanical properties and toxicological properties of the sheets were evaluated. The hydrogel coating of latex-based urinary catheters was carried out by various approaches.

Technical Co-ordination Cell

Sri. D. RANJIT, BE *(Electrical)*
Engineer

The Technology Transfer and Patent related activities were co-ordinated by this Division.

The newly reconstituted Technology Transfer Committee of the Institute chaired by Dr.S.Varadarajan held its meeting in November 1998.

The Technology Development Committee of the Institute had its meeting in December 1998.

The status of the Institute's INTELLECTUAL PROPERTY RIGHTS was as follows :

Patents sealed	:	32 Nos
Design held	:	12 Nos
Patents filed and pending	:	32 Nos
Designs filed and pending	:	01 No.

The Institute's Science Exposition involving a display on the achievements and R & D efforts was organised for THE KERALA UNIVERSITY SILVER JUBILEE, SCIENCE FEST '98, in Aug., 98 and Kannur University, Students Union SCIENCE FEST-99 in March '99.

The Sree Chitra Tirunal Institute for Medical Sciences and Technology exhibition was also organized in Chennai, Indian Science Congress - DST pavilion, January 3-8, 1999.

A one day workshop on "PATENTS -Intellectual Property Rights : Concepts and Procedures" was organised on 12 May 1998. It was sponsored by DST, New Delhi and attended by academicians from all over Kerala.

Technology Proving Facility

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

Shri. D. S. NAGESH, MTech
Engineer

The regular cleaning and maintenance of the clean areas was carried out and made available to users.

The fabrication and assembly of prototype oxygenators were carried out for Membrane Oxygenator Project.

Design of centrifugal potting system with the provision of potting 8 units at a time during commercial production was completed and vendor development was initiated.

Thrombosis Research Group

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

Dr. MAYA DEVI C, MSc, PhD
Post Doctoral Fellow

Mr. SANTHOSH KUMAR T. R., MSc
PhD Student

SMT. RESMI K. R., MSc
PhD Student

Haematology Analyser

Blood samples during evaluation of membrane oxygenator were analysed. The testing of hemoperfusion column beads for haemocompatibility was carried out.

Biochemical Analysis

Blood sugar, urea, creatinine, enzymes and lipid profiles of rabbits for testing herbal drug for its anti-atherosclerotic effect and cholesterol lowering effect was carried out.

Fibrin Glue

A dried, sponge like sheet was fabricated from the components of fibrin glue and found to be an excellent haemostatic agent in experimental animal surgeries. The product was a good adjunct to stop bleeding from animals with systemic heparinization . The applicator for fibrin glue delivery was ready for use. The technical report on the development and evaluation of fibrin glue and the haemostatic fibrin sheet was presented to the Ethics Committee and permission for clinical trials was obtained.

Endothelial Cell

An ideal matrix was developed for growing human umbilical cord endothelial cells on tissue culture plastic and PTFE grafts. By incorporating growth hormones with the matrix components, confluent EC layer could be obtained in 2-3 days after seeding the cells. The EC monolayer formed was non thrombogenic compared to the bare graft surface or the gelatin-coated graft.

Antibodies

Antibody against beta - thromboglobulin was raised and isolated from chicken egg by immunising the hen with the pure antigen. This poly clonal antibody-conjugate with HPP was used for detection of the antigen in plasma samples.

Antibody against Russell's Viper Venom was isolated from Chicken egg yolk after immunising the hen with gamma-irradiated venom. The antibody reacted with native venom and neutralised the thrombin-like activity of venomin in vitro experiments.

Toxicology

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

DR. A. C. FERNANDEZ, MSc, PhD
Scientist

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

Toxicological tests such as systemic toxicity, intracutaneous irritation, haemolysis, sensitization, intramuscular implantation and subcutaneous implantation as per international protocols of different candidate materials for devices under development were carried out.

Besides these, the small animal facility was maintained. The main activity pertained to care and management of small animals like guinea pig, rabbit, rat and mice required for other R & D programmes.

In vivo cytogenic studies like chromosomal aberration and micronucleus studies were carried out for the rubber accelerator ZMBT. Intracutaneous irritation potential of different rubber chemicals was also examined as a part of new research activity.

Vivarium

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

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

This Division maintained laboratory animals like calf, sheep, goat, rabbit and poultry. They were procured as needed and used after pre-conditioning. An excellent infrastructure and expertise existed for conducting experimental surgical procedures and relevant laboratory investigations. Various biomedical devices and biomaterials underwent biocompatibility, safety and efficacy evaluation.

Mouse quadriceps assay for evaluation of osteoinductive materials was done. Application of Fibrin glue during vascular graft surgery was evaluated. Osteocompatibility evaluation of BG and BG-HAP combination was done in rabbit model. Membrane Oxygenator prototype was evaluated by in vitro experiments.

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Patents Granted

1. Mediastinal Drainage Device - (No.180411) of 1993
   Inventors : H. Vijaykumar, B. Ajithkumar, S. Vijayan, C. P. Narayanan Nair
2. Improved Humidifier for Air/Oxygen or other gases - (No.180294) of 1992.
   Inventors : G. S. Bhuvaneshwar C. V. Muraleedharan, R. Sreekumar, L.R. Moses
3. Epidural Sensor for use in Intra Cranial Pressure Monitoring System - (No.180298) of 1993.
   Inventors : G. S. Bhuvaneshwar C. V. Muraleedharan
4. A process for the preparation of a dental paste for use in dental cement - (No.180414) of 1991
   Inventors : S. N. Pal, V. Kalliyanakrishnan Ashima Valiathan, Sheela M. S, Krishna Tamareselvy
5. A process for the preparation of silver oxide incorporated anti-microbial polymers - (No.179825) of 1994.
   Inventors : K. Sreenivasan, L.R.Moses, R. Sivakumar
6. A process for the preparation of beta-tricalcium phosphate Bioceramic powder - (No.181310) of 1994.
   Inventors : Harikrishna Varma, R. Sivakumar
7. A process for the preparation of haemodialysis membrane - (No.179881) of 1992.
   Inventors : C. P. Sharma, Willi Paul
8. A process for the preparation of uncross-linked and cross-linked PMMA microspheres - (No.179451) of 1991.
   Inventors : A. Jayakrishnan, B. C. Thanoo
9. A process for the preparation of hydroxyapatite powder for applications such as in bioceramics - (No.181625) of 1994.
   Inventors : H.K. Varma, R. Sivakumar

Patents Filed

1. A process for the preparation of anti-snake venom in hens and isolation of immunoglobulins from chicken egg-yolk
   Inventors : Lissy. K, Krishnan Mary Vasantha Bai
2. A biodegradable and haemostatic fibrin sheet for wound care application
   Inventors : Lissy. K, Krishnan, Mira Mohanty, Arthur Vijayan
3. A process for the preparation of a photopolymerisable dentine bounding agent
   Inventors : V. Kalliyanakrishnan P. P. Lizymol
4. A process for the preparation of urethane tetramethacrylate resin matrix(utma)
   Inventors : V. Kalliyanakrishnan P. P. Lizymol
5. Design application for the assembly fixture for production of concentric needle electrode
   Inventors : Niranjan D, Khambete V. Ramesh Babu E. B. Mohan Raj O. S. Neelakantan Nair

Externally Funded Research Projects

1. 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.

2. 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.

3. Title

Efficacy and long term outcome of Pallidotomy for Parkinson's disease.

Principal Investigator :

Dr. Asha Kishore

Funded by :

Kerala State Financial Enterprises.

Duration: 3 years

Status: Ongoing.

4. 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.

5. 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.

6. 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. Santosh Kumar

Funded by :

German Pharmaceuticals

Duration: 1 year

Status: Ongoing.

7. Title

Seizure; An artificial intelligence programme for diagnosis of Epilepy.

Principal Investigator :

Dr. Sanjeev V. Thomas

Funded by:

Department of Electronics, Government of India.

Duration: 2 years

Status: Ongoing.

8. 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.

9. Title

An open-label study on the safety and 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.

10. Title

Characterisation of glycoconjugates containing tumor-related epitopes, terminal x-galatoside and T-antigen in normal and neoplastic human brain tissue using jacalin.

Principal Investigator :

Dr. P. S. Appukuttan

Funded by :

Council for Scientific and Industrial Research, New Delhi

Duration: 4 years

Status: ended 31.3.99

11. Title

Interactions of human serum anti- galactoside antibody 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 .

12. Title

Coconut oil and incidence of Coronary Artery Disease in Kerala.

Investigators:

Dr. K. Subramonia Iyer, Dr. N. Jayakumari, Dr. Jaganmohan Tharakan, Dr. Sankara Sharma.

Funded by:

Coconut Development Board, Ministry of Agriculture, New Delhi

Duration: 3 years

Status: Ongoing.

13. Title

Stimulation of cardiac fibroblast proliferation by lanthanides: A superoxide-mediated response.

Principal Investigator :

Dr. R. Renuka Nair

Funded by :

Indian Council of Medical Research, New Delhi

Duration: Four years

Status: Ongoing

14. Title

Mechanism of cardiac fibrogenesis in experimental magnesium deficiency

Principal Investigator :

Dr. K. Shivakumar

Funded by :

Department of Science & Technology, New Delhi

Duration: Three years

Status: ongoing

15. Title

"Synthesis of Hydroxyapatite and sintered body for Biomedical Applications"

Principal Investigator :

Dr. H. K. Varma

Funded by:

Department of Science & Technology, New Delhi

Status: Ongoing

16. Title

" Process Optimization and Development of high flex-life polyurethane for use in cardiovascular devices ."

Principal Investigator:

Dr. M. Jayabalan

Funded by :

Department of BioTechnology , New Delhi

Duration: Three years

Status: Ongoing

17. Title

"Toxicity evaluation of an anti-atherosclerosis plant drug"

Principal Investigator :

Dr. P. V. Mohan

Funded by :

Cybele Herbal Laboratories, Kochi

Duration: One years

Status: Ongoing

18. Title

"Development of Non-toxic Latex formulation for Biomedical Applications."

Principal Investigator:

Dr. P. V. Mohanan

Funded by :

Department of Science & Technology, New Delhi

Status: Sanctioned

19. Title

"Hydroxyapatite -ethylene vinyl acetate copolymer composite for bone substitute applications."

Principal Investigator :

Dr. P. Ramesh

Funded by :

Department of Science & Technology, New Delhi

Status: Sanctioned

20. Title

"Development of a hollow fibre-based membrane oxygenator."

Principal Investigator :

Dr. G. S. Bhuvaneswar

Funded by :

SPIC Pharma Ltd., Madras

Duration: Three years

Status: Ongoing

21. Title

"Biodegradation of calcium phosphate-based ceramics in bone"

Principal Investigator :

Dr. Annie John

Funded by :

Department of Science & Technology, New Delhi

Duration: Three years

Status: Ongoing

22. Title

Identification of molecular basis of Temporal lobe epilepsy

Principal Investigator:

Dr. Annie John

Funded by :

Science, Technology & Environment Committee, Scientific Research Fund Scheme, Kerala

Duration: Three years

Status: Ongoing

23. Title

"Development of Diamond Like Coatings for Biomedial and other Applications."

Principal Investigator :

Dr. G. S. Bhuvaneswar

Funded by :

IFCPAR, New Delhi

Duration: Three years

Status: Ongoing

24. Title

Study of the carrier status of potential pathogenic bacteria in the nose, throat and skin and its relation to post-operative wound infections among Cardiac Surgery patients.

Principal Investigator :

Dr. J. Shanmugham

Funded by :

Science and Technology Environment Committee, Government of Kerala

Duration: 3 years

Status: Ongoing

25. Title

Identification and characterisation of protective antigens of M.tuberculosis with the potential practical benefits of identification of vaccine candidates and as reagents for diagnostic tests.

Principal Investigator :

Dr. M. Muralidhar K. Katti

Funded by :

Science and Technology Environment Committee, Government of Kerala

Duration: 3 years

Status: Ongoing

26. Title

Studies on mucoid vasculopathy in Kerala

Principal Investigator:

Dr. S. Sandhyamani

Funded by :

Department of Science and Technology, New Delhi.

Duration: 3 years

Status: Ongoing.

27. Title

Diarrhoea morbidity among underfive children : A comparatative study of two villages each in Kerala and Tamil Nadu states.

Principal Investigator:

Dr. K. R. Thankappan

Funded by :

Kerala Research Programme for Local Development.

Duration: 1 1/2 years

Status: Ongoing

28. Title

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

Principal Investigator:

Dr. V. V. Radhakrishnan

Funded by :

Department of Science & Technology, New Delhi.

Duration: 3 years

Status: Ongoing

29. Title

Role of cytokines in the prognosis of Guillian Barre Syndrome

Principal Investigator :

Dr.V. V. Radhakrishnan

Funded by :

Department of Bio Technology, New Delhi

Duration: 3 Years

Status: Sanctioned

Conferences, Workshops and Training Programmes Organised in the Institute

Date	Name of the event	Distinguished guests partcipated
12.5.98	Workshop on "Patents Intellectual Property Rights: Concepts and Procedures." Sponsored by the Dept. of Science & Technology, New Delhi	
22.5.98	International Seminar on Emerging Public Health Issues in South Asia - Inaugurated by HE the Governor of Kerala	80 delegates from 7 countries participated.
7.6.98	CME in "Coronary Artery Disease"	More than 70 delegates participated. Recent advances were discussed
6.8.98	Fifth National Movement Disorders Workshop	Dr. Donald Calne (Canada) Dr. Andreis Bosch (Netherlands)
11.10.98	A CME on "Recent trends in the management of stroke" was conducted	More than 80 delegates attended the programme. Faculty from SCTIMST, SAT and Medical College, Trivandrum, presented the paper.
16.10.98	Vice Chancellors' Conference (South Zone)	
11.11.98	Tenth National Conference of the Society for Biomaterials and Artificial organs with the theme "New Frontiers in Biomedical Materials and Devices"	Dr. A. P. J. Abdul Kalam inaugurated the Conference. Prof. Erhan Pisking, Hacetteppe University, Turkey, delivered the keynote address.

14.11.98	Second National Workshop on Intractable Epilepsy	Prof. Jerome Engel (Los Angeles), Prof. Omkar N. Markand (Indiana) Prof. Herbert Silfvenus (Swedan) Dr. E. Perucca (Italy) and Dr. Nimal Senanayake (Sri Lanka)
19.11.98	Workshop on Atrial Septal Defect closure using an Amplatzer device	Dr. Ramesh Arora, Director Professor, Cardiology, G. B. Pant Hospital, New Delhi was the Principal Operator
15.12.98	Dr. Surendran Memorial CME	
16.12.98	Sixth Annual Conference of the Indian Epilepsy Association	
18.12.98	SCTIMST - Confederation of Indian Industry (CII) theme seminar on Medical Device Technology - Business opportunities	Dr. Placid Rodriguez
13.3.98	Workshop on Atrial Septal Defect closure using an Amplastzer device	Dr. George Joseph, Cardiologist, CMC, Vellore, was Principal Operator.
31.3.99	Demonstration - Technique of percutaneous mitral commissurotomy using Cribier's Metal valvulotometane	Professor Alain Criber, France

Special Visitors

1. Nobel Laureate, Dr. James D. Watson, addressed the staff and students of the Institute.
2. Bharat Ratna Dr. A. P. J. Abdul Kalam, Scientific Advisor to the Defence Minister, inaugurated the tenth national conference of the Society for Biomaterials and Artificial Organs.
3. Dr. Hywel Davies DM, FRCP, FACC, former Professor of Cardiology, Denver, Colorado, USA and Cambridge, United Kingdom, discussed ongoing investigations on Vitamin D and atherosclerotic coronary artery diesease.
4. Dr. Kumaresan Cooper, Department of Anatomic Pathology, The South Africa Institute of Medical Research, Johannesburg, talked on Degenerative Cardiovascular diseases in South Africa.
5. Dr. Jerome Engel, MD., Ph.D, UCLA School of Medicine, Los Angeles,California, USA.
6. Dr. Omkar N.Markand, MD., FRCP, Indiana Univ School of Medicine, Indianapolis, Indiana, USA.
7. Dr. E. Perucca, MD., Associate Professor of Medical Pharmacology, University of Pavia, Pavia, Italy.
8. Dr. Nimal Senanayake, FRCP, Ph.D, Dean/ Faculty of Medicine, University of Peradeniya, Peradeniya, Sri Lanka.
9. Dr. Herbert Silfvenius, MD., Ph.D, Department of Neurosurgery, University Hospital, Umea, Sweden, guided the first hemispherectomy in the Institute.
10. Sid Gilman, MD., Chief of Neurology Service, University of Michigan, Ann Arbor, Michigan, USA.
11. Roy J Mathew, MD., Professor of Psychiatry, Duke University Medical Center, Durham, North Carolina, USA.
12. Donald Calne, FRCP(C)., Director, Neurodegenerative Disorders Centre, Vancouver, Canada.
13. Andreis Bosch, MD., Professor of Neurosurgery, University of Amsterdam, Amsterdam, The Netherlands.
14. Prof. S. Kalachandra, University of Carolina, USA delivered a lecture on Dental Composites in the Biological Environment.
15. Dr. R. Suryanarayanan of Laborotoire de Chime des Solides, University of Paris-Sud, France held discussions on the Indo-French collaborative project.
16. Mr. Yvon Sampeur, Director, ICMC, (Industrial Collaborator).
17. Dr. Yoshiyuki Yokogawa , Head , Bioceramic Laboratory, National Industrial Research Institue of Nagoya (NIRIN), Nagoya, talked on Biomimetic processing of Bioceramic Materials.
18. Professor Alain Cribier, and Ms. Helene Eltchaninoff, cardiologists, Charles Nicolle University Hospital, Rouen, France . Demonstrated the technique of percutaneous mitral commissurotomy using Cribier's Metal Valvulotome.
19. Professor William Reinke from the Johns Hopkins University, Baltimore, USA, talked to the MPH scholars on Management in Public Health.

Visits Abroad for International Conference

1. K. Mohandas participated in the Commonwealth Universities General Conference at Ottawa, Canada.
2. Anil Bhat was sponsored by the Institute for a fellowship in Interventional Cardiology at the Hospital Charles Nicolle, Rouen, France, under Professor Alain Cribier, for a period of six months from 15-04-1998 .
3. Asha Kishore underwent one month training in movement disorders at the Emory University School of Medicine, Atlanta, Georgia, U.S.A.
4. M. Bhaskara Rao participated in the third seminar of Neurosurgery update for young neurosurgeons in Asia held at Osaka in October 1998.
5. G. S. Bhuvaneshwar visited France in October 98 for discussions with the French collaborators and for planning the execution of the project.
6. Dilip Panikar went for advanced training in "Surgery for movement disorders" to Emory University School of Medicine, Atlanta, in June 1998. He also participated in the third seminar of Neurosurgery update for young neurosurgeons in Asia, held at Osaka in October 1998.
7. Lissy K. Krishnan attended a conference organised by Cambridge Health Institute, U.S.A, in November 1998, and presented a paper during the Tissue Sealants session.
8. Mala Ramanathan completed training in Medical Anthropology through the Amsterdam Masters in Medical Anthropology at University of Amsterdam. She also attended a meeting on "Communicating Sexuality" organised by MacArthur Foundation at Kathmandu, Nepal, in February 1999.
9. K. Radhakrishnan attended the Neurology update on medically refractory epilepsy organised by the Neurological Association of Sri Lanka, Colombo, Sri Lanka, July 1998.
10. V. V. Radhakrishnan was a visiting Professor at the Department of Neuropathology, Montreal Institute of Neurology, Montreal, Canada in August 1998. He also presented a paper at the fifth International Conference of Neuroimmunology at Montreal, Canada, in August 1998 (Rapid diagnosis of Tuberculous meningitis by immunological method).
11. R. C. Rathod, Rupa Srinivas, Srinivas V.G, P. K. Neema and Ratan Gupta participated and presented papers at the annual conference of ISA held at Kathamandu (Nepal) during December 1998.
12. P. Sankara Sarma presented an abstract "Association of blood pressure in childhood with parental socioeconomic position : A crosss-sectional study of school children in Delhi "at the Global INCLEN meeting at Bangkok during March 1-4, 1999.
13. R. Sivakumar was a member, Scientific Programme Committee, the 4th Asian Symposium on Biomedical materials, Singapore, December 1998. He visited the National Research Institute of Nagoya (Japan) March 1-18, 1999.

14. Santhosh Joseph attended the Second Asia Pacific Cardio Vascular Stenting Symposium and Live Demonstration Course at Hong Kong during March 23 - 27, 1999.

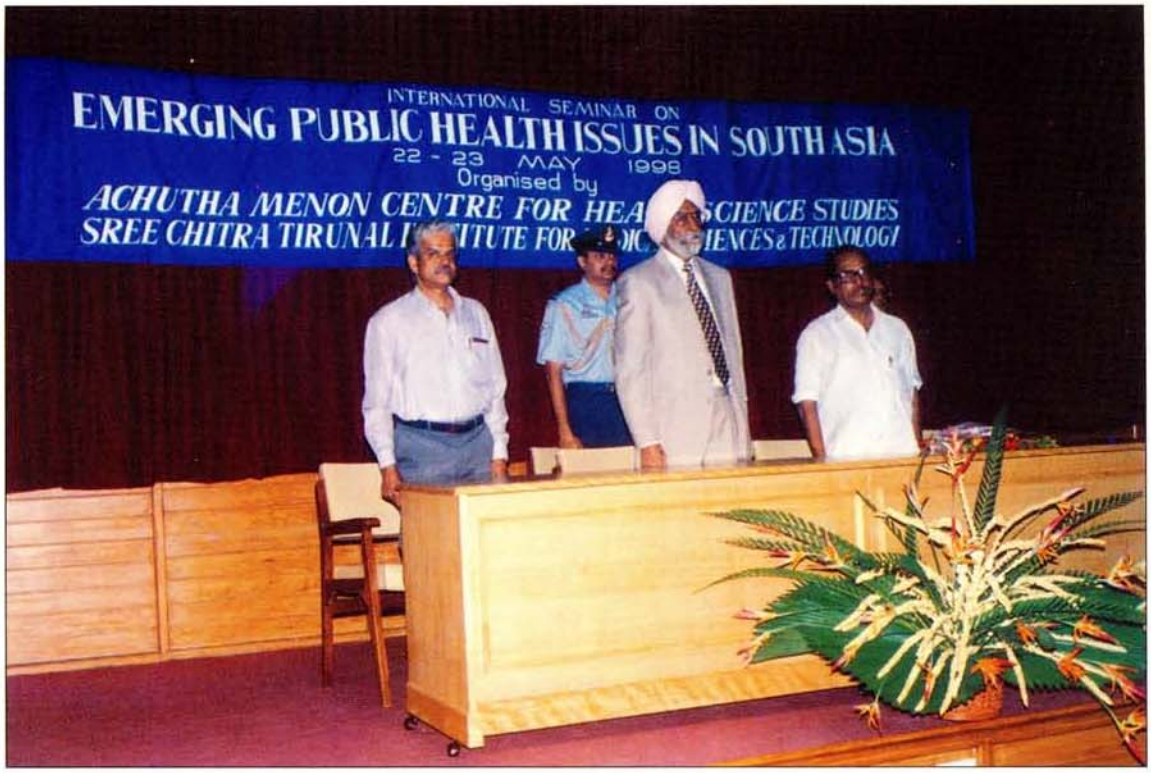
15. Suresh Nair participated in the Second Asian Congress of Neurological Surgeons meeting at Osaka and Fujita Health University seminar at Toyokae.

16. K. Shivakumar spent an year in the Laboratory of Cardiovascular Science, National Institute of Health, United States of America.

17. K. R. Thankappan attended the Advisory Committee meeting of Health Services Division of the Rockefeller Foundation at New York, U.S.A, in August 1998. He also attended "Public Health Schools without walls (PHS WOW)" meeting at Bangkok .

18. D. Varatharajan visited the Ministry of Health and Tribhuvan Institute of Preventive and Social Medicine (NIPSOM) and Bangladesh Rural Advancement Committee (BRAC) in Bangladesh during November 1998 to study the health policies of these two countries.

19. H. K. Varma was awarded STA fellowship by Science and Technology Agency, Ministry of International Trade and Industry, Japan, to carry out post-doctoral research in the area of biomimetic processing of bioceramic materials.



His Excellency Shri. Justice Sukhdev Singh Kang (Retd.)
inaugurates the International Seminar on "Emerging Public Health Issues in South Asia" on Friday, 22 May, 1998.

Licence agreement between SCTIMST and Dynamic Orthopaedic Pvt. Ltd., Aluva, Kerala
for Hydroxy Apatite Porous Granules

Statement of Accounts
1998-'99

Contents

Balance Sheet As at 31st March 1999

Figures for the previous year	GENERAL FUND AND LIABILITIES	Amount
Rs Ps		Rs Ps
	GENERAL FUND :	
722070068.24	Balance as per last Balance Sheet	853729666.24
	Additions out of	
	(a) Grant from Govt. of India for	
128730000.00	Plan Expenditure	136700000.00
	(b) Donations for Specific purposes	
2929598.00	utilised during the year	1000000.00
853729666.24		991429666.24
944549.96	Less : Capital Investments written off	986549.96
	Less : Excess of Expenditure over Income	
158456635.80	adjusted out of General Fund upto 31.03.1997	215737059.91
57280424.11	Less : Excess of Expenditure over Income for the current year	72892710.71
637048056.37		701813345.66
27813434.00	Sinking Fund	41232711.00
11734984.00	Technology Development Fund	11861869.00
9924553.34	Unutilised Grants for Research Projects	10856017.01
95226076.55	Employee's Benefit Funds	123275091.05
	Current Liabilities & Provisions	
6477865.52	Sundry Creditors for expenses	7018712.52
21825283.98	Other Liabilities	15414325.98
810050253.76	**Total**	**911272072.22**

Note: Changes suggested by the audit were incorporated in the above statement.

sd/
Financial Adviser &
Chief Accounts Officer

Figures for the previous year	ASSETS	Amount	
Rs Ps		Rs Ps	Rs Ps
599209691.83	**FIXED ASSETS**	668418838.72	
944549.96	Less : Assets written off	986549.96	
598265141.87			667432288.76
	Current Assets		
12883593.76	General Stores	12138056.17	
1485743.64	Tools	1678228.87	
3851989.01	Instruments	3960464.91	
1136858.08	Glasswares	1022327.10	
4349141.91	Medicines	4349141.91	
2000.00	Investment in shares of Employees co-operative Society	2000.00	
			23150218.97
1525298.28	**Deposits**		1534298.28
	Deposit with Banks		
94519998.46	For Staff Benefits		122863374.96
43035644.58	For Specific Purposes		65370395.08
	Loans and Advances		
	Advances Recoverable in Cash or in kind or for Value to be recovered		
	Unsecured considered good		
13065580.91	For purchases	12101501.60	
15268436.46	To staff	12338328.56	
1765145.13	Other Advances	2460013.63	
8030000.00	Grant receivable from Govt. of India	0.00	
1106590.26	Amount receivable from sponsers of Projects	1178221.61	
			28078065.40
	Cash & Bank Balances		
278288.53	Cash and stamps in hand	251435.65	
9480802.88	Balance with Banks	2591995.12	
			2843430.77
810050253.76	**Total**		**911272072.22**

sd/
Director

Income and Expenditure Statement Account for the year ended 31st March 1999

Figures for the previous year	EXPENDITURE	Amount
Rs Ps		Rs Ps
	Excess of Expenditure over Income	
106035570.64	Hospital Wing	113164086.41
13504601.37	Bio Medical Technology Wing	18181611.99
136543.00	Expenses for Committee Meetings	301630.00
117750.00	Legal Expenses	58720.00
84339.00	Travelling Expenses	404835.00
7234369.00	Expenses for Academic Programmes	10802355.28
955106.30	Travelling expenses for Seminars and Conferences	779978.00
230671.00	Expenses of Achutha Menon Centre	193482.00
128298950.31	**Total**	**143886698.68**

sd/
Financial Adviser &
Chief Accounts Officer

Figures for the previous year	**INCOME**	Amount
Rs Ps		Rs Ps
68700000.00	Grant received from Govt. of India	68266000.00
292837.00	Rent	238630.00
547292.20	General Receipts	618868.95
0.00	Fees collected-AMC	
1170947.00	Interest received	944269.00
237950.00	Application & Examination fee from P G Students	884220.02
69500.00	Income from Sale of Assets	42000.00
57280424.11	Excess of expenditure over income transferred to General Fund Account	72892710.71
128298950.31	**Total**	**143886698.68**

sd/
Director

Income and Expenditure Account for the year ended 31st March 1999 Hospital Wing

Figures for the previous year	EXPENDITURE	Amount
Rs Ps		Rs Ps
18118776.38	Medicines	19527373.40
1885235.68	Chemicals	2282471.73
3281183.00	Medical Gases	3163586.25
2325657.52	Films & Chemicals for Radiology Dept.	2090122.90
735717.85	Uniforms & Hospital linen	552011.04
55724154.39	Hospital Items	63707352.13
725746.15	Hospital Expenses	1116314.10
2194324.40	Inpatient Diet expenses	2386767.96
1369991.10	Laboratory Expenses	2403921.95
73029827.14	Salaries & Allowances	89978138.45
180364.00	Honorarium to Visiting Faculty	161394.00
1715290.40	Medical benefit to staff	2665709.60
1011971.00	Contribution to Provident Fund	443377.00
93072.00	Travelling Expenses	295573.00
31150.00	Expenses for visiting faculty	37210.00
256481.00	Home travel & Leave travel concession	325886.00
815425.95	Postage, Telephone and Telegrams	904823.10
1398677.25	Printing & Stationery	1390595.80
610310.00	Advertisements	499165.00
126288.00	Recruitment Expenses	299473.00
8141453.55	Electricity & Water Charges	9544205.00
199569.35	Freight, Insurance & Handling charges	270042.25
414512.89	Vehicle Maintenance Expenses	389215.34
521964.21	Bank charges and commission	1047628.59
75.00	Agricultural Expenses	25650.00
91054.40	Taxes & Licence	222365.00
	Repairs and Maintenance	
15068211.45	Equipments	11935140.68
1370109.32	Buildings	1182570.50
456797.40	Others	486282.00
25559.00	Staff Training Expenses	216011.00
33532.00	Research-In House Projects	0.00
142517.50	Other Expenses	153637.00
0.00	Bonus & Festival Allowences	
1295334.44	Tools, Glassware & Instruments - consumed	1290737.64
2199085.00	Contribution to Pension Fund	6230287.00
4724066.00	Contribution to Sinking Fund	5996112.00
400000.00	Contribution to Gratuity Fund	0.00
200713484.72	**Total**	**233221150.41**

sd/
Financial Adviser &
Chief Accounts Officer

Figures for the previous year	**INCOME**	Amount
Rs Ps		Rs Ps
	Hospital Collections	
75251504.08	Inpatient Charges	96643643.00
19230315.00	Investigation & Registration Charges	23284415.00
196095.00	Overhead Charges Collected from Projects	129006.00
106035570.64	Excess of expenditure over Income transferred to Income & Expenditure Account - General	113164086.41
200713484.72	**Total**	**233221150.41**

sd/
Director

Income and Expenditure Account for the year ended 31st March 1999 - Biomedical Technology Wing

Figures for the previous year	EXPENDITURE	Amount
Rs Ps		Rs Ps
435360.84	Chemicals	689630.20
57830.00	Consumable Stores	76773.80
421192.83	Laboratory Expenses	295406.35
11127226.35	Salaries & Allowances	13544906.60
245518.00	Medical benefits to staff	175525.00
67771.00	Travelling Expenses	123138.50
16546.00	Uniforms to Staff	30958.40
4222.00	Expenses for Visiting Faculty	24615.00
206873.00	Postage, Telephone & Telegrams	197216.50
95582.15	Printing & Stationery	90418.00
59600.00	Advertisements	49824.00
1132390.00	Electricity & Water Charges	1114827.00
62921.50	Freight, Insurance & Handling Charges	82129.50
147335.04	Bank Charges & Commission	51453.47
98208.50	Garden & Estate Expenses	44258.00
	Repairs & Maintenance Expenses	
471780.57	Equipments	904275.00
78364.00	Buildings	313270.00
29370.00	Others	41786.90
298217.35	Animal Research Lab Expenses	229154.65
136211.70	Other Expense	153014.00
253592.55	Workshop & Tool room expenses	304986.63
750.00	Honararium	15000.00
148364.50	Seminar & Conference expenses	150304.00
10365.00	Legal Charges	17547.00
23361.50	Exhibition expenses	14711.00
76999.00	Home travel & Leave travel expenses	155246.00
27908.20	Vehicle maintenance expenses	17375.00
140514.00	Taxes & Licences	168618.00
323313.24	Tools, Glassware and Instruments written off	374517.58
36836.00	Staff Training expenses	6178.00
1173598.00	Contribution to Technology Development Fund	0.00
11423.90	Research expenses - In house projects	126885.00
0.00	Visiting faculty expenses	103646.00
43242.50	Committee meeting expenses	70918.00
17462789.22	**Total**	**19758513.08**

sd/
Financial Adviser &
Chief Accounts Officer

Figures for the previous year	**INCOME**	Amount
Rs Ps		Rs Ps
1173848.00	Premium & Royalty received	126885.00
692270.00	Facility charges received	192380.00
0.00	Overhead charges collected from projects	90277.84
15391.00	Interest received	14406.00
19067.70	Income from Garden & Estates	13965.00
42322.75	Sundry receipts	35696.25
1990238.40	Interest from technology fund	1009933.00
20408.00	Rent collected from staff	86958.00
4642.00	Sale of tender forms	2400.00
	Examination fee received	4000.00
13504601.37	Excess of expenditure over income transferred to general income and expenditure account	18181611.99
17462789.22	**Total**	**19758513.08**

sd/
Director

Receipts and Payments Account for the year ended 31st March 1999

Figures for the previous year	RECEIPTS	Amount
Rs Ps		Rs Ps
	Opening Balance	
245402.24	Cash in hand	278288.53
5430064.29	Balance with banks for G.P.	9480661.88
	Hospital Collection	
79781479.85	Inpatient deposit	95001835.00
18766775.00	Investigation and Registration charges	22858145.00
	Research and Development Wing	
1173848.00	Royalty received	126885.00
19067.70	Income from estate	13965.00
28702.00	Sundry receipts	30219.00
11565.00	Interest on bank deposits	11762.00
1990238.40	Interest on special deposit	1009933.00
680620.00	Facility hire charges	180380.00
	General Receipts	
500746.20	Sundry receipts	512646.95
37213.00	Rent	98660.00
1039923.00	Interest received	862495.00
237950.00	Application & Examination fee from PG students	954620.02
33193.00	Notice pay received	112509.00
	Grant received from Govt. of India	
68700000.00	For recurring expenses	68266000.00
120700000.00	For capital expenses	144730000.00
	Grant for specific research	
8007935.00	Projects	6923534.00
2192774.00	Receipts for specific purpose	10831337.00
574456.90	Deposits received	1158618.00
69500.00	Receipts from sale of Assets	42000.00
42264953.70	Receipt for PF & Pension Fund	23245084.00
1500000.00	Donation for specific purpose	1000000.00
6011918.00	Temporary over draft (Bank)	0.00
40000000.00	Deposit refunded	0.00
399998325.28	**Total**	**387729578.38**

Note: Payments for fixed assets includes advances granted for procurement Rs. 75,13,162.90

sd/
Financial Adviser &
Chief Accounts Officer

Figures for the previous year	PAYMENTS	Amount
Rs Ps		Rs Ps
	Expenses for Hospital Wing	
82821404.39	To staff	96956104.25
121924027.47	To others	123107756.29
	Expenses for BMT Wing	
11730921.00	To staff	14304784.75
6025542.31	To others	4957547.28
792925.60	Expenses for general purpose	682600.50
1077336.60	Expenses for Academic purpose	9725242.90
211401.00	Expenses for Achutha Menon Centre	170722.00
109806678.35	Payment for fixed assets	69690002.70*
13796.65	Payments for tools	472274.45
735887.00	Payment for glasswares	634606.30
1776338.00	Payment for Instruments	684240.20
0.00	Refund of Bank overdraft	6823112.00
6087263.30	Payment for Projects	4536063.24
933488.00	Deposits Refunded	866516.25
46302365.20	Deposit for specific expense	37855297.50
	Deposit for sinking fund	13419277.00
	Closing balance	
278288.53	Cash in hand	251435.65
9480661.88	Cash with banks	2591995.12
399998325.28	**Total**	**387729578.38**

sd/
Director

Schedule of Fixed Assets

Particulars of Assets	As on 1-4-1998	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	82813015.18	2825616.00	85638631.18		85638631.18
Satelmond Palace	2166170.00	0.00	2166170.00		2166170.00
Compound Walls	1096559.68	2283002.00	3379561.68		3379561.68
Equipments	370005668.62	48622222.44	418627891.06	505410.00	418122481.06
Gas plant installations	607730.09	289914.00	897644.09		897644.09
Air conditioners & refrigerators	13251547.91	1714397.00	14965944.91	25000.00	14940944.91
Cold room installation	341700.00	0.00	341700.00		341700.00
Sub-station installations	1349552.25	0.00	1349552.25		1349552.25
Electrical installations	9441813.52	1108962.30	10550775.82		10550775.82
Water coolers	62866.50	0.00	62866.50		62866.50
Lift installations	2577633.10	0.00	2577633.10		2577633.10
Canteen Equipments	79404.84	3980.65	83385.49		83385.49
Office Equipments	813998.54	36696.00	850694.54		850694.54
Furniture & Fixtures	14759770.61	739434.00	15499204.61	54107.00	15445097.61
Motor vehicles	2715789.30	0.00	2715789.30	356614.89	2359174.41
Telephone installation	1653165.94	75025.00	1728190.94	0.00	1728190.94
Library books	44926170.14	5795402.50	50721572.64	3338.07	50718234.57
Kitchen Utensils	395088.82	0.00	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	375182.70	58194.00	433376.70		433376.70
Oxygen cylinders	203362.42	0.00	203362.42		203362.42
Live stock	3298.00	28550.00	31848.00		31848.00
Borewells	174615.00	0.00	174615.00		174615.00
Building-AMC	46884772.16	5627751.00	52512523.16		52512523.16
Total	**599209691.83**	**69209146.89**	**668418838.72**	**944549.96**	**667474288.76**

Accounting Policy of Sree Chitra Tirunal Institute for Medical Sciences & Technology, Trivandrum

The System of Accounting followed by Institute is detailed below:

1. Income and Expenses of Institute are accounted on accrual basis.
2. Depreciation on assets not provided for, since the format approved by C&AG, do not provide for the same.
3. Plan Fund Grants received from Govt. of India (DST), and donations received specifically for acquiring Fixed Assets are added to General Fund of Institute and expenses incurred for Research and Academic purposes from Plan Fund are reduced from it.
4. Five percent of receipts from patients are transferred to a Fund for meeting unexpected expenses on equipments.
5. Funds received from Technologies developed by Institute are transferred to a Fund (Technology Development Fund) for meeting additional expenses on improvement of Technologies already developed.

Sd/	Sd/
FA & CAO	Director

Audit Report

Audit Report on the Accounts of the Sree Chitra Tirunal Institute for Medical Sciences & Technology, Thiruvananthapuram for the year 1998-99

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 from the Central Government. During thie year 1998-99, the Institute received a sum of Rs.2129.96 lakh as grants from 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 Sree Chitra Tirunal Institute for Medical Sciences & Technology, Act, 1980.

Comments on Accounts

2. Revision of Accounts

(i) Sinking Fund

The Sinking Fund Account was originally shown in the accounts as Rs. 360.59 lakhs. An amount of Rs. 51.73 lakhs was not accounted for under this head. This was done at the instance of Audit. As a result there was an increase in assets and liabilities to that extent.

Replies to Audit Comments

Details of interest accrued was received only after accounts were prepared for audit. However this was corrected in accounts before audit was completed.

(ii) Capital Assets Written off

Sale proceeds to the extend of Rs. 42,000 received by disposal of Capital assets was not included in the Balance sheet under the Heads Capital Assets written off. This was brought to the Head Capital Assets written off at the instance of Audit. This has resulted in reduction in Fixed Assets.

Since corrected in accounts.

3. 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 year were to the extent of Rs. 1867.83 lakh. As against this, the investments & deposits made were to the extend of Rs. 1759.58 lakh only. Hence there was an uncovered deficit of Rs. 108.25 lakh in the investments.

The Institute stated (November 1999) that due to payment of the arrears of revised pay and allowances, the Grant amount released was not sufficient to meet the expenses of the Institute fully and the matter has been taken up with the Government for additional funds to meet increase in pay and allowances.

Due to payment of revised pay and arrear payments the Grant amount released was not sufficient to meet the expenses of Institute fully. Taken up with Government for additional funds to meet increase in pay and allowances.

4. Mixing up of Plan-Non-Plan Grants

Grant received from Govt. of India to meet capital expenditure was to the extent of Rs. 1367.00 lakh. Out of this expenditure to the extend of Rs. 692.09 lakh was only incurred under capital and the balance amount of Rs. 674.91 lakh was diverted to meet recurring expenditure, resulting in over statement of Capital fund to this extent in the Balance Sheet. Plan grants of Rs. 674.91 lakh were, therefore, mixed up with Non-Plan grants.

Rs. 1367.00 lakhs released under Plan scheme was to meet expenditure for Assets and recurring Plan expenses including pay revision arrears. The expenses were incurred as per Budget approved by Governing body of Institute.

The Institute stated that Rs. 1367.00 lakh released under Plan scheme was to meet expenditure for Assets and recurring plan expenses including pay revision arrears. The expenses were incurred as per Budget approved by Governing Body of the Institute. However, the Institute was not able to furnish any documentary evidence on release under Plan scheme being for pay revision arrears.

5. Discrepency in Assets Register

As per the provisions contained in Rule 152(4)(a) of GFR, an Asset Register in Form GFR 19 is required to be maintained. The register maintained by the Institute was not in the prescribed format and the closing balance for 1998-99 has not been arrived at in the Register. Hence, the correctness of the figure against assets shown in Balance sheet could not be verified in Audit.

The Asset Register will be revised as suggested by audit.

6. Non-quantification of depreciation

The asset accounts depict book value of acquisition and do not exclude obsolscent, unusable, irreparable and condemned assets and also do not take into account depreciation with corresponding reduction of capital account. Though a note to this effect was made by the Institute in its Accounting Policies, the Institute did not quantify the depreciation. Therefore, the capital and asset account are overstated accordingly thereby not giving the correct picture.

The Balance sheet format was as approved by C&AG of India. There is no provision for providing Depreciation in the approved format.

sd/
Pr. Director of Audit
Scientific Departments

Place: New Delhi
Date: 25 Jan. 2000

sd/-
Director

Place: Thiruvananthapuram
Date: 25 Jan. 2000

Audit Certificate

I have examined the Receipts and Payment Accounts, Income and Expenditure Account and the Balance Sheet for the year ended 31st March, 1999 of the Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thriuvananthapuram. 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.

Sd/
Principal Director of Audit
Scientific Departments

Place: New Delhi
Dated : 25 Jan. 2000

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. Sri. George Eden,
Member of Parliament
(Lok Sabha) Link Garden Houssing Colony,
Kaloor, Cochin (upto 26.4.99)
6. The Secretary to the Government of India,
Ministry of Health and Family Welfare
Nirman Bhawan, New Delhi-110 011
7. Dr. M. R. Das, (Ex-officio)
Chairman, State Committee on Environment,
Science and Technology, Government of Kerala, Thiruvananthapuram.
8. The Secretary to the Government of India,
Ministry of Human Resources Development,
Shastri Bhavan, New Delhi - 110 001.
9. Sri. V. Dhananjaya Kumar,
Member of Parliament (Lok Sabha) Pavithra
Dandakari Road, Yeyyadi Mangalore ,
Karnataka (up to 26.4.99)
10. Dr. S. K. Mahajan,
Head, Molecular Biology & Agri. Division,
BARC, Trombay,
Mumbai - 400 085.
11. Dr. K. Mohandas,(Ex-officio)
Director, SCTIMST,
Thiruvananthapuram - 695 011.
12. Dr. V. R. Muthukkaruppan,
4, G, B- Block, ALS Garden, Dhanalakshmi Colony, No.8, Natarajan Salai, Vadapalani,
Chennai-600 026.
13. Sri. Rahul Sarin, IAS, (Ex-officio)
Joint Secretary and 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, (Ex-officio)
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,
SCTİMST, Thiruvananthapuram- 695 012.
18. Dr. K. K.Talwar,
Professor of Cardiology, All India Institute of Medical Sciences, New Delhi - 110 029.
19. Sri. Vayalar Ravi,
Member of Parliament (Rajya Sabha)
15, Pandit Pant Marg, New Delhi.
21. Dr. Vijay Kak,
Director, Principal Secretary, Medical Education and Research, Government Medical College, Chandigarh - 160 036.

22. Sri. V. Vijayachandran, (Ex-officio)
Secretary to the Government of Kerala,
Health & Family Welfare, Sports and Youth
Affairs. Thiruvananthapuram.

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. M.R. Das,
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, SCTIMST, Thiruvananthapuram.
5. Prof. V. S.Ramamurthy,
Secretary to the Government of India,
Department of Science and Technology,
Technology Bhavan,
New Delhi - 110 016.
6. Dr.R.C.Rathod,
Professor of Anaesthesiology, SCTIMST,
Thiruvananthapuram.
7. Dr. R. Sivakumar,
Head, Biomedical Technology Wing,
SCTIMST, Thiruvananthapuram-695 012.
8. Dr.K K. Talwar,
Professor. of Cardiology, All India Institute of
Medical Sciences, New Delhi - 110 029.

Standing Committees

Academic Committee

1. Dr. K. Mohandas,
Director, SCTIMST, (Chairman)
2. Dr. R. Sivakumar,
Head, Biomedical Technology Wing,
SCTIMST, Thiruvananthapuram-12.
3. Dr. A. K. Gupta,
Additional Professor of Radiology, SCTIMST,
Thiruvananthapuram.
4. Dr. G. S. Bhuvaneswar,
Scientist -F, SCTIMST,
Thiruvananthapuram -12.
5. Dr. N. Babu,
Vice Chancellor, University of Kerala,
Thiruvananthapuram.
6. Dr. K. Srinath Reddy,
Professor of Cardiology, AIIMS,
New Delhi-29
7. Dr. S. K. Mahajan,
Head, Molecular Biology & Agri. Division,
BARC, Trombay, Mumbai - 400 085.
8. Prof. S. Ranganathan,
Emeritus Professor, Regional Research
Laboratory, Thiruvananthapuram.
9. Dr. K. Radhakrishnan,
Professor of Neurology, SCTIMST,
Thiruvananthapuram.

Building Committee

1. Dr. K. Mohandas,
   Director, SCTIMST (Chairman)
2. Dr. R. Sivakumar,
   Head, Biomedical Technology Wing,
   SCTIMST, Thiruvananthapuram-12.
3. Sri.V. Vijayachandran,
   Secretary to the Government of Kerala,
   Health & Family Welfare, Sports and Youth
   Affairs, Thiruvananthapuram.
4. The Civil / Construction Engineer, ISRO,
   Vikram Sarabhai Space Centre,
   Thiruvananthapuram.
5. Sri. P. Vijayakrishnan,
   Financial Advisor & Chief Accounts Officer,
   SCTIMST (Convenor)

Finance Committee

1. Dr. K. Mohandas, (Chairman)
   Director, SCTIMST, (Chairman)
2. Prof. V. S. Ramamurthy,
   Secretary to the Government of India,
   Ministry of Science and Technology,
   Technology Bhavan, New Delhi - 110 016.
3. Dr. M. R. Das,
   Chairman, State Committee on Environment,
   Science and Technology, Government of
   Kerala, Thiruvananthapuram.
4. Sri. P. Vijayakrishnan, Financial Advisor &
   Chief Accounts Officer, SCTIMST,
   Thiruvananthapuram (Convenor).

Senior Staff Selection Committee

1. Dr. K. Mohandas
   Director, SCTIMST, Thiruvananthapuram.
2. Dr. V. R. Muthukkaruppan,
   (Former Vice Chancellor, Bharatidasan
   University), Vadapalani, Chennai-600 026
3. Dr. R. Sivakumar
   Head, Biomedical Technology Wing,
   SCTIMST, Thiruvananthapuram-12.
4. A nominee of the Secretary, Department of
   Science & Technology, Government of India,
   New Delhi
5. A Senior Professor of SCTIMST,
   Thiruvananthapuram.
6. An Outside Expert.

Junior Staff Selection Committee

1. Dr. P. R. N. Menon, (Chairman),
   Medical Superintendent, SCTIMST,
   Thiruvananthapuram.
2. Dr. R. Sivakumar, (Chairman),
   Head, Biomedical Technology Wing,
   SCTIMST, Thiruvananthapuram-12.
3. Dy. Director (Admn),
   SCTIMST, Thiruvananthapuram.
4. Nursing Superintendent, SCTIMST,
   Thiruvananthapuram.
5. A representative of Academic Staff of the
   Institute nominated by the Director.

Ethics Committee

1. Mr. Justice S. Sankarasubban, (Chairman), Judge, High Court of Kerala, Kochi.
2. Dr. K. A. Kumar, Professor of Psychiatry, Medical College, Thiruvananthapuram.
3. Head BMT Wing, SCTIMST, Thiruvananthapuram.
4. An external expert on the device technology (to be identified and nominated by the Director each time)
5. Director of the Institute.

Technology Development Committee

1. Dr. K. Mohandas, (Chairman) Director , SCTIMST
2. Dr. N. Appaji Rao, Department of Biochemistry, Indian Institute of Science, Bangalore-560 012
3. Dr. Aurthur Vijayan Lal, Scientist-F, SCTIMST, Thiruvananthapuram.
4. Dr. A. P. Chaukar, Prof. & Head of CVTS, Dept. of CVTS, LTM Medical College, Sion, Mumbai- 400 022.
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