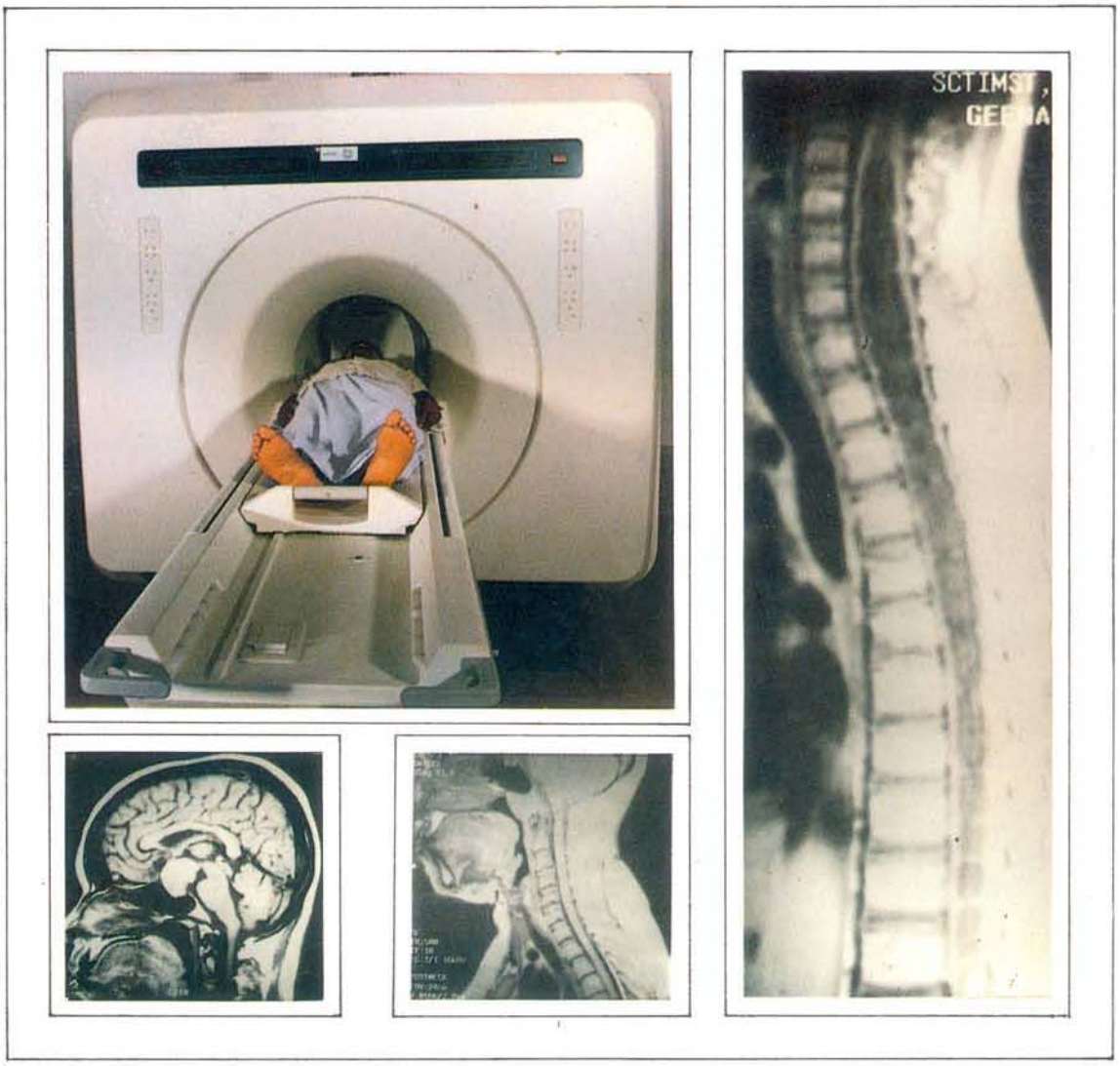

ANNUAL REPORT
1992-93

Sree Chitra Tirunal Institute for Medical Sciences & Technology
Trivandrum India

Annual Report
1992-'93

Sree Chitra Tirunal
Institute for Medical Sciences and Technology
Thiruvananthapuram-695 011
Kerala, India

CONTENTS

Cover : Magnetic Resonance Imaging facility was opened by Shri Nani A. Palkhivala, President of the Institute during May 1993.

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 Shri P. N. Haksar in 1976 and the growth of a Biomedical 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 postgraduate training programmes of the highest quality in advanced medical specialities and biomedical engineering and technology.

OVERVIEW

The hospital services maintained their previous levels and high standards even though they continued to fall short of the ever increasing demand. The temporary dislocation in hospital admissions following the revision of charges stabilised and the patient services returned to their normal pattern in less than three months. The reduction in free category and revision in charges notwithstanding, 374 cardiac operations were done free of cost during the year.

It was a matter of satisfaction that the public as well as the referring physicians were beginning to view the Institute as not only a hospital concerned with patient care but also committed to the promotion of science and technology for the advancement of medicine. This change in public attitude is an ingredient in the evolution of the hospital wing as a special institution with a character of its own like the famous clinical branch of the National Institute of Health, Bethesda. This is no more than a restatement of the themes of life and knowledge which figure in the motto of the Institute.

The Magnetic Resonance Unit which was opened by Sri Nani A. Palkhivala greatly enhanced the quality of the diagnostic services in the hospital wing. As the facilities of the Unit would be available to patients from other institutions it was undoubtedly a major contribution to the patient services in the region as a whole.

The Achutha Menon Centre for health science studies took the first step in its development when Dr. Manmohan Singh, Union Finance Minister, laid its foundation stone in June 1992. The Architects for the Centre were appointed and their plan and estimates approved a few

months later. The Government of Kerala generously approved the transfer of some land adjacent to the hospital campus for the construction of the Centre which was expected to begin during 1993 and terminate in 1995. Pending the completion of the building, the activities of the Achutha Menon Centre were expected to begin during 1993 in the form of epidemiological investigations, monthly seminars and formulation of project proposals for research. A nucleus of faculty members was expected to be in place for this purpose shortly.

Under the Eighth Plan, the existing Division of cardiomyopathy was sought to be developed as a new Division of Molecular and Cellular Cardiology which is hardly pursued in any other institution in the country. The extensive work done in the Division had gone beyond cardiomyopathies and established a basis for investigating the cardiac response at the cellular, sub-cellular and molecular levels to organic and inorganic stimuli. This became evident during the International Symposium on endomyocardial fibrosis which was attended by participants from many foreign countries and the Proceedings of which was published by the Oxford University Press. Currently housed in the Department of Pathology, the laboratories of the new Division were expected to move into its own permanent location in one of the large library halls 240 msq. during 1995 when the library would shift to the new building of the Achutha Menon Centre.

Sponsored projects constituted an important part of the activities of the Institute. The scientists of the Institute operated 10 projects with external funding as Principal Investigators during the year quite apart from an industrially sponsored project in technology transfer.

The biomedical technology wing maintained its good record in R&D and technology transfer in spite of the winds of liberalisation in Indian economy. The multicentric trial of the Chitra valve made fine progress in six institutions and the TTK Pharma signed an MOU for the pilot production of valves in the Institute's laboratories prior to their commercial production in Bangalore. The National Research Development Corporation relicenced the blood bag technology to the Hindustan Latex Ltd. who sought the services of Dr. S.N. Pal, Polymer Technologist of the Institute, in

setting up their manufacturing facilities. The blood bag technology was licenced for the third time to M/s. Electromedical & Allied Industries, Calcutta by the NRDC, thanks to the great demand for blood bags in the country. Two products — a dental composite and vascular graft — were ready for transfer to the industry for production during 1993. The Institute could take legitimate pride in the uninterrupted flow of its technologies and its growing contribution to the growth of a medical devices industry in the country.

PATIENT CARE

Dr (Maj). K.A. Hameed, BSc, MBBS
Medical Superintendent

Dr. D. Hariprasad, MD.
Administrative Medical Officer

The demand for new registrations especially of cardiac patients, was on the increase. Due to the ceiling on the number of registrations to 25 per day, there were longer waiting periods and the total registrations during the year dropped by 7%.

Computerised appointment system and scheduling of surgery were found to be quite effective and very helpful.

To overcome budgetary constraints, it was decided to recycle the funds collected from paying patients for procuring costly disposable items.

The Hospital Management Council met regularly to monitor and improve the working of hospital services.

The investigations and procedures done and the hospital statistics for the year are given in Table 1 and Figs. 1–7, respectively.

Table 1

Cardiology		*Radiology*		*Neurology*	
TMT	2126	Aortography	207	EEG	734
Catheterisation	925	IVDSA	49	EMG	262
Pace maker implantation	51	Bronchography	11		
		Cerebral-angiography	280		
		Myelography	153		
		Peripheral-angiography	96		
		Venography	1		
		Angioplasty	96		

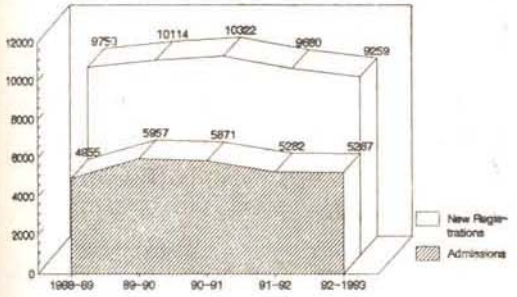

Fig. 1. Hospital Statistics

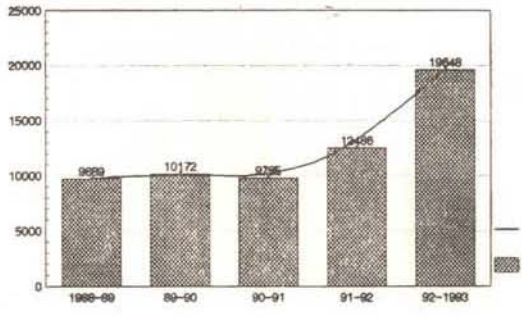

Fig. 4. Laboratory Investigations

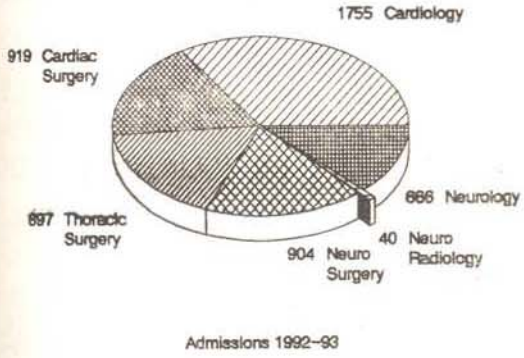

Fig. 2. Hospitalisation

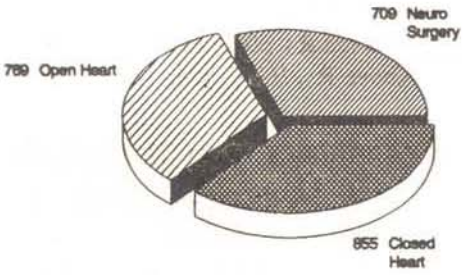

Fig. 5. Heart & Brain Operation Classified

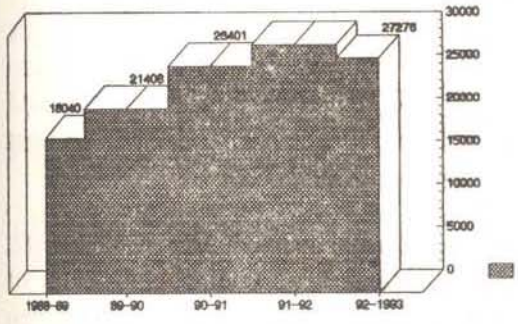

Fig. 3. Follow-up Cases

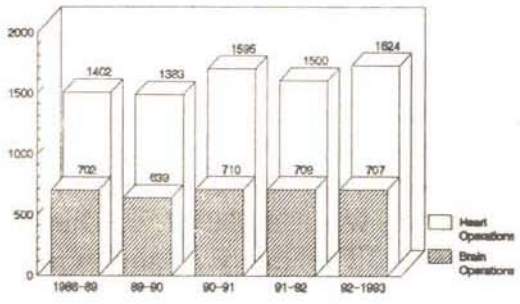

Fig. 6. Heart & Brain Operations

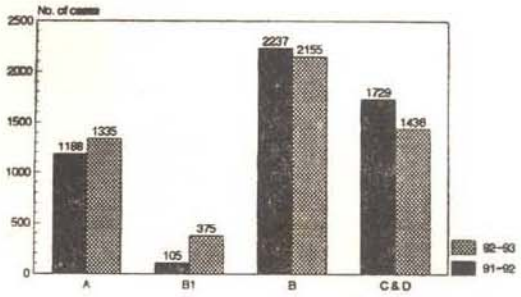

Fig. 7. Paying & Non Paying Analysis

Income grouping
A Less than Rs. 300/- pm.
B1 Between Rs. 300/- and Rs. 500/- pm.
B Between Rs. 500/- and Rs. 1000/- pm.
C&D Above Rs. 1000/- pm.

98 candidates from 21 institutions underwent short term training in the Institute: in dietary, nursing, perfusion technology, air conditioning and blood bank services.

Hospital Economics Unit

Dr. V. Raman Kutty, MD, MPH, M. Phil.
Scientist

Consultancy in study design and data analysis as well as collaboration work with scholars from other Institutes were undertaken during the year. The analysis and reporting of the Project "Study of the community prevalence of coronary artery disease in rural Trivandrum District", was completed.

A collaborative project with RRL, Trivandrum on "Raw palm oil as Vitamin A supplement in children" was initiated.

Dr. Raman Kutty acted as facilitator in the "Problem solving for better health" Workshop conducted by the Health Foundation, New York, at Trivandrum, in March 1993.

Dr. Raman Kutty was selected as a member of the joint ICMR-ICSSR panel on "Alternatives in Health".

Medico Social Work

The Medico-social workers continued to provide service to both patients and their relatives and played a cohesive role in hospital administration. They were helpful in new registrations and income assessment of patients, co-ordinating OPD/Inpatient services, blood donor motivation and doctor-patient correspondence.

A study on "The emotional, behavioural and social problems of epilepsy patients" was undertaken with the guidance and help of the

Department of Neurology. Therapeutic group meetings were conducted regularly for epilepsy patients, facilitating effective prevention and their psychosocial rehabilitation.

A one day orientation programme was conducted for a team of MSW students specialising in medical and psychiatric social work, from Tata Institute of Social Sciences, Bombay. Miss Reena George from Loyola College of Social Services, Trivandrum, undertook a study on "Problems of epileptic patients and their families."

Mrs. Usha Kandaswamy and Mr. Jayachandran participated in the AIDS awareness programme organised by the Kerala Council of Social Workers and Social Organisation for Mental Health Action, at Trivandrum.

Mr. Jayachandran was elected as the Secretary of the Trivandrum branch of Indian Epilepsy Association.

Medical Records

Sri. P. Krishnamurthia Pillay, MA.
Senior Medical Records Officer

This section extended its services to all the clinical and non-clinical Departments of the Institute. Out of the 1,35,000 charts preserved in our MRD, 65528 charts were retrieved during the year for the purposes mentioned in Table 2. This is higher than in previous years.

Table 2

1. Follow up of patients	27276
2. Correspondence of patients with physicians for appointment dates	10564
3. Analytical and retrospective studies	5672
4. Audit purposes	16
5. Updating entries in computer	22000

9529 new registrations and 5267 admissions were done.

Upkeep of medical records, sending admission letters for operations and catheterisation, entries in OT registers and sending enquiry letters for updating the waiting list were all completely computerised. Statistical reports from the computer were made available for research purposes.

Table 3

Important Statistics

	1992–93	1991–92
New registration	9259	9680
Follow up	27276	28800
Admissions	5267	5292
Discharges	5259	5301
Deaths	261	299
Open Heart Surgery	769	781
Closed Heart Surgery	855	719
Neurosurgery	707	709
CT Scan	4190	5595
Cardiac Catheterisation	688	889
Coronary Angiography	237	310
PTCA	29	15
Septostomy	8	16
Coarctation dilatation	7	14
4 vessel angiography	280	246
Aortogram	207	240
IV DSA	49	31
Venogram	1	6
Special angiogram	7	13
Embolisation	55	71
Angioplasty	96	18
Bronchogram	11	19
FNAC	4	2
Barium Swallow	7	13
Barium Meal	4	9
Screening	23	32
Myelogram	153	157
Balloon Aortic valvotomy	6	7
Balloon Pulmonary valvotomy	23	30
Balloon Mitral valvotomy	3	26

Medical Illustration

Sri. P. J. George
Chief Technician

Sri. Joy Abraham
Artist

High quality art work, projection slides and photographs were prepared for over eighty scientific papers published during the year and papers presented in national and international seminars.

Sri. Joy Abraham attended a workshop on animation, organised by the Centre for Developing Imaging Technology, in collaboration with the National Institute of Design, Ahmedabad and held at Trivandrum in February 1993.

Nursing Services

Mrs. Chandini Tyagi, BSc (Nursing)
Nursing Superintendent
(till October 1992)

Mrs. Rosamma Edwards, RN, RM, DNA.
Deputy Nursing Superintendent

Smt. Maria Jose who returned after training at the Queen Elizabeth Hospital for Children, London, was put in charge of the Cardiac Surgery ICU.

The Ward Sisters, Staff Nurses and the Nursing Instructor took part in the in-service educational programme for nurses.

Smt. Chandini Tyagi, Nursing Superintendent, Smt. C. Xavier, CSSD Supervisor and Smt. G. Hariharan, Ward Sister attended a workshop organised by the Indian Society of Health Administrators at Bangalore.

Four staff nurses from Babuji Hospital, Davangiri, Karnataka, were given training for a period of 6 months, in peroperative and postoperative cardiac nursing.

MSc (Nursing) students from RAK College of Nursing (New Delhi) and College of Nursing (Trivandrum), had their short term clinical field experience here. BSc (Nursing) students from College of Nursing, Kottayam and Calicut, were given clinical experience in our Institute for a period of two weeks.

57 nursing educators from different hospitals in Kerala visited the Institute as part of their workshop programme conducted by the Director of Health Services of Kerala State.

MSc students from College of Nursing (Vellore), GNM students from Upasana Hospital (Kollam), Christian Fellowship Hospital (Oddan Chatram) and St. Gregorios School of Nursing (Parumala), had their observation visits to the Institute.

Rehabilitation Unit

Smt. M. Meenakumari, BSc, DPT
Physiotherapist in-charge

Apart from manual therapy, equipments like short wave diathermy, infra red lamps, ultra violet lamps, flowtron, cervical and lumbar traction sets, nerve stimulator, TENS, suspension therapy frame, static cycle, exercise chair, shoulder wheel apparatus, parallel bars, rowing machine etc. were used to speed up the recovery of patients.

The number of patients treated by physiotherapy during 1992–1993, department-wise, was as follows.

Table 4

Cardiac Surgery	:	4226
Neurosurgery	:	3751
Thoracic Surgery	:	2050
Neurology	:	4269

Speech Pathology & Audiology

Smt. S. Maya, MSc.
Speech Therapist

244 patients with hearing problems and 174 patients with various speech and language problems were evaluated during the year. 681 speech therapy sessions were arranged for patients with developmental and acquired language disorders.

A project work on "Linguistic aspects of communicative disorders — an interdisciplinary study" was initiated in collaboration with the International School of Dravidian Linguistics.

Clinical Engineering

Sri. R. Mohan Das, ME	Biomedical Engineer
Sri. K. Vijayakumar, BSc (Eng)	Asst. BME
Sri. Koruthu P. Varughese, BSc (Eng), PGDip (Comp)	Asst. BME
Sri. S. Mohanlal, BSc (Eng)	Asst. Engineer
Sri. B. Madhusoodanan Pillai, BSc (Eng), PGDip (Comp)	Junior Engineer

Sri. Koruthu P. Varughese along with Sri. Raveendran of Division of Microbiology, obtained an Indian Patent for a Mini CO_2 incubator.

A book on Biomedical Engineering for vocational higher secondary education was prepared for the Government of Kerala, by the staff of this Division.

Mr. Mohan Das and Mr. Koruthu P. Varughese continued as Vice Chairman and Secretary of IEEE for this year also.

Computer Division

Smt. G. Geetha, M.Tech (Comp.Sc)
Systems Manager

Terminals fully equipped with local printers and accessories, apart from the line driver and RS 232 cable link up to the computer room, were installed at user locations like Medical Records, General Stores and Pharmacy. Active support was provided to the System requirements at these Divisions as well as to Accounts, X-ray library, Blood Bank and Microbiology. A multi-user and multi-accessible Unix based Telex System was commissioned. Six PCs for independent utility at the Hospital Block, Blood Bank, Accounts section, BMT Library, Surgical Block and Typing pool were installed. Cash counter related softwares concerning IP and OP billing, daily cash book printing, receipts / payments, outstanding reports etc. were conceived in association with and as per requirements of the Accounts Section.

Routine laboratory data from Microbiology Department were stored in computer with a design for quicker and accurate analysis. This has specific relevance to instances of nosocomial infections, and long term comparative statistical data bank.

Public Relations

Smt. T. V. Hemalatha, BSc,LLB,DJ. Public Relations Officer

This newly formed section deals with the public health education programmes of the Institute and has already published booklets on Cardiac diseases, Epilepsy and AIDS. A quarterly in-house magazine also is brought out, to keep the employees in touch with the developments of the Institute and to further their own literary talents. In addition, formation of an Alumni Association has been initiated.

BIOMEDICAL ENGINEERING & TECHNOLOGY WING

Dr. R. Sivakumar, B.Tech, Ph.D. Head

The technological activities of the Biomedical Technology Wing were related to products like heart valve and hydrocephalus shunt, which had been developed earlier. New activities were initiated in the areas of development of electrodes, bioceramics and artificial hip implants.

In the case of heart valves, pilot production of 200 valves was completed and these were sent to various centres for multicentric evaluation. The pilot plant activity is expected to be completed by May 1993, with the production of 100 more valves. This technology has been transferred to M/s. T. T. K. Pharma, through NRDC, Delhi. In the case of Shunts, 150 of them were sent to various centres for multicentric evaluation and 200 of them were handed over to M/s. Hindustan Latex Ltd., Trivandrum, who sponsor the pilot production.

The dental composites developed await industrial sponsorship for pilot scale development and standardisation. Bone wax and dental bands are ready for transfer to industries for commercialisation. Steps to identify suitable entrepreneurs were under way.

In terms of new activities, the development of needle electrodes for neurological applications (DST Project) and also the development of ophthalmic sponge were taken up. Development of biocompatible hydroxyapatite and its variants are under way for applications in dentistry and orthopaedics.

Co-operative R&D programmes at the international level were initiated in the areas of glass ionomer cement (Liverpool University) and orthopaedic implants (Queen Mary Westfield College). Proposals for initiating other new programmes like the development of haemodialyser are under consideration.

As part of the long term strategy for expansion, it is planned to develop technologies with the active collaboration of industries, depending on market needs.

ACADEMIC PROGRAMMES

Dr. G.N.A. Nayar Registrar

Ph.D. Programmes

The list of candidates who were awarded the degree of Ph.D. of this Institute, showing the titles of their theses and names of Guides, is given in Table 5.

Mrs. Annamma Mathai submitted her thesis on "Immunodiagnosis of Tuberculous Meningitis". The thesis which was guided by Dr (Mrs). Shobha Sehgal, Professor of Immunopathology, PGIMER, Chandigarh, is under evaluation.

Details of candidates who have registered for Ph.D. of the Institute are given in Table 6.

Admissions to Post Doctoral Courses

The nation-wide response, admissions and course-wise demand are shown in Tables 7 & 8 respectively.

Table 5

Name	*Title*	*Guide*
Mr. N. Shanmuga Kumar	Studies on the stability of polyurethane materials and their interaction with tissues	Dr. M. Jayabalan Head, Division of Technical Evaluation of Biomaterials SCTIMST
Mr. V. Kalliyana-krishnan	Studies on the radiation grafting of hydrophilic monomers onto plasticized poly (vinyl chloride) to prevent plasticizer migration	Dr. Joseph Francis Professor & Head Dept. of Polymer Science and Rubber technology, Cochin University of Science and Technology, Cochin

Table 6

Name	*Topic*	*Guide*
Ms. M. S. Latha	Preparation and evaluation of casein microspheres as drug carriers	Dr. A. Jayakrishnan Head, Division of Polymer Chemistry SCTIMST
Ms. S. R. Jameela	Studies on the controlled release of anti-fertility vaccines using biodegradable polymeric matrices	Dr. A. Jayakrishnan
Ms. S. Rajasree	Cardiovascular pathology related to Vit. D toxicity	Dr. C. C. Kartha Addl. Professor Dept. of Pathology SCTIMST
Mr. B. Prakash Kumar	Molecular mechanisms of cardiomyopathic changes in experimental magnesium deficiency	Dr. K. Shivakumar Division of Cardiomyopathy SCTIMST

Table 7
Nation-wide Response & Admissions

State/Union Territories		*No. applied*	*No. admitted*
Andhra Pradesh	...	30	1
Assam	...	3	1
Bihar	...	5	..
Goa	...	3	..
Gujarat	...	11	1
Jammu & Kashmir	...	3	..
Karnataka	...	58	3
Kerala	...	95	7
Madhya Pradesh	...	8	..
New Delhi	...	22	1
Maharashtra	...	20	2
Orissa	...	2	..
Pondicherry	...	8	..
Punjab	...	5	..
Rajasthan	...	3	1
Tamil Nadu	...	45	3
West Bengal	...	16	2
Uttar Pradesh	...	5	..

Table 8
Course-wise Demand

Course	*No. of applicants*	*No. of admissions*
DM Cardiology	120	4
DM Neurology	23	2
MCh CVTS	42	3
MCh Neurosurgery*	101	4
PDCC Anaesthesiology	33	6
PDCC Radiology	17	2
PDCC Vascular Surgery	6	1
TOTAL	342	22

* Including direct admission after MBBS.

The demand for short term training/ observership in various Departments/ Divisions, is given in Table 9.

Table 9

Department/Division	*No. of candidates*
Anaesthesiology	18
Biomedical Technology	3
Blood Bank	11
Cardiology	6
CVT Surgery	4
Microbiology	5
Neurology	1
Neurosurgery	4
Radiology	12

Nursing Education

Mrs. P. P. Saramma, MSc (Nursing)
Nursing Tutor

The duration of Post Basic Nursing Courses was increased from 10 months to one year, with effect from 1993 session. There were 60 applicants, out of which 11 were admitted for Cardiac Nursing and 5 for Neuro Nursing.

Diploma in Cardiac Laboratory Technology

There were 175 applicants for one seat.

Diploma in Operation Theatre Technology

There were 137 applicants for 2 seats.

National Science Day

National Science Day was celebrated this year also. Second Year students of Thiruvananthapuram Medical College, numbering 200, were taken on a study tour of the Institute, on two days. Demonstrations on various procedures like Cardiac Catheterisation, Echocardiography, Exercise Tolerance Test, CT Scan, MRI, EMG, EEG, were given. Students also had an opportunity to become familiar with essential services like critical care, blood transfusion and clinical laboratory.

Library: Hospital Complex

Smt. R. Prasanna Kumari, MA, MLISc
Librarian cum Documentation Officer–I

Smt. S. Jayaprabha, BA, BLISc
Librarian cum Documentation Officer–II

As in previous years, the library supported the academic and research programmes of the Institute

and extended its services to the faculty, post graduate students and research scholars of other institutions as well.

Table 10

Total members	:	397
Faculty	:	73
PG Students	:	53
Paramedical staff	:	232
Others	:	39
Faculty and research scholars from other institutions	:	710

Due to budgetary constraints, collection development continued to be under great pressure and showed a decline during the current year. (Fig. 9).

During the year, the library acquired a special collection of old and classic books on medical sciences which belonged to Dr. V.S. Valiathan and Dr. Raman Pillai, who studied medicine at Edinburgh during the 1st decade of this century.

The statistics and distribution of expenditure are shown in Figs. 10 & 11. The library had 7671 books

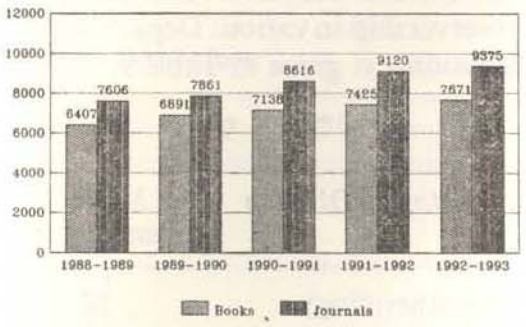

Fig. 8. Library Collection (1988–1993)

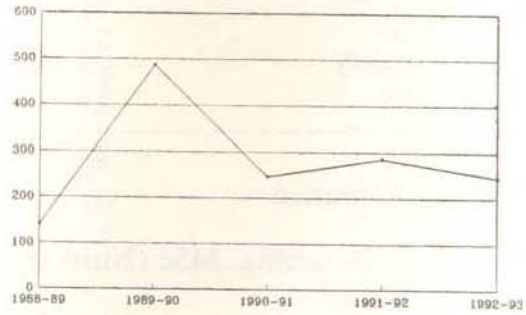

Fig. 9. Purchase of Books (1988–1993)

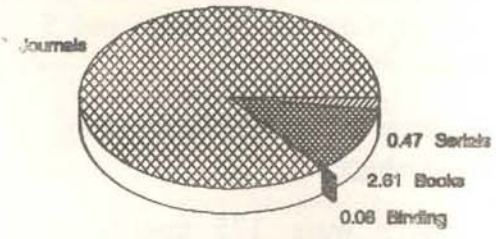

Fig. 10. Library Expenditure (Rs. in Lakhs)

and 9375 bound journals and subscribed to 192 journals. In addition, 70 periodicals were received gratis.

The library continued to provide inhouse services like retrospective literature search and reprographic services. The monthly additions bulletin and the weekly current contents bulletin were of great use to the readers. The library used Medline database in CD-ROM for providing information to its users.

Constant updating of the data bases of books and periodical holdings continued as in previous years.

As part of the plans for further broadening the purview of the information services, it was decided to subscribe to more database in CD-ROM like BIOSIS and EMBase.

The library was linked to NICNET through the Micro Earth Station at National Informatics Centre, Kerala State Unit to enable the Institute to function as one of the twenty-one institutes identified as NICNET nodes for MEDLARS Searches. Proposal to purchase a Micro Earth Station to have direct access to NIC/

Table 11

Information Services

Reprographic services	:	Institute staff	:	3840
		Others	:	960
Selective Dissemination of Information (SDI)	:	No. of patrons	:	25
		Topics	:	92
Indexing and abstracting service				
Abstracts retrieved from secondary sources			:	3200
References retrieved from secondary sources			:	3800
No. of literature searches conducted			:	500

MEDLARS at New Delhi through Satellite Communication was processed this year.

A training course on "Computers in Library and Information Systems" sponsored by National Information System for Science and Technology, DSIR, Govt. of India, as part of their manpower development programme, was organised by the library from 15–7–92 to 11–8–92. It aimed at increasing the awareness among librarians on the application of information technology in libraries and information centres and at providing hands on training to develop necessary skills in using computers and the use of computer softwares of proven capabilities. Twenty librarians sponsored by various Govt. Departments participated in the course.

The Library and National Informatics Centre jointly conducted a training programme on "Fundamentals of Medline Search", during 29-10-92 to 4-11-92, at the National Informatics Centre, Kerala State Unit, Trivandrum. The objective of the programme was to give training to the participants on Medline search strategy and hands on training on BRS/Search. Twentytwo doctors from Medical College, Trivandrum, Dr. MGR University of Medical Sciences, Madras and our Institute participated in the programme.

Smt. Jayaprabha, and Sri. A. Gopikuttan, Smt. L. Sabitha, Sri. Jayachandradas, Library Assistants, attended the 4 weeks NISSAT-SCT-IMST "Short term course on computer application in library", at the Institute. Smt. Jayaprabha, attended the seminar on Bioinformatics, sponsored by National Informatics Centre and organised by NIMHANS Bangalore on 11th September 1992, at Bangalore. She also attended a 6 weeks course on medical librarianship organised by National Medical Library at New Delhi during Nov-Dec. 1992.

Smt. Sabita attended the training programme on Fundamentals of Medline Search, held at NIC, Trivandrum.

Sri. Gopikuttan was sponsored for one year MLISc course at Madurai Kamaraj University.

Prof. M.A. Gopinath, Director, Documentation Research and Training Centre (Indian Statistical Institute) visited the library during the year.

The faculty and students of the Department of Library and Information Science, University of Pune, visited the library as part of their learning programme.

Ms. Bijimol Joseph, student of the Department of Library and Information Science, Mangalore University, did a case study of SCTIMST library for her MLISc dissertation.

Sri. Easwaran Namboothiri and Ms. Seena MK, from the Department of Library and Information Science, Kerala University, carried out a project of bibliography compilation on Haemophilia and Parkinson's disease as part of their BLISc course.

Plans to collaborate with National Informatics Centre to develop a National Cardiology Database and to function as a nodal centre for National Cardiology Information Programme, were formulated.

LIBRARY : BMT WING

Smt. P. Jayasree Thankom, MA, MLISc. — Librarian cum Documentation Officer (Grade II)

475 books were purchased during the year, bringing the total collection to 6550. The Library has a total of 3400 back volumes of periodicals and subscribes to 100 journals. 50 standards were purchased making the total number of standards available to 1500. 50 Patents were purchased during the year. Two offline and two online patent searches were made.

The Library continued to update the catalogue databases. The total number of topics in which bibliographies were compiled has reached 44.

Computerised SDI monthly bulletin service is being issued from November 1992. Current Journals were indexed and entered into the SDI database using the ISIS microversion package.

The journal "Current Contents–Physical, Chemical and Earth Sciences" was made available in floppies for reference.

Mr. Sankariah, Regional Librarian of the British Library, Madras, along with Mr. S. Parthasarathy, Librarian, British Library, Trivandrum, visited our Library.

DEPARTMENTAL REPORTS

HOSPITAL WING

Department of Anaesthesiology

Dr. K. Mohandas, MD	Professor and Head
Dr. R. C. Rathod, MD	Additional Professor
Dr. (Mrs.) A. Rout, MD	Additional Professor
Dr. H. D. Waikar, MD	Additional Professor
Dr. Rupa Sreedhar, MD, Dip NB	Associate Professor
Dr. K. P. Gopakumar, MD	Assistant Professor
Dr. Samir Girotra, Dip NB	–do–
Dr. P. K. Neema, MD	–do–
Dr. G. Suresh, MD	–do–

Candidates for Post Doctoral Certificate Course

Dr. V. N. Desurkar, MD
Dr. Patel Santosh I, MD
Dr. Nalgirkar RS, MD
Dr. (Mrs.) R. Cherian Koshy, MD
Dr. Sanjeev Vasudevan, MD
Dr. Thomas Koshy, MD

Dr. Mohandas presented a paper on "Anaesthetic and post operative management of resection of transverse arch aneurysms", at the First UAE Conference on Anaesthesia, Analgesia and Critical Care, held at Abu Dhabi, in October 1992. Another paper, on "IPPV in intractable pulmonary oedema – the Chitra experience", was presented by him at the 2nd Gulf Conference on Intensive Care, held at Dubai, in January 1993.

Anaesthetic support was given to the following procedures.

Table 12

Open heart surgery	..	769
Thoracic, vascular & open heart surgery	..	858
Neurosurgery	..	711
Investigational radiological procedures	..	89
Interventional radiological procedures	..	46

Dr. Samir Girotra, attended the 10th World Congress of Anaesthesiology at Hague, The Netherlands, in June 1992 and presented a paper on "Effect of narcotic premedication on arterial blood gases in patients with mitral stenosis".

A one day CME programme was organised in the Institute, jointly with the Department of Anaesthesiology, Medical College, Trivandrum, in March 1993.

Post graduate students in Anaesthesiology, from the University of Colombo (Sri Lanka) and Medical Colleges of Goa, Trivandrum, Belgaum and Davangere, had short term training programmes in this Department, during the year.

Division of Biochemistry

Dr. K. Subramonia Iyer, PhD	Head & Addl. Professor
Dr. N. Jayakumari, PhD	Asso. Professor
Mrs. Santha A. George, MSc	Scientist
Mr. B. Sasikumar, MSc	Scientific Assistant

The Central Clinical Laboratory continued to provide round-the-clock service to the hospital. Although some of the investigations were discontinued due to severe financial constraint, the total number of investigations in Clinical Chemistry and Pathology crossed 2.12 lakhs, registering an increase of 3% over the previous year.

The research activity of this division was focussed on the evaluation of free radical involvement during ischaemia or reperfusion injury, a condition which is commonly observed during thrombolytic therapy, bypass surgery and PTCA. This study again confirmed our earlier finding that free radicals play an important role during ischaemia/reperfusion injury. Perhaps it is time to consider the use of free radical scavengers prior to reperfusion.

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 annual statistics of blood transfusion services is given in Tables 13 and 14.

A blood bank refrigerator and reader & printer for HbsAg micro ELISA system, were acquired for the division.

The projects for the year included screening of atypical antibody in

Table 13

Blood Donation		:	5987
Whole Blood Transfusion		:	3908
Components transfused (Packed cells, FFP, PRP, SDP)		:	1378
Compatibility testing by	: saline	:	9230
	: albumin	:	9230
	: AHG	:	2951
Blood Grouping	: Patients	:	6859
	: Donors	:	7204
Components prepared	: Packed cells	:	876
	: FFP	:	503
	: PRP	:	414
	: SDP	:	417
Components issued to other Institutions		:	669

Table 14

HBsAg screening	:	6288
Anti HIV screening	:	6319
RPR test for syphilis	:	5562
Atypical antibody testing	:	6258
Therapeutic Haemopheresis	:	444
Washed concentrated cells for autologous transfusion	:	655

samples from both donors and patients, by two stage enzyme technique.

For platelet storage and preservation, a horizontal platelet agitator was fabricated with the help of Division of Tool Room Engineering of BMT Wing.

Platelet concentrate for the preparation of GPIIb/IIIa antigen for monoclonal antibody production was prepared in collaboration with the Division of Thrombosis of BMT Wing.

Dr. Jaisy Mathai spent six months from May 1992, at the Australian Red Cross Society Blood Transfusion Services and West Mead Hospital, Sydney, under a Fellowship of the Association of Commonwealth Universities. She also attended the 26th Annual Scientific Meet of the Australasian Society of Blood Transfusion at Canberra.

Mr. Poul Bjerre Jensen of Pharmaplast International Medical Bag Division (Denmark), Mr. K. Rodenheuser, Manager, Technology Transfer of Biotrans Blood Bag Division (Germany) and Ms. Poornima Kumar of Diagnostic Products, Gene Lab Technologies (California), visited the division during the year.

Dr. Kanchana Giridhar, Medical Officer of IMA Blood Bank (Cochin) and Dr. Basanthi Nair, Blood Bank Officer, RCC Trivandrum, were given training in blood transfusion techniques.

Department of Cardiology

Dr. K. G. Balakrishnan, MD, DM, FACC, FAMS	Professor and Head
Dr. C. G. Venkitachalam, MD, DM	Professor (On Special leave)
Dr. J. M. Tharakan, MD, DM	Addl. Professor
Dr. Thomas Titus, MD, DM	Addl. Professor
Dr. V. Ramakrishna Pillay, MD, DM	Asso. Professor
Dr. V. K. Ajith Kumar, MD, DM	Asst. Professor
Dr. Anil Bhat, MD, DM	Asst. Professor
Dr. Ghosh Ray MD, DM	Asst. Professor
Dr. Pramod Kumar Jaiswal, MD, DM	Asst. Professor
Mr. K. N. Vijayasenan, BSc, DCCT	Sc. Assistant

Candidates for DM

Dr. J. S. Bhuvaneswaran, MD
Dr. Zulfikar Ahmed, MD
Dr. Radjassegar, MD
Dr. Bimal Francis, MD
Dr. Sudha Mani, MD
Dr. P. Jyothi, MD
Dr. Ravi Narayanan, MD
Dr. O. Mohammed Najeeb, MD
Dr. N. P. Padmaja, MD
Dr. Gopi, MD
Dr. K. R. Shyam Sunder, MD
Dr. Rajpal K. Abhaichand, MD
Dr. Sunil Baran Roy, MD

There was no increase in the total number of patients seen and special investigations and interventional procedures done during the year, as a saturation point has reached with a ceiling on the number of new admissions per day. However, there has been an increase of about 45% in re-admission of patients, most of them with rheumatic valvular heart diseases.

Natural history studies of patients with Eisenmenger Syndrome, Tropical Endomyocardial Fibrosis on medical management and Sick Sinus Syndrome not treated with permanent pace maker, were completed during the year. Ongoing studies include, natural history study of patients with primary pulmonary hypertension and those with ventricular septal defect with aortic regurgitation who were not operated. Oral dipyridamol stress in patients

with chest pain syndrome, but with normal coronaries, and those with coronary artery disease with collateral vessels shown in coronary angiography, are under study. Another topic under study is thrombolysis in patients with thrombosed prosthetic heart valves.

In collaboration with the Division of Biochemistry of the Institute, work on estimation of free radicals and antioxidant enzyme levels, in patients with coronary artery disease undergoing percutaneous transluminent coronary angioplasty, was initiated. Another project under way is identification of biochemical and genetic marker for myocardial hypertrophy at cellular level in patients with hypertrophic cardiomyopathy, conducted in collaboration with the Biochemistry Department of Madurai Kamaraj University.

Dr (Mrs.) Usha Prathap, Paediatrician, Bhilai Steel Plant Hospital, underwent training in Echocardiography in the Department for a period of four months from January 1993. MD paediatrics students of Trivandrum Medical College had short term training in Cardiology, as part of their regular postings.

Dr. C. G. Venkitachalam was relieved on a secondment scheme for setting up a Cardiology Department in a private sector hospital.

Division of Cardiomyopathy

Dr. M. S. Valiathan	Head
Dr. C. C. Kartha, MD	Addl. Professor
Dr. Renuka Nair, PhD	Scientist
Dr. K. Shivakumar, PhD	Scientist
Dr. John T. Eapen, PhD	Scientist
Ms. S. Rajasree, MSc	SRF (ICMR)
Mr. B. Prakash Kumar, MSc	JRF (DST)

The geochemical hypothesis which relates the causation of tropical Endomyocardial Fibrosis (EMF) to synergistic effects of Magnesium (Mg) deficiency and Cerium (Ce) toxicity continued to engage the attention of the division. While an animal model remained elusive, demonstrations of severe myocardial lesions in hypomagnesemic rats fed on Ce-adulterated diet provided adequate fillip for sustaining the effort.

Long term experiments on rats and rabbits were initiated to examine whether chronic Mg deficiency and prolonged administration of Ce would produce cardiac lesions that are characteristic of EMF. Short term experiments on rats were also initiated to delineate the temporal sequence of molecular events underlying cardiac muscle damage, fibroblast activation and cardiac fibrosis induced in vivo by acute Mg deficiency and Ce. Procedures for preparation of viable cardiac fibroblasts from adult rats, isolation of intact mitochondria from rat heart and skeletal muscle, mitochondrial translation and radiolabelling of cardiac muscle bits, were standardised. A research project on the effects of Ce and Mg deficiency on myocardial contractility was also initiated.

The subject of another ongoing study is a hypothesis that hypervitaminosis D in the tropics could lead to dystrophic calcification and Ca induced hyperplasia in tissues. Necessary techniques were standardised as a prelude to a screening of the population for Vitamin D status. For familiarising with the techniques, Ms. Rajasree spent three weeks at the NIN, Hyderabad.

Extension of the geochemical hypothesis on the causation of EMF to coconut root (Wilt) disease signalled a significant departure from conventional thinking on the affliction of coconut palms, that has baffled investigators and farmers alike for over a century. The similarity in the reciprocal relationship between Mg and Ce, coprevalence in Kerala and the analogous course of degenerative tissue changes suggested a common geochemical basis for the two diseases. This finding has stimulated several studies at the Kerala Agricultural University.

Ms. Deepa Krishnaswamy and Ms. Sunita Lorraine D'Souza worked in the Division for two months on a Fellowship from the Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore.

Research Projects :

Title	Cellular basis of myocardial damage by Cerium in Magnesium deficiency.
Principal Investigator	Dr. K. Shivakumar
Co-investigators	Dr. C. C. Kartha Mr. K. Rathinam Dr. John T. Eapen Dr. P. T. Manoharan (IIT, Madras)
Funded by	Department of Science & Technology
Duration	3 Years
Status	Ongoing

Title	Structural and functional changes in the myocardium due to sub optimal concentration of Mg.
Principal Investigator	Dr. R. Renuka Nair
Funded by	Roussel Scientific Institute, India
Duration	3 Years
Status	Ongoing

Dr. Renuka Nair visited the Laboratories of Prof. Seidel at the Institute of Genetics and Toxicology, Karlsruhe, W. Germany and Dr. Gercken at the Department of Biochemistry and Molecular Biology, University of Hamburg, W. Germany, for training in adult cardiomyocyte culture and myocardial contractility measurements.

Dr. Tritthart of the Department of Medical Physics and Biophysics, Karl-Franzens-University, Austria, visited the Division and gave a talk on the use of optical dyes in cardiac electrophysiology.

Department of Cardiovascular & Thoracic Surgery

Prof. M. S. Valiathan	Professor & Head
Dr. M. P. Mohan Singh, FRCS (Edin), FRCS (Eng)	Professor
Dr. K. S. Neelakandhan, MS, MCh	Additional Professor
Dr. R. Sankarkumar, MS, MCh	Additional Professor
Dr. K. G. Shyamkrishnan, MS, MCh	Additional Professor
Dr. Aruna Kashyap, MS, MCh	Associate Professor
Dr. M. Unnikrishnan, MS, MCh	Associate Professor
Dr. Y. Nazer, MS, MCh	Associate Professor
Dr. Krishna Manohar, MS, MCh	Assistant Professor
Dr. S. K. Nair, MS, MCh	Assistant Professor

Candidates for M.Ch. Course

Dr. Mrinal Bandhu Das, MS
Dr. Sushil Chandran, MS
Dr. Usha Parvathy, MS
Dr. T. M. Babu, MS
Dr. Avinash Dal, MS
Dr. N. R. Ravishankar, MS
Dr. (Ms) Rekha Matta, MS
Dr. Susanth Mukhopadhyay, MS
Dr. R. Sunder, MS
Dr. R. Muralidhar, MS

The total number of surgical procedures was 1627 of which open heart surgery claimed 769 and the remainder consisted of closed heart, thoracic and vascular operations. While vascular procedures made steady progress in number and complexity, the innovation in open heart surgery included the introduction of right ventricular exclusion in cases of advanced right ventricular endomyocardial fibrosis. The long term observation of these patients is currently under way.

The clinical trial of the Chitra valve entered the second year with over 70 patients having had it placed in the mitral and aortic positions with excellent results. This was in line with the experience in the KEM Hospital, Bombay, Post graduate Institute, Calcutta, Kuppuswamy

Naidu Memorial Hospital, Coimbatore and JIPMER, Pondicherry, where over 40 Chitra valves had been implanted. With the availability of all sizes, the clinical trial was expected to make faster progress and reach the target of 300 valve replacements during 1993.

The woven vascular graft project had reached an advanced stage of development following 60 porcine implantations but had to be put aside a few years ago, thanks to the pressures for the development of the Chitra valve. The project was revived and Dr. Unnikrishnan carried out implantation trials with larger diameter grafts in several pigs with very good results (Fig. 11). The South India Textile Research Association (SITRA), Coimbatore was equally enthusiastic on the revival of the project and grafts woven on their new loom were expected to be available in 1993 for clinical trial.

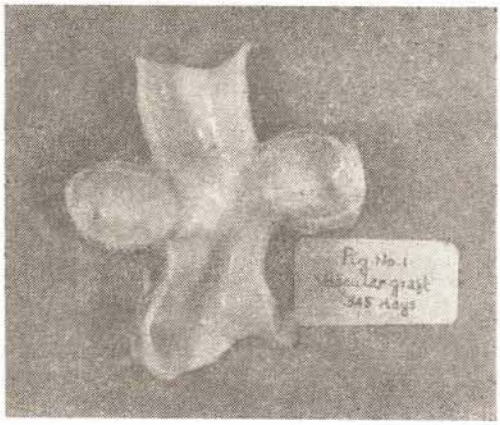

Fig. 11

Dr. Shyamkrishnan was deputed by the Institute to the Department of Pediatric Cardiac Surgery under Dr. Roger Mee to gain additional experience which would contribute to the growth of pediatric cardiac surgery of the Institute. Dr. Shiv K. Nair who had already spent 3 months under Dr. Antunes at Coimbra to learn mitral valve reconstruction procedures proceeded on a year's scholarship of the Swiss Government to work in the Department of Dr. Turina in Zurich. His return to the Department was expected to strengthen the clinical and research activities.

The following candidates for M.Ch spent varying periods ranging from a few weeks to six months as observers.

Dr. Narendra, JJM Medical College, Davangare
Dr. Mathew Sebastian, Medical College, Calicut.
Dr. Bhuvanendra Kumar, Kasturba Medical College, Manipal.
Dr. Mantana, Kasturba Medical College, Manipal

The following trainee perfusionists spent 6 months each in the Department.

Mr. Raj Kumar – sponsored by the Indian Association of Cardiovascular and Thoracic Surgeons.

Mr. Bagalad, JJM Medical College, Davangare.

Dr. Neelakandhan was awarded the Godrej Karai Oration in vascular surgery by the Indian Association for Cardiovascular and Thoracic Surgeons. Dr. Valiathan gave the C.S. Sadasivam Oration of the Association at the annual conference in Hyderabad. He became the President of the Association of Indian Universities for 1993.

Dr. Usha Parvathy was awarded the second prize at the Annual Conference of the Cardiological Society of India for a paper by her and Dr. Nazer on the laser revascularisation of the myocardium.

Dr. Aruna Kashyap resigned.

Division of Microbiology

Dr. J. Shanmugam, MSc, PhD	Additional Prof. and Head
Ms. Molly Thomas, MSc, DMV	Assistant Professor
Mr. M. Raveendranath, BSc	Scientific Assistant
Mrs. K. Naseema BSc. MSc (MLT)	Scientific Assistant

Routine screening for HBsAg was done by means of ELISA, in all our patients. This resulted in an increase of 30% in the workload of immunology section. The statistics of total investigations carried out during the year is given in table 15.

Staph. aureus and Coagulase Negative Staphylococci (CNS) were characterised for various biochemical reactions and the CNS species were classified. They were also tested for beta-lactamase production, MIC values against Penicillin-G and for slime production.

Mr. M. Raveendranath along with Mr. Koruthu P. Varughese, received a cash award, for patenting a CO_2 chamber. An improved version of the chamber is now under fabrication.

After modifying the surface of flat bottom wells in imported and Indian microtitre plates, the growth of VERO cells was studied, in collaboration with Dr. M. Jayabalan of BMT Wing. A few metal extracts were tested for cell toxicity using VERO cell line, in collaboration with Mr. K. Rathinam of BMT Wing.

Table 15

Isolation and identification of bacteria	:	9615
Antibiotic sensitivity tests	:	1935
Staining and culture of m. tuberculosis	:	712
Immunodiagnostic tests	:	4892
HBsAg detection by ELISA technique	:	3225
Virological investigations	:	1353

Ms. Molly Thomas visited the Department of Microbiology in Kelantan, University of Sains, Malaysia, from July to September 1992, under the 'THES' fellowship of the Association of Commonwealth Universities. She got acquainted with the techniques of isolation, purification and raising of monoclonal antibodies to outer membrane antigens of Sal. typhi and Sal. paratyphi A and B strains. Under the supervision of Prof. Ong Kok Hai, she had a brief exposure to in vitro immunisation procedures also.

Dr. Shanmugam was appointed as the Honorary Sectional Editor in Medical Virology of the Indian Journal of Virology, for another term of three years.

Staff and students of Trivandrum Medical College, Institute of Environmental Studies, Cochin, and Institute of Marine Studies, Cochin, had short term training in immunology, tissue culture and virology, in this division.

Department of Neurology

Dr. Bindu T. Desai	Professor and Head
Dr. C. Sarada, MD, DM	Associate Professor
Dr. Muralidharan Nair MD, DM	Associate Professor
Dr. Sanjeev V. Thomas, MD, DM	Assistant Professor
Dr. Asha Vijayaraghavan MD, DM	Assistant Professor
Dr. P. A. Suresh, MD, DM	Assistant Professor

Candidates for DM Course

Dr. Sreekantaswamy, MD
Dr. Sunil K. Narayanan, MD, DCH
Dr. A. R. Bhat, MD
Dr. B. Santhoshkumar, MD
Dr. S. D. Nayak, MD
Dr. Abdu Rahiman, MD, Dip. NB

A number of research projects were undertaken by the faculty during this year. Dr. P. A. Suresh started a study in collaboration with the Department of Radiology, on a project "Correlative study of structural alterations of brain anatomy in aphasic patients with linguistic abnormality–a CT/MR imaging study." In addition to this he continued to work on the project "Linguistic study of communicative disorders– an interdisciplinary study", in collaboration with the International School of Dravidian Linguistics.

Dr. C. Sarada was involved in a study on "An analysis of neurologic intensive care – a decade's review", and another on "Efficacy of ayurvedic treatment in the amelioration of diabetic neuropathy" in collaboration with the Trivandrum Ayurveda College.

Dr. Sanjeev Thomas collaborated with the Department of Gynaecology and Obstetrics, Trivandrum Medical College, on "a prospective study of the neurological manifestations of eclampsia" and with the Regional Cancer Centre, Trivandrum in the study of "thyroid function abnormalities in epilepsy – their impact on seizure control and neuropsychological performance".

This year the Department received several distinguished visitors who gave very valuable guidance in both academic and clinical areas.

Dr. Anil D. Desai, Professor Emeritus, University of Bombay, came

as Visiting Professor to the Department during November–December 1992. He gave a series of lectures on Magnetic Resonance Imaging in Neurology.

Dr. Phiroze L. Hansotia, Professor of Neurology, University of Wisconsin, USA, was the first of the four visiting Professors who spent a week each in the Department, in January 1993. He conducted seminars on electronics in relation to electrophysiology, EEG and sleep studies, neonatal EEG, EEG in metabolic encephalopathy and coma and "an approach to clinical research". He also gave hands-on training in EEG, EMG and evoked potentials.

Dr. Prakash Kotagal, from the Section of Epilepsy and Clinical Neurophysiology, The Cleaveland Clinic Foundation, USA, was the second visitor. He gave lectures on Visual and Auditory Evoked Potentials, Evoked Potentials in Spinal Surgery, EEG in Childhood Epilepsy and Intensive Monitoring and Epilepsy Surgery.

Dr. D. Ram Ayyar, Professor of Neurology, University of Miami, Florida, spoke on Inflammatory Myopathies, Disorders of the Neuromuscular Junction, Dystrophin and Muscular Dystrophy, Peripheral Neuropathy and Diagnostic Dilemmas. Dr. Ayyar conducted hands-on training sessions in EMG.

Dr. S. H. Subramony, Professor and Vice-chairman, Department of Neurology, University of Mississippi, USA, was the last of the four visitors from USA. He gave lectures on EMG, Myotonic Disorders, Demyelinating Neuropathies and Neurogenetics in spino-cerebellar degeneration.

Three Post Graduate students in Paediatrics, from Trivandrum Medical College were observers in the Department, for two weeks each. Dr. V. S. Mohan, a Psychiatrist from District Mental Hospital, Trivandrum, had training in EEG technology for 3 weeks in the department.

The paper "A postal review : the experience from a developing country on optimisation of resource management for epilepsy" by Dr. Sanjeev Thomas et. al. was accepted by the 20th Epilepsy International Congress, Oslo, Norway, to be held in August 1993.

Dr. Sanjeev Thomas designed a neuropsychological test battery in epilepsy, specifically for patients in Kerala and prepared a questionnaire in Malayalam.

Department of Neurosurgery

Dr. Damodar Rout, MS, MCh, FAMS	Professor and Head
Dr. B. K. Misra, MS, MCh, Dip NBE	Addl. Professor
Dr. Suresh Nair, MCh	Asso. Professor (on leave)
Dr. Satish Krishnan, MCh, Dip NBE	Asst. Professor
Dr R. Krishna Das, MCh	Asst. Professor
Dr. M. Bhaskara Rao, Dip NBE	Asst. Professor

Candidates for MCh

Dr. K. Uma Nambiar, MS
Dr. Dilnavaz B. Bhiladvala, MS
Dr. Moni K. Vinod, MBBS
Dr. Rajesh Shishoo, MS
Dr. Muralidhar Pai, MS
Dr. Rajneesh Kachhra, MS
Dr. N. I. Kurian, MS
Dr. Sumit Deb, MS
Dr. Girish Menon, MBBS

The volume of operative work remained more or less the same as in the previous year (Table 16). While the overall operative mortality rate was 2.2%, there was no mortality for surgery of cerebral arteriovenous malformations and the mortality rate for intracranial aneurysmal surgery was a record low of 1% during this year (Fig. 12).

The multicentric clinical trial of "CEREDRAIN", the Chitra hydrocephalus shunt system, with a common protocol, made satisfactory progress and the preliminary results were encouraging.

Table 16

Aneurysm	102 (92 patients)
Arteriovenous malformations	41
Acoustic neurinomas	30
Other cranial nerve neurinomas	10
IC meningiomas	77
Intraventricular tumours	27
Pituitary tumours	40
Craniopharyngiomas	8
IC Gliomas	49
Skull base tumours	12
Epidermoids	7
CV junction anomalies	57
Spinal tumours	42
Other spinal lesions	58
Miscellaneous	161

Research Project

Title	:	Multicentric trial of Chitra hydrocephalus shunt system for clinical evaluation.
Principal investigator	:	Dr. D. Rout
Funded by	:	Dept. of Science & Technology Govt. of India
Status	:	Ongoing

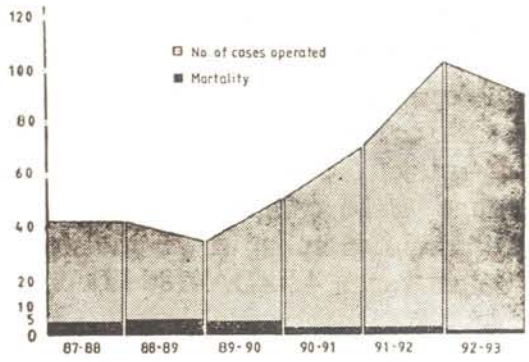

Fig. 12

Dr. Suresh Nair, Associate Professor, left for a period of six months to establish a Department of Neurosurgery in the private sector.

Dr. Tran Quang Vinh from Vietnam, Dr. Bhaskara Rao, from Madras and Dr. Premjit Ray from Vishakhapatnam were observers in the Department for short periods.

The Chitra hydrocephalus shunt system "CEREDRAIN" manufactured by M/s. Hindustan Latex Ltd., was formally launched in the market on 5th February 1993.

Dr. D. Rout delivered the Twelfth Institute Day Oration of the Institute of Neurology, Madras.

Division of Neurochemistry

Prof. Debkumar Basu, PhD	Professor
Dr. P. S. Appukuttan, PhD	Addl. Professor
Mrs. K. I. Annamma, BSc	Scientific Asst.
Mr. P. L Jaison, MSc	Sr. Res. Fellow
Mr. V. M. Kannan, MSc	Sr. Res. Fellow

Research activities in the Division included : use of anti– α – galactoside antibody (Anti–Gal), which is unique to the sera of man and old world monkeys, covalently conjugated to a marker enzyme (HRP) as a probe for terminal linked galactose moieties in animal and human tissues. Human brain glycoproteins were found to be rich in these glycoprotein moieties, whereas it was absent in all other human tissues. This observation may be significant to autoimmune disorders, since breakdown of the blood brain barrier that usually occurs as a consequence of inflammations such as in infection or tumor may expose the brain glycoproteins to the serum antibody. Five glycoprotein subunits of this type, in the molecular weight range 94 kDA – 230 kDA were identified. Recently we obtained preliminary evidence to indicate that certain neutral glycolipids of human brain are also recognised by this antibody.

Another project was subcellular localisation of endogenous receptors of human brain cortex. Using antibody to the glycoproteins labelled with HRP, in immunohistochemical staining on paraffin embedded human brain cortex sections revealed that they were mostly confined to the cell membrane and the nucleus of the cells. The receptors, 14 kDA β – galactoside binding lectin were found to be comprised of five glycoprotein subunits in the molecular weight range 47 kDA–186 kDA.

A β – galactoside binding lectin identified and isolated from human brain stem was found to be similar to the cortex lectin, immunologically and in sugar specificity. Two endogenous receptors of the lectin were also identified and isolated. Characterisation of the carbohydrate portions of the above two receptors using enzyme labelled lectins and sugar binding antibodies has been undertaken.

Research Project

Title	: Galactose binding lectins and endogenous lectin binding glycoconjugates of mammalian brain : their structure and interactions in normal and tumor affected tissue.
Principal Investigator	: Dr. P. S. Appukuttan
Principal co-investigator	: Dr. Debkumar Basu
Funded by	: Dept. of Science and Technology Government of India
Duration	: 4 years
Status	: Ongoing

Department of Pathology

Dr. V. V. Radhakrishnan, MD	Addl. Professor and Head
Dr. C. C. Kartha, MD	Additional Professor
Dr (Mrs). Sandhyamani, MD	Additional Professor
Mrs. Annamma Mathai, MSc	Scientific Assistant

The routine investigations carried out during the year, for hospital services, are listed below.

Table 17

Histopathology	:	932
Cytopathology	:	456
Frozen sections	:	292
Muscle biopsies	:	35
Immunological tests	:	2020
Autopsies	:	48

Apart from the immunodiagnostic tests for neurotuberculosis, the Department is currently engaged in isolation and characterisation of newer immunodominent antigens of M.tuberculosis. Specificity and cross-reactivity between antigens of M. tuberculosis and atypical mycobacteria are being investigated.

Dr. Sandhyamani continued her studies on mucoid vasculopathy.

Department of Radiology

Dr. K. Ravi Mandalam, MD	Additional Professor
Dr. A. K. Gupta, MD	Additional Professor
Dr. Santhosh Joseph, MD	Associate Professor
Dr. N. Madhavan Unni, MD	Associate Professor
Dr. A. Srinivasa Rao, MD	Associate Professor

Candidates for Post Doctoral Certificate

Dr. Sanjay Saluja, MD
Dr. Srikant Murthy, MD

The data on routine activity are given below:

Table 18

Diagnostic Procedures		
Plain X-rays	:	16184
Aortograms	:	207
IV DSA	:	49
Venogram	:	1
Four vessel angiograms	:	280
Spinal angiograms	:	7
Myelograms	:	153
Bronchograms	:	11
Fine needle aspiration biopsy	:	4
Interventional Procedures		
Embolizations	:	55
Angioplasty	:	96
CT Scans		
Registered patients	:	2840
Outside patients	:	1350

A prototype of Palamaz–type balloon expandable, intravascular stainless steel stent was made and in vitro tests are under way. The project was done in collaboration with the VSSC, Trivandrum. Dr. Santhosh Joseph and Dr. Appa Rao (VSSC) were the main investigators.

A project funded by Department of Electronics, "Development of digital radiography system (Picture archival system) was initiated in collaboration with ER & DC and sample images digitised to 512 x 512 matrix showed good resolution. A computer with colour monitor and printer was acquired for the purpose.

An MRI Scanner of 1.5 Tesla units, has been added to the department.

Dr. A. K. Gupta and Dr. Santhosh Joseph attended an "End users of MRI" meeting sponsored by M/s. General Electric Co, USA, at Penang, Malaysia, in May 1992.

Dr. Suparna Roy, Dr. Senthil Kumar and Dr. Bryan Martis from JIPMER (Pondicherry), Dr Jessia and Dr. Jayaraj from Trivandrum Medical College, Dr. Modi from Bombay Hospital and Dr. Sankar Kumar from General Hospital, Madras, had their training in this Department during the year.

Dr. V. R. K. Rao, who was Professor and Head of the Department of Radiology, left the services of the Institute in January 1993. He had headed the Department for 10 years with great distinction.

BIOMEDICAL TECHNOLOGY WING

Head : Dr. R. Sivakumar, BTech, PhD

Materials Testing Laboratory

Dr. R. Sivakumar, BTech, PhD	Head
Dr. K. Srinivasan, PhD	Scientist
Sri. B. Ajith Kumar, MTech	Engineer
Dr. Annie John, PhD	Research Associate
Sri. Niranjan D. Khambate, BE, M. Tech	Engineer
Sri. Harikrishna Varma, MSc	Scientist
Sri. S. Vijayan, BSc	Scientific Assistant

This new Laboratory was created to focus on the development, characterisation and testing of biomaterials.

The Transmission Electron Microscope was shifted from the Hospital Complex and installed in the BMT Wing. In addition, a new Scanning Electron Microscope was also purchased and installed. Analytical facilities like IR Spectroscopy, HPLC, DTA/DSC and Instron Mechanical testing were made available for various research projects of the Institute. All these facilities were also extended to other Institutions like Kerala University, Central Tuber Crops Research Institute and certain Industries, on a chargeable basis.

The main focus of research was on the development of chemical sensors and separation methods. Polymers capable of sensing pH and metal ions were developed and specificity imparted, based on the mechanism of diffusion through the polymers.

The effects of Nd–YaG laser on tissues in terms of temperature rise and extent of damage were studied to optimise exposure parameters for different clinical applications. This information will also be utilised to design laser delivery systems.

Research Project

Title	: Development of electrodes for neurophysiological applications
Principal investigator	: Dr. R. Sivakumar
Co-investigators	: Sri. G. S. Bhuvaneshwar Dr. S. N. Pal Sri. O. S. Neelakantan Nair Sri. C. V. Muraleedharan Sri. D. S. Nagesh
Funded by	: Dept. of Science & Technology
Duration	: 2 years
Status	: Ongoing

It is proposed to build facilities for melting and processing glasses and ceramics. This is being done under two specific programmes.

1. Development of Fluoro–aluminosilicate glasses for glass-ionomer dental restoratives in collaboration with polymer technology group.
2. Development of hydroxyapatite based porous bodies and coatings, in collaboration with Biosurface Technology group.

Dr. R. Sivakumar presented a paper on "Analytical approach to plasma spraying" at the International Conference on "Surface Engineering" held at Bremen, Germany, in March 1993. He also visited a number of Fraunhofer Institutes dealing with different surface modification technologies under the sponsorship of International Buro, Germany.

Dr. Julia Shelton, Queen Mary & Westfield College, London, visited the Laboratory in January 1993, in connection with initiating collaborative programme in the area of Orthopaedics.

Division of Thrombosis

Dr. M. Jamaluddin, PhD	Head
Dr. Lizzy Kalliyanakrishnan, PhD	Scientific Assistant

Routine activity related to thrombosis research, with focus on blood-material interactions and cardiovascular diseases.

A method was devised to measure Ca^{2+} dependent platelet activation reaction in response to agonists. Such measurements employing both calf and human platelets have indicated that Ca^{2+} ATPase and membrane diffusion may be important regulators of platelet activation. More support was obtained for the sequential shape-change and interaction model of platelet aggregation, proposed earlier from this laboratory.

Glycoproteins IIb and IIIa were isolated from human platelets to be used as antigens for producing monoclonal antibodies to monitor antigen loss during cardiopulmonary bypass surgery and blood storage.

Work was initiated to monitor changes in platelet properties on storage in PVC bags.

Research Project

Title	: Mechanisms and modulations of platelet activation and aggregation
Principal Investigator	: Dr. M. Jamaluddin
Funded by	: Dept. of Science & Technology
Duration	: 3 years
Status	: Ongoing

Division of Artificial Internal Organs

Sri. G. S. Bhuvaneshwar, MS	Engineer
Sri. C. V. Muraleedharan, MTech	Engineer
Sri. R. Sreekumar, BSc	Scientific Asst.

The division's activity was centered around the pilot production and technology transfer of Chitra Heart Valve prosthesis. Subsequent to the successful clinical trials of these valves at our Institute, the multicentric clinical evaluation of the valves was started in early 1992, involving the Department of Cardiovascular and Thoracic Surgery of the Institute and six other Centres. During the year 1992–93, 208 valves in four sewing ring diameters were assembled and despatched to seven Centres.

The core group of M/s. TTK Pharma employees were systematically trained in the production of valves. A major part of the technology transfer documentation for the device was also completed. The division will be continuing the technology transfer work on this device to M/s. TTK Pharma. A memorandum of understanding between the Institute and TTK Pharma was signed for continued production of Chitra Heart valves by TTK Pharma using our facilities.

Development work towards optimising the design of Chitra Heart Valve prosthesis with respect to hydrodynamics of the device was completed. Further work in this direction is planned for the next two years.

The division also actively co-operated with the Division of Technology Transfer in the pilot production of "CEREDRAIN" Hydrocephalus Shunts.

Dr. Jyotirmay Chanda of Bangladesh, on an ICCR Fellowship of Govt. of India, worked towards the development of a Bioprosthetic Heart Valve based on bovine pericardium.

Mr. K.P. Antony, MCA student from Department of Electrical Engineering, Regional Engineering College, Calicut, is working on the development of "Control software for Hydrocephalus Shunt test system" as a part of his project work.

Dr. K. B. Chandran, Professor and Director, Hemodynamics Laboratory, Department of Biomedical Engineering, University of Iowa, USA, visited the Institute and delivered two lectures on Prosthetic Heart Valve Testing. He also had detailed discussion in this Division regarding the hydrodynamic evaluation of heart valves.

An hydraulically operated compaction press for the solid state compaction of UHMW-PE heart valve discs, was acquired during the year.

Division of Biosurface Technology

Dr. Chandra P. Sharma, MTech, MS, ScD, MEBE	Scientist in charge
Dr. Thomas Chandy, PhD	Scientist
Mr. P.R. Hari, BSc.	Scientific Assistant

Ampicillin was embedded in a chitosan matrix to develop an oral release dosage form. The in vitro release profile of ampicillin from chitosan beads and microgranules was monitored as a function of time, in gastric solution (pH 2.0) and intestinal solution (pH 7.4). The amount and percentage of drug release were much higher in gastric solution and the release rate of ampicillin from beads was slower. SEM studies suggested that the drug forms a crystal structure within chitosan beads which dissolves out slowly to the dissolution medium through the micropores of chitosan matrix. It seems, chitosan matrix may be a promising vehicle for sustained release preparations for oral drug delivery.

Liposome-encapsulated Insulin was embedded in a chitosan matrix and the release profile of Insulin was studied in gastric solution and intestinal solution, in comparison with free insulin loaded microgranules. The release rate was slower for lipo-insulin. This finding suggested the possibility of modifying the formulations to obtain the desired controlled release of Insulin in an oral sustained delivery system.

An attempt was made to develop polymer matrices which selectively remove immunoglobulins from plasma. Cellulose and polyacrylamide microspheres were used as the model systems. Cellulose activated by cyanogen bromide was coupled with aminoligands such as tryptophan and phenyl alanine. Selective adsorption of various circulating–immunoglobulins like IgA, IgG, IgM was studied under static conditions. It was found that the modified matrices adsorb significantly more immunoglobulins when compared to unmodified cellulose.

Polyacrylamide microspheres were activated by 1% glutaraldehyde and then coupled with tryptophan and phenyl alanine. Preliminary

experiments indicated that modified PAAM adsorbs more γ–globulins from human plasma under flow conditions. It was also found that these microspheres were biocompatible as the haemolysis of blood was less than 3%.

Liposomes have low stability and are rapidly cleared by the reticuloendothelial system. Liposomes were coated with polyvinyl alcohol and later cross linked with glutaraldehyde. It was found that the stability of liposomes was improved by the process. It was also observed that the release kinetics of drugs was not significantly altered by this modification.

A study of the prevention of bioprosthesis associated calcification has been undertaken by Dr. T. Chandy. The possible prevention of calcification by surface modifications and drug delivery were also taken up for study.

Hydroxyapatite (HA) synthesised in our laboratory was characterised with the help of RRL, Trivandrum. From the XRD studies it has been found that though the starting material is HA, on heating b-tricalcium phosphate is formed. Toxicity evaluations showed that our product is nontoxic.

A technique was developed to prepare HA and chitosan coated HA microspheres and beads. By using HA microspheres of desired size various forms and shapes of controlled pore size can be obtained by pressing and sintering. These have applications as replacement of hard tissues in Dental and Orthopaedic fields. These microspheres can also be used to form high quality plasma sprayed coatings on dental and orthopaedic implants, as they are free flowing.

Dr. David Katz of Queen Mary and Westfield College, University of London, visited the laboratory in February 1993. A project was initiated with him on Hydroxyapatite/ Chitosan composite. The aim of the project is to evaluate the use of the composite for clinical application of bone-filling material.

Morphological changes of adhered platelets (calf) on bare and hydrogel grafted (poly HEMA, PEG–1500 and polyelectrolyte synthesised from natural rubber) Angioflex sheets were evaluated using SEM. The density of adhesion and morphological changes were less on PEG and polyelectrolyte grafted ones.

Research Project

Title	: Development of blood compatible functional polymers as selective adsorbents for protein bound antigens during haemoperfusion.
Principal investigator	: Dr. C. P. Sharma
Co-investigator	: Dr. T. Chandy
Duration	: 3 years
Status	: Ongoing
Funding agency	: Dept of Biotechnology

Division of Non Traditional Toxicology

Dr. P. V. Vedanarayanan, BVSc, PhD	Senior Toxicologist
Dr. A. C. Fernandez, PhD	Scientist

In continuation of our previous year's work on "Immune response to implant materials", titration experiments for standardising complement fixation test was completed. The analysis of the results of pilot studies indicated the need to repeat the experiments with certified HSV–positive antigen, to validate the experiments, as the titration experiments carried out by us were with HSV-positive antigen which was obtained locally.

Standardisation of primary cell cultures of lymphocytes, macrophages and hepatocytes for the toxicity evaluation of biomaterials was completed last year. Further experiments were initiated to find out whether short term exposure to biomaterials or their extracts can induce significant aberrations in the chromosomes of lymphocytes used as an index for evaluation of cytotoxicity. As a preliminary step, a study of chromosome pattern of the normal peripheral lymphocytes of rabbits was completed.

Division of Toxicological Screening of Materials

Sri. K. Rathinam, MSc Scientist
Sri. P. V. Mohanan, MSc Scientific Asst.

Toxicity screening/biocompatibility studies like systemic toxicity, intracutaneous irritation, haemolysis, intramuscular/subcutaneous implantation tests for the candidate materials intended for fabrication of various intra and extracorporeal devices, are the cardinal functions of the division. Mandatory biological tests such as pyrogen, sterility, LAL and microtox studies were carried out maximum during this year, for the finished devices such as oxygenator, heart valve cages and hydrocephalus shunt. The division concentrated on long term tests like sensitization, oral and dermal toxicity studies for the base metal alloy, titanium, chromium–cobalt–molybdenum-silicone alloy, hydroxyapatite and light cured hybrid type composite dental materials.

The division collaborated in a DST project on "Cellular basis of myocardial injury by cerium, in magnesium deficiency".

Cytotoxicity studies (cytobiocompatibility) using in vitro mast cell systems were standardised. Peritoneal mast cell collection, separation using density gradient method and attempts to find out their effects on toxic and nontoxic material extracts, are under way.

The teratological and chromosomal aberration effects of bone wax and barium methacrylate (monomer) were studied. The standardisation of whole blood culture for in vitro chromosomal studies, is in progress.

The division is engaged in a collaborative study of anti-bacterial effect of bare glow discharged and surface modified Angioflex (Siliastic poly urethane material), with the division of Biosurface Technology.

Ms. Vijayalakshmi from SPIC, Madras, received training in systemic toxicity tests in the division.

Sri. Rathinam shared the MRSI award for the best poster presentation during the Annual meeting held at Trivandrum in February 1993.

Sri. P.V. Mohanan underwent one month's training in the Genetic Toxicology and Chromosomal Studies section, at BARC, Bombay.

Division of Pathophysiology

Dr. Mira Mohanty, MD	Scientist
Dr. T. V. Kumary, PhD	Scientist

Histological evaluation of tissue response to a wide range of materials was undertaken. A large number of skeletal muscle, subcutaneous tissue and cerebral tissue samples with implants were studied at time intervals of 1 week, 1 month, 3 months and 6 months, post implantation. The materials studied included glass, ceramic, hydroxyapatite, copper wire, titanium, silicon rubber, high density polyethylene, IPCL, silicon, lasered stainless steel and beads of casein and polysaccharide. Vaginal mucous membrane of rats was also studied as part of mucous irritation test in the toxicological evaluation of base metal alloys, titanium and cobalt–chromium-molybdenum-silicon alloy.

Gross and microscopic observations of various major organs of rats were carried out as part of a study on short term oral systemic toxic effects of extracts of base metal alloys, dental materials, cobolt-chromium – silicon – molybdenum

Research Project

Title	: Elucidation of mechanisms of toxicity of haemoglobin
Principal investigator	: Dr. T. V. Kumary
Co-investigators	: Dr. Mira Mohanty Mr. K. Rathinam
Funded by	: Indian Council of Medical Research
Duration	: 3 Years

alloy and titanium, done in Division of Toxicology. Haematological and biochemical parameters were also investigated in the above study.

An investigative study on the tissue response, degradation and calcification of bovine pericardium, was done at varying time intervals following subcutaneous implantation and skin grafting in rats. The bovine pericardium samples received had been chemically modified as part of the research on biocompatibility of bovine pericardium for use as a bioprosthetic heart valve and skin graft.

A project on the standardisation of processing techniques in the study of bone response to materials was initiated.

Dr. T. V. Kumary left for UK on a Leverhulme Commonwealth Visiting Fellowship at the Department of Clinical Engineering, Royal Liverpool Hospital, for a period of 10 months.

Polymer Division

Dr. M. Jayabalan, PhD, Scientist
Dr. Prabha D. Nair, PhD, Scientist

Synthesis and processing of polymers as biomaterials intended for fabrication of hospital supplies and devices were the main thrust of the activities of this division. Cost effective synthesis and processing methods were developed for the modification of polystyrene microtiter culture plates for increased cell growth, production of polymer based ophthalmic sponges and for the prevention of leaching of plasticizer from polyvinyl chloride used in the manufacture of blood bag.

The surface processed indigenous microtiter plates compared favourably with imported ones. Polyvinyl sponges from different formulations were prepared and studies on swelling, sterilisability and eye irritation were carried out. Modification of polyvinylchloride used in the manufacture of blood bag was carried out by thermo-chemical processing. Studies of leaching in a low viscosity medium showed that processed polyvinyl chloride sheets resist leaching considerably.

Synthesis of polyurethane hydrophilic adhesive for use as electrically conducting self adhesive pad in diagnostic equipment was undertaken. Electrical resistivity and moisture retention capacity were considered for further studies. Processing of polymeric fibers such as nylon and polyester to an electroactive fiber was initiated using gamma radiation source. Electroactive polymeric fibers have potential biomedical applications.

Following the visit of Prof. Erhan Piskin, Director, Bioengineering Programme, Department of Chemical Engineering, Hacettepe University, Turkey, in January 1993, a collaborative project on the development of hollow fiber hemodialyser system was initiated.

Dr. Girish Giridhar, Scientist, Musculoskeletal Research Institute, Herndon, Virginia, USA, visited the division in May 1992 and participated in discussions on "Material-macrophages interactions in long term implant".

Dr. Prabha D. Nair secured the Young Scientist Award for the best paper presented in the field of "Health Care" at the Kerala Science Congress held at Kottayam, Kerala, in January 1993.

Division of Polymer Chemistry

Dr. A. Jayakrishnan, PhD	Scientist
Dr. B. Chitambara Thanoo, PhD	Scientist (On leave)
Sri. M. C. Sunny, AIC	Scientific Assistant

The DST and DBT supported projects on controlled release of drugs from casein microspheres and controlled release of vaccines from biodegradable polymers respectively, were actively pursued.

Research Project

Title	: Studies on the controlled release of anti-fertility vaccines using biodegradable polymeric matrices
Principal Investigator	: Dr. A. Jayakrishnan
Funded by	: Dept. of Biotechnology
Duration	: 3 years
Status	: Ongoing

Title	: Preparation and evaluation of casein microspheres as drug carriers
Principal Investigator	: Dr. A. Jayakrishnan
Funded by	: Dept. of Science & Technology
Duration	: 3 years
Status	: Ongoing

Microspheres of desired size and spherical geometry could be obtained by using concentrations of polymeric dispersing agents. Encouraging results were obtained from the study of the release of drugs such as theophylline and 5 fluorouracil from casein microspheres.

A novel synthetic procedure for the preparation of glutaraldehyde crosslinked chitosan microspheres was devised and a model protein such as bovine serum albumin was loaded to the extent of ca 5% by a post synthesis technique. The release profile of BSA was studied in vitro and the degradation of crosslinked chitosan spheres was monitored in vivo in a rat model by intramuscular implantation. It was found that the microspheres did not degrade completely in 6 months in vivo, and were histologically well tolerated by the tissues without producing any adverse tissue reactions. This observation opens up the possibility of using crosslinked chitosan as a matrix for prolonged drug delivery, as the degradation profile was comparable to the conventional polylactic and polyglycolic acid based matrices. Work is being continued on the problem.

Surface modification of polyester sewing ring of heart valve prosthesis was successfully accomplished using an indigenous technique. Ultraviolet radiation was successfully used to graft polyvinyl pyrollidone onto the fabric. The extent of grafting was studied thoroughly with respect to various reaction parameters and the desired degree of grafting was selected. The grafted material has been extensively characterised and is at present ready for in vivo evaluation. This work assumes importance in view of the fact that no published or patented literature exists on hydrophilic surface modification of the polyester sewing ring of heart valve prosthesis. The modified ring is expected to have better blood and tissue compatibility.

In another area of research, a new approach was pursued for retarding the migration of phthalate plasticizers from plasticized poly (vinyl chloride) used in medical applications. Azidated PVC was dip coated onto the surface of PVC and irradiated with UV light to crosslink the coating. Phthalate ester migration from such coated surfaces could be reduced upto 80% in hexane. In another approach, a phase transfer catalysed azidation reaction was carried out on the plasticized PVC

surface in aqueous medium and was then exposed to UV radiation to crosslink the surface. The migration phenomenon was examined from such modified surfaces and it was seen that upto 60% reduction in migration of the plasticizer could be achieved by this technique.

Smt. C. S. Subhaga, an MPharm student from the College of Pharmaceutical Sciences, Trivandrum, spent a few months in the laboratory, working on the controlled release of oral drugs such as theophylline, from microspheres of polyurethane. Her work demonstrated the possibility of using polyurethane as a matrix for the controlled release of oral drugs. The in vitro study carried out demonstrated that a near zero order release was possible from a polyurethane matrix.

A poster entitled "Hydrogel microspheres for therapeutic embolization", presented at the IV Annual Meeting of the Materials Research Society of India (MRSI) held in RRL, Trivandrum, in February 1993, bagged the prize for the best poster presented. Highlighted in this presentation was the work on hydrogel spheres, from synthesis to clinical trials, carried out by the division in collaboration with other divisions and departments in the Institute.

Dr. B. C. Thanoo continues to be at the College of Pharmacy, University of Kentucky, USA, as a Post Doctoral Associate, for the second year.

Division of Polymer Technology

Dr. S. N. Pal, MSc (Tech), PhD	Scientist (on deputation)
Dr. V. Kalliyanakrishnan, PhD	Scientist
Mr. Roy Joseph, MTech	Scientist

The main activity of the division was focussed on the development cf dental materials. Work on both chemical and light curing systems made good progress. A standard formulation for visible light curing system was established.

Studies were done on changes in mechanical properties such as compressive strength, diametral tensile strength and microhardness, by varying the amine and initiator concentrations. Effects of aging on the mechanical properties of dental composites and the effect of using strontium based radio-opaque glasses as fillers on the mechanical properties, were also studied. Toxicity studies on visible light curing systems are in progress. Changes caused due to salination on different grades of fillers have been observed. Work is in progress to improve the shelf life problem of dental composite pastes at room temperature to suit Indian conditions.

A standard formulation for liquid/paste two component single paste system was identified and the process of preparation was standardised. The objective of developing this system is for fixing orthodontic brackets onto teeth.

Aging effects of chemical and visible light curing dental composite systems stored in various food simulative media and the effect of pH upon the material are being studied currently.

Development of glass ionomer cement system for restorative and lining material applications was initiated.

The other areas of work in the division include:

1. Studies on platelet adhesion and aggregation on surface modified poly (vinyl chloride) bags.

2. Development of a suitable polythene drape for the microscope used in Neurosurgery.

3. Identification and characterisation of a suitable silicon fluid capable of crosslinking, for use as a cell culture substrate.

1200 chest drainage systems and 180 gms of bone wax were supplied to the Institute hospital during the year. 8600 hydrocephalus shunts were made by the staff of HCS project, using the facilities and materials available in the division.

An INSTRON Universal Testing Machine was acquired by the division for the project 1052–GN (development of dental composite restorative materials).

Action for technology transfer of chemical and visible light curing systems were initiated.

The following PATENTS were filed from this division during the year.

1. Visible light cured dental composites.
2. A process for preparing improved bone wax.
3. Chemically cured two component paste/liquid system.

Dr. Lawrence Mair, Dept. of Chemical Engineering, University of Liverpool, visited the division for two weeks in January 1993. He collaborated with the laboratory in the "Determination of resin rich layer formed by dental composites and its effect on wear and marginal integrity".

Two MTech students from Cochin University of Science and Technology, were guided for their research projects and two students from the same University are currently doing their project work here.

Dr. S. N. Pal went on deputation for one year to Hindustan Latex Ltd., Trivandrum, for implementing the blood bag project. Dr. V. Kalliyanakrishnan rejoined the Division after spending one year at the Dept. of Clinical Engineering, University of Liverpool.

Mr. C. V. Muraleedharan (Operator/Tradesman) received a cash award and merit certificate from the Institute for his involvement in the development of chest drainage system.

Division of Technology Transfer

Sri. G. S. Bhuvaneshwar, MS — Engineer in charge
Sri. D. S. Nagesh, MTech — Engineer

The activities of the division continued to be many sided, involving pilot production, technology training, documentation and patenting.

The launching of the Hydrocephalus Shunt by M/s. Hindustan Latex Ltd. under the brand name "CEREDRAIN" and the signing of an MOU with M/s. TTK Pharma Ltd. for Heart Valve Production, during 1993–1994, were important milestones in the technology transfer of these two devices.

Technoprove facility

The industrial sponsored scale-up production of medical devices continued at the Technoprove facility, with the close interaction and blending of professionals from production, R & D and industry.

The production of Hydrocephalus Shunt under the project, sponsored by M/s. Hindustan Latex, has progressed further, after clearing the bottlenecks faced due to shortage of some of the raw materials.

Standardisation of unit processes and quality assurance procedures were among the significant improvements carried out. This has not only improved the quality of the product but also has reduced the value added rejection.

A profile projector has been added for inspection/quality control.

The development of a fully automated multichannel data acquisition system for testing of shunts, is under way.

A task force was constituted for the smooth functioning of the project and the monitoring committee continued to evaluate the progress of the project.

The multicentric trial of shunts is in progress and preliminary feedback is coming in. The product was formally launched in the market by M/s. Hindustan Latex, on 5.2.1993.

The scale up production of mediastinal drainage system, custom pack, blood filter and humidifier were carried out by M/s. Peninsula Polymers, utilising the Technoprove facility.

Documentation Cell

Dr. R. Sivakumar, PhD, In-charge
Sri. D. Ranjit, BE, Engineer

The newly formed Documentation cell co-ordinated the patent activities of the Institute. Three new patents were filed. The current status of patents is shown below.

Patents sealed	: 6
Designs held	: 10
Patent applications filed	: 11

Suitable entrepreneurs have to be identified for the technologies with market potential and the Documentation Cell has initiated works in this direction. The technologies awaiting transfer are dental composites, bone wax and dental band.

Technology Transfer and license agreements related to the production of Hydrocephalus Shunt and Heart Valve, were drafted.

The technology transfer documents associated with Heart Valve and Blood Bag-2nd Edition, were prepared for distribution to the NRDC Licencees, M/s. TTK Pharma Ltd. and M/s. Hindustan Latex Ltd, respectively. A brochure on the "Profile of Biomedical Technologies at SCTIMST" was prepared for distribution at the March '93 Annual Meeting of the Materials Research Society of India.

Mr. Ranjit participated in the Science and Technology Parliamentary Consultative Committee Meeting held at New Delhi and co-ordinated the SCTIMST exhibition organised by DST in connection with the meeting.

Division of Engineering Services

Sri. O. S. Neelakantan Nair, BSc (Eng)	Engineer & Head
Sri. K. P. R. Bhas, Dip (El. Eng)	Junior Engineer

To complete the pilot production of 300 artificial heart valves, more than 1000 UHMW discs and three sets of compression moulding dies were machined. In addition, 24 sets of valve holders of different sizes also were fabricated. Dies for the pilot production of various parts of CSF shunt connectors were made. Humidifiers, bioprosthetic heart valve stents, moulds for sterile drapes, high pressure syringes required by Radiology Department and atraumatic needle assemblies were fabricated during the year.

A new high capacity incinerator which can handle 130 Kg of waste per hour and working on pyrolitic system, was installed.

Division of Vivarium

Dr. G. Arthur Vijayan Lal, BVSc	Veterinary Scientist
Dr. S. Bhaskara Rao, MVSc, LLB	Veterinary Surgeon

The division extended help to various departments in the evaluation of devices, and materials. The division provided laboratory animals, organs, blood and tissues to other divisions. Breeding stock of animals was supplied to other research and educational Institutions also.

Work on standardising anaesthesia regimen in small animals using xylazine hydrochloride was initiated. The techniques for bone implantation in rabbits are being standardised. Preliminary work on the effects of deficiency of magnesium and addition of cerium to the feed, in the production of EMF in large animal models in under way.

Dr. Arthur Vijayan Lal participated in the evaluation of larger diameter polyester vascular grafts in pigs, the experimental production of increased ICP in dogs to study the effects of oral glycerol and IV mannitol.

In collaboration with Dr. Jotirmay Chanda, Visiting Scientist from Bangladesh, preliminary studies on developing a bioprosthetic heart valve using bovine pericardium, were undertaken.

Other collaborative studies included the use of treated pericardium as a skin replacement in pigs, calcification levels of treated bovine pericardium, duramater and facia lata in rats and haemostatic potential of chitosan.

Dr. Rajan of Madras Medical Mission Institute of Cardiovascular Diseases, Dr. William of Madras Veterinary College, Dr. Julia Shelton of Inter Disciplinary Research Centre in Biomedical Materials, Queen Mary and Westfield College, London and Final Year BVSc students from Gujarat Veterinary College, visited the division during the year.

Dr. G. A. V. Lal was a member of the group which received the Best Paper Award (D. P. Basu Award) for its work on experimental production of myocardial infarction

and revascularisation with Nd-YaG Laser, at the Annual meeting of the Cardiology Society of India, held at New Delhi in November 1992.

Dr. G. A. V. Lal shared the MRSI award for the best poster at the Annual meeting held at RRL Trivandrum, in February 1993.

SCIENTIFIC PUBLICATIONS

BOOK

ENDOMYOCARDIAL FIBROSIS
Editors : Valiathan MS, Somers K, Kartha CC
Oxford University Press, New Delhi. (1993)

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Central India Institute of Medical
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88/2, Bajaj Nagar,
Nagpur-440 010 (Maharashtra)

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Lucknow-226 015.

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