



Annual Report 1981-'82

Sree Chitra Tirunal
Institute for Medical Sciences and Technology
Trivandrum, Kerala



Annual Report 1981-'82

**Sree Chitra Tirunal
Institute for Medical Sciences and Technology
Trivandrum, Kerala**

CONTENTS

Introduction	5
Reports from Departments:	
(i) Hospital Wing	9
(ii) Biomedical Technology Wing	22
Administrative Bodies	32
Publications	40
Hindi translation	45

INTRODUCTION

During 1981-82, the Institute witnessed its full transformation as an Institution of National Importance. The Institute Body, Governing Body and various statutory committees (Appendix 1) which took office during the year met regularly and established a functional pattern and style which were effective and harmonious. Keeping in view the main objectives which include the development of biomedical technology, demonstration of high standards of patient care and the organisation of integrated training programmes, the Institute was able to consolidate its base in medical sciences and technology and initiate post graduate courses for training during the current year.

The progress of biomedical technology which looms large in the activities of the Institute was characterised by the successful development of new surfaces and plastic formulations which

would minimise the uncertain dependence on commercial manufacturers for the supply of biocompatible plastics. Given the integrated nature of its programme which embraces the full spectrum from the conceptualisation of a device or technology to its eventual supply to the patients or hospitals, the Institute could claim to have reached a stage when serious discussions were being held with public sector agencies for the productionisation of biomedical devices. The guiding principles in these discussions were the highest degree of assurance for patient safety and the reasonable cost of the devices. The short time-interval for the 'Chitra devices' to evolve and successfully graduate from the experimental class seemed to vindicate the original policy of the Institute in seeking to integrate medical sciences and technology.

In exercise of the powers vested by the Act, the Institute admitted for the first time post-graduate doctors for training leading to DM (Cardiology and Neurology), M.Ch (Cardiothoracic and Neuro Surgery) and Postdoctoral Certificate Course in Anaesthesiology during March, 1982. The 3 year course for DM and M.Ch. has sought to improve upon the existing syllabi and included an opportunity for the trainees to be exposed to the exciting development of biomedical technology. Similarly, the diploma course in cardiac and neurologic anaesthesia is unique in the country and designed to augment skilled manpower in branches of anaesthesia where specialists are few. The selection to the post-graduate courses were made on the basis of national advertisement and the strict criteria laid down by the Institute. Sir Dorabji Tata Trust generously donated two Fellowships for

post-graduates selected for M.Ch. course in cardiothoracic surgery and Neurosurgery.

The work on the Setu Parvati Bayi Surgical Centre continued to make progress. As a large project which would treble the surgical programmes of the Institute and expand the teaching and research facilities substantially, its completion was not expected until 1983; its outpatient services, however, were scheduled to open earlier during 1982 and relieve the mounting pressure on the old hospital block. When fully commissioned, the new surgical centre would have 80 beds, 7 modern operating rooms, advanced diagnostic facilities including CAT whole Body Scanner, research laboratories for pathology, class rooms with audiovisual arrangements, colour TV facilities for viewing surgical operations and other novel features such as an independent oxygen plant.

The library grew steadily and its volumes and journal subscriptions rose to 9100 and 380 respectively during the year. The purchase of back volumes and the addition of a microfilm reader and reprographic machine greatly enhanced the utility of the library services.

The first phase of the construction of housing for the hospital staff was completed at the Kumarapuram colony which was linked to the Hospital Campus by a new road. Even though inadequate even for the present needs, the housing colony currently provides 56 dwelling units in B, C and D categories who have experienced great difficulty due to the scarcity and high rent of private accommodation. A plan for the construction of a multistoreyed block of flats

for postgraduate students was approved for immediate implementation in view of the opening of postgraduate courses. An additional acre of land was also acquired adjacent to the Kumarapuram colony for extending the housing scheme which has left out several categories including senior members of the academic staff.

The national image and performance record of the Institute attracted a steadily increasing number of doctors and technologists for short term training in radiology, electrophysiology, cardiac catheterisation, heart lung bypass, microbiologic methods and other specialised techniques. The visit of these candidates to the Institute was sponsored by their parent institutions in Srinagar, Banaras, Pondichery and Bangalore.

In association with the University of Kerala, the Institute hosted the 47th Annual Meeting of the Indian Academy of Sciences in Trivandrum during November, 1981. An annual scientific event of importance in the country, the meeting attracted over 100 Fellows of the Academy and featured a remarkable series of lectures and symposia which sought to transcend scientific boundaries and, in the words of Prof.C.V. Raman, "advance our essential comprehension of nature as a whole."

The reports from the individual departments of the Hospital Wing and Biomedical Technology Wing are given in the following sections.

REPORTS FROM DEPARTMENTS

HOSPITAL WING

Department of Anaesthesia

Dr. P. Mazumder, M.D., FFARCS.	Professor
Dr. K. Mohandas, M.D.	Associate Professor
Dr. V. Padmanabha Iyer, M.D.	Associate Professor
Dr. (Mrs) A. Rout, M.D.	Lecturer
Dr. R.C. Rathod, M.D.	Lecturer
Dr. R. Ramani, M.D.	Lecturer
Dr. K.V. Raghavendran, M.D.	Lecturer

The department maintained the previous year's record in providing anaesthetic administrations to cardiac and neurologic operations as well as investigative procedures. The department also significantly contributed to the critical care of post-operative patients. The pulmonary function laboratory of the department was optimally used in the assessment of lung function of both hospital and outpatients.

A post doctoral certificate course of twelve months duration was introduced during the year to provide comprehensive training in cardiac and neuroanaesthesia and basic research methodology. The course is designed to fill the existing void in the post-graduate training programmes in anaesthesiology in the country. It has already received enthusiastic support from educational experts and young post-graduates from all over India.

The I.C.M.R. research project on "Parenteral alimentation of Intravenous Lipid" continued to make significant progress under Prof.P.Mazumder.

Division of Biochemistry

Dr. K. Subramonia Iyer, Ph.D. Assistant Professor

Smt. Santha George, M.Sc. Lecturer

The department continued to provide investigative support to the clinical departments on round the clock basis. The addition of a Clinicon Corona Auto Analyser and IL system 502 Na⁺/K⁺ analyser greatly improved the quality and efficiency of the investigative services.

The Division continued its studies on the serum proteins of patients with endomyocardia fibrosis. Using the two-dimensional electrophoretic technique, it has been possible to demonstrate abnormalities in the serum protein pattern of these patients.

Division of Blood Transfusion

Dr. P.A. Jayaprakash, MBBS, DIBT Blood Transfusion Officer

Dr. D. Hari Prasad, MBBS Junior Blood Transfusion Officer

With the continued co-operation of various voluntary organisations and colleges of Trivandrum, more than 1000 voluntary donors were recruited to the existing panel of 5000 volunteers and the volume of voluntary blood donation increased by 8%. During this period, the blood utilisation went up by 10%.

Blood component administration and therapy were regularly utilised during the year with consequent optimisation in the use of blood for patients. To preserve blood for longer time, a switch over was made to CPD solution from ACD anticoagulant for collection and storage. A beginning was also made in plasmapheresis as a form of therapy for certain neurological diseases.

Training for the medical and technical staff of the department on some of the recent developments in blood banking techniques was given by Dr. W.J. Lockyer and Mr. Terry Ray of Regional Blood Transfusion Centre, Bristol during their visit to the Institute. One doctor and one technician also received training at the Blood Group Reference Centre (ICMR) Bombay.

The research and development of the blood collection bags, thanks to the active collaboration of the Biomedical Technology Wing, made good progress during this period.

Department of Cardiology

Dr. K.G. Balakrishnan, MD., DM.	Associate Professor
Dr. C.G. Venkitachalam, MD., DM.	Assistant Professor
Dr. V. Ramakrishna Pillai, MD, DM.	Assistant Professor
Dr. R. Subramaniam, MD, DM.	Assistant Professor
Dr. P.S. Bhat, MD, DM.	Lecturer
Dr. Thomas Titus } Dr. K. Raman } on leave for DM.	Lecturers

While patient services in terms of new out-patient registration, admissions and invasive investigations stabilised at 1980 level, echocardiography including the new technique of contrast echo study registered a dramatic increase over the previous year's record. With the addition of the two dimensional real time echo facility, the information obtained with contrast echo study has improved considerably. Exercise tolerance test and coronary arteriography have also shown an upward trend as the department is fully equipped and staffed to develop this important area of cardiology.

The main research effort of the department centred on Endomyocardial Fibrosis and its

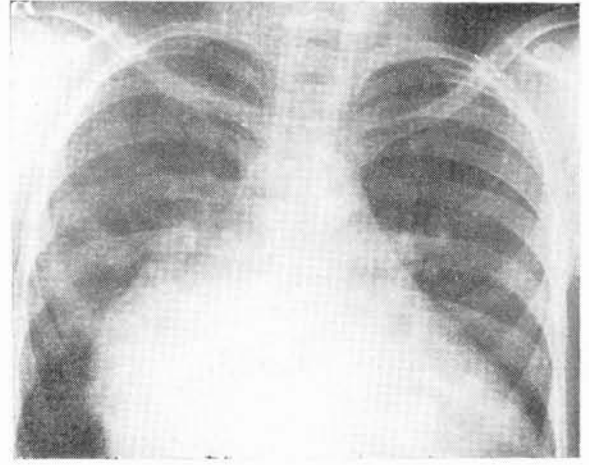
clinical, haemodynamic, angiographic and echocardiographic characterisation. Collaborative efforts were also begun with other departments in the immunopathologic and biochemical studies of EMF tissues removed from diseased hearts at open heart operations.

The first batch of two post-graduate students joined the department for D.M. Degree course which consists of academic and clinical activities on a full time basis.

Department of Cardiac Surgery

Dr. M.S. Valiathan, Ch.M., FRCS, FRCSE, FRCS(C), FACC, FAMS, FASc.	Professor
Dr. M.P. Mohan Singh, FRCS, FRCS(E)	Associate Professor
Dr. K.S. Neelakantan, MS., M.Ch.	Lecturer
Dr. Hrishikar, MS., M.Ch.	Lecturer
Dr. R. Sankar Kumar, MS.	Lecturer
Dr. K.V. Krishnan, MS. (On study leave for M.Ch.)	Lecturer

The operative work load and range remained unchanged from the previous year in view of the fixed bed strength and intensive care facilities. Open heart operations for complex congenital anomalies, valve replacement and coronary artery bypass figured prominently in the surgical services in the descending order of frequency even though coronary artery surgery did show a small trend toward increase. The introduction of valve replacement and endocardectomy for several disabled patients with endomyocardial fibrosis offered them marked palliation and provided an opportunity to study the diseased tissues removed at operation by modern laboratory techniques.



Palliative operations can significantly reduce the gross enlargement in heart size and provide relief to patients with endomyocardial fibrosis—a disease common in Kerala.

The department continued to play an effective role with the collaboration of the Biomedical Technology Wing in developing the technology of extracorporeal devices and bio-implants. As a result of these interdisciplinary efforts, cardiomy reservoir-cum-filter and a disposable oxygenator approached the stage of commercial transfer which is under negotiation. On the basis of a series of 3 and 6 month implantation studies in pigs, the vascular graft which had been developed in collaboration with the South India Textile Research Association, Coimbatore was further improved and long term observation upto 2 years initiated. The Chitra prosthetic heart valve demonstrated excellent durability of four years in the accelerated wear tester and was shortly to be implanted in the mitral position in porcine trials.

The department admitted two post-graduate students including an in-service Lecturer for M.Ch in Cardiothoracic Surgery.

Division of Microbiology

Dr. J. Shanmugam, Ph.D.	Associate Professor
Dr. Ashalatha Nair, MD.	Lecturer
Sri. M. Ravindranath, B.Sc.	Scientific Assistant
Miss. Molly Thomas, M.Sc.	Scientific Assistant

The Division of Microbiology responded positively to the mounting demand for diagnostic tests which registered a significant increase over the previous year. Two research projects—one on experimental production of pancarditis due to Coxsackie B viruses in mice (funded by DST, Govt. of India) and another on Virus Etiology of Pancreatitis in collaboration with the Department of Gastroenterology, Medical College Hospital, Trivandrum (funded by ICMR), initiated during 1981, made good progress. Other research activities currently being carried out include (a) study on Betalactamase production by clinical isolates including methods of detection, (b) Correlation of Streptococcal antibodies with RF and RHD, (c) Virus etiology of encephalitis in children with collaboration of Dept. of Paediatrics, SATH, Trivandrum, (d) Coxsackie—B virus study of valvulitis and (e) Application of a new serological tool namely, single radial haemolysis in gel (SRHG) in measuring antibodies against various viruses including Coxsackie—B viruses.

Three technicians were offered training in basic bacteriology, streptococcal serology and tissue culture techniques during 1981. A technologist from the Institute of Medical Sciences, Srinagar was also accepted for training in diagnostic microbiology from January, 1982.

Dr. J. Shanmugam was nominated by the Government of India to participate in the Inter-country training course in Microbiology at Colombo, Sri Lanka held in January 1982. He was

also invited to take part in the INDO-US Workshop-cum-Seminar on Rheumatic Fever in New Delhi in March, 1981.

Dr. Asha Latha Nair attended the Workshop on "Laboratory Diagnosis of Anaerobic Infections in Man" at All India Institute of Medical Sciences, New Delhi, in March 1982.

Department of Neurology

Dr. Vimla Virmani, MA(Psy), FRCPE, FAMS	Visiting Professor
Dr. P.K. Mohan, MD, DM (Neurology)	Assistant Professor
Dr. P.K. Saha, MD, DM (Neurology)	Lecturer
Dr. J. Tharakan, MD, DM(Neurology)	Lecturer
Dr. P. Ashok, MD, (on leave of DM)	Lecturer

The department continued to register an upward trend in the number of new cases seen in the O.P. and in the number of cases admitted for specialised investigations and management. About 780 specialised electro-neurophysiological investigations like EEG, EMG, etc. were carried out. Research in the field of CNS infections, which was started last year in collaboration with divisions of Microbiology and Pathology, continued and is expected to grow further with the active collaboration of the division of Neurochemistry. The department collaborated with departments of Neurosurgery and Neuro-radiology in the study of craniovertebral anomalies seen in this part of the country. Other areas of investigations included intracranial vascular diseases and neurological complications following open heart surgery. The latter was undertaken in collaboration with the department of Cardiac Surgery with a view to delineate the subtle mental and cognitive disturbances which may result from surgical procedures or other metabolic interventions.

Academic programmes in the form of seminars, symposia, lectures and group discussions were instituted as a part of the training programme for two D.M. candidates.

Department of Neurosurgery

Dr. D. Rout, MD., M.Ch.	Associate Professor
Dr. R.N. Bhattacharya, MS, M.Ch.	Lecturer
Dr. Lekshman Das, MS, M.Ch.	Lecturer
Dr. S.M. Pillai, MS.	Lecturer

The department recorded a steady increase in the volume of clinical services. This was particularly noticeable in the number of neurosurgical procedures which also showed a decline in operative mortality to 2.8%. In collaboration with the Division of Radiology, the techniques of therapeutic embolisation of inoperable AV malformations and spinal angiography were standardised during this period. The department also took the lead in achieving microsurgical decompression of the facial nerve for uncontrolled facial myoclonus. The services of radio frequency lesion for trigeminal neuralgia and tran-sphenoidal surgery for sellar lesions continued to attract patients from the southern region.

The department collaborated with the departments of Neurology, Radiology and Pathology in several research projects which included the study of cranio-vertebral anomalies, immune profile in experimental fungal infections of the central nervous system and the role of hyaluronidase in experimental cryptococcal infections of the central nervous system.

A lecturer in Neurosurgery was accepted for admission to the M.Ch. course in Neurosurgery,

Division of Neurochemistry

Dr. Debkumar Basu, Ph.D.	Professor
Dr. P.S. Appukuttan, Ph.D.	Lecturer

In continuation of the ongoing programme on the utilisation of hospital wastes, two lysosomal enzymes from placental tissue were purified. They were :

1. α -Mannosidase and
2. β -galactosidase.

α -Mannosidase was purified to homogeneity and its structural studies are in progress. It was found to be a tetramer containing 77,000 dalton monomers. It contained only one subunit of 77,000 dalton even in presence of β -mercapto-ethanol-SDS. The carbohydrate content was found to be 10%.

β -galactosidase was purified to near homogeneity with the absence of other lysosomal enzyme activities except for a trace of β -hexosaminidase activity. Affinity chromatography column with an inhibitor as ligand is being planned. It was observed that the enzyme is completely inhibited by 10^{-6} M P-hydroxymercuribenzoate (PHMD). This inhibition was reversible by cysteine at 10^{-4} M concentration. It would be reasonable to conclude that SH group is involved in its structural integrity or at the active site of the enzyme. The enzymic activity was split into two peaks on gel filtration through Sephadex G-200 at pH 7.0, a high molecular weight fraction eluted just after void volume containing about 30% of total activity. Another fraction of 98,000 dalton was eluted in the inner volume of the column. The latter fraction was further purified and was found to contain two major subunits of 35,000 and 25,000 dalton molecular weight. The enzyme contained 6% carbohydrate.

The project on the utilisation of Enzyme Engineering for medical diagnosis also made progress. Creatine kinase from brain was purified to homogeneity and its physiochemical properties studied in detail. The production of an antibody to this brain creatine kinase BB-form is being undertaken which will be able to detect heart muscle MB-form in other biological fluids. Plans are also under way to utilise Enzyme linked Immuno Sorbent Assay (ELISA) method for the detection of MB-form of creatine kinase for diagnostic purposes. The label enzyme to be employed for this purpose will be α -Mannosidase and or β -galactosidase from the placental tissue purified in this laboratory.

The work on sugar-specific plant storage proteins from locally available sources continued during the year. A sugar-specific protein from locally available jack-fruit seeds (*Artocarpus integrifolia*) was isolated and purified. This protein was found to be specific for α -galactose and its purification step to involve a specific α -galactose polymer gum (guar gum). Guar gum was immobilised by a simple indigenously developed procedure. The protein has a molecular weight of 40,000 dalton, having identical subunit of 10,500 dalton. Further physiochemical and fluorescent quenching studies are in progress. Serological utilisation of jack-fruit seed and winged-bean seed agglutinin is also being explored.

Division of Pathology

Dr. V.V. Radhakrishnan, MD	Assistant Professor
Dr. C. Chandrasekharan Kartha, MD	Lecturer
Dr. Ashok Parameswaran, MD	Lecturer

The haematological and other clinical pathology investigations increased by approximately 18% over the previous year and coagulation studies provided essential support to the care of cardiac

surgical patients. The histopathology laboratory examined and reported over 900 specimens from patients and experimental tissues and steadily built up a wealth of material for further studies. The histopathology laboratory also gave substantial assistance to the Biomedical Technology Wing by performing tissue compatibility studies of polyester cloth, bioglass and Polyvinyl chloride.

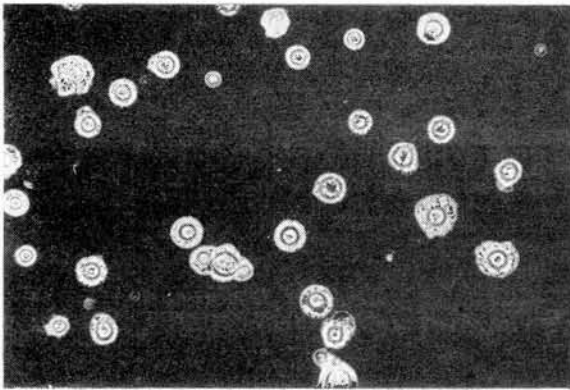


Fig. 1

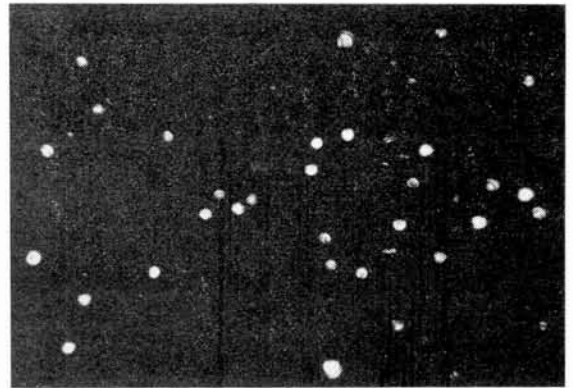


Fig. 2

Cryptococcus neoformans is a deadly pathogen which often attacks the central nervous system. The minimal defence reaction of the host tissues to cryptococcal infections has been ascribed to the protective capsule of the organism (Fig 1). In experiment animals, this capsule could be broken with hyaluronidase and the infective core exposed to the defences of the host (Fig. 2)

Autopsy rate remained at 30% and provided valuable material for teaching and research.

The immunology laboratory regularly undertook investigations such as electrophoresis, immunoglobulin assay, phagocytic function tests, chemotaxis assay, lymphocyte sub population assay, immune complex assay and immunofluorescent studies.

The experimental research activities of the Division included the following projects :

- (i) Pathological profiles of candidal and cryptococcal infections in albino rats under experimental conditions.

- (ii) Pathophysiologic mechanisms in cryptococcal infections.
 - (a) In-vitro phagocytic mechanism
 - (b) In-vitro macrophagal neutrophil chemotaxis in cryptococcal infection.
 - (c) The role serum inhibition factor and complement depletion in cryptococcal infection.
- (iii) Therapeutic application of hyaluronidase in experimental cryptococcal infection with possible evaluation in clinical cases.
- (iv) Experimental eosinophilia in rats (ICMR sponsored)
- (v) To initiate work on *L. carinii* infection in rodent model, a colony of cotton rats and colonies of mite *Bdellonyssus bacoti* was set up. Support was also given to the division of microbiology for a research project on experimental myocarditis in mice.

Division of Radiology

Dr. K. Sasidharan, MD	Associate Professor
Dr. V.R.K. Rao, MD	Assistant Professor
Dr. Bhat Venkataraman, MD	Lecturer
Dr. R. Venkat Rama Rao, MD	Lecturer

The number of cardiac and neuro radiological investigations rose slightly over the level of the previous year except for pneumoencephalograms and 4 vessel cerebral angiograms which showed a 30% increase. The neuro-radiology section added a Newton-Hasty Stereotome to its diagnostic range of instruments.

Fig. 3

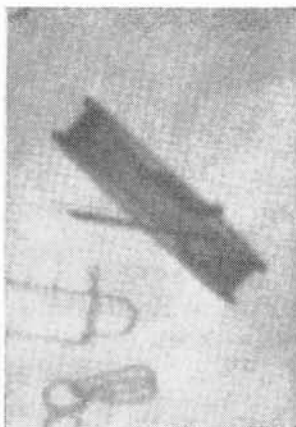
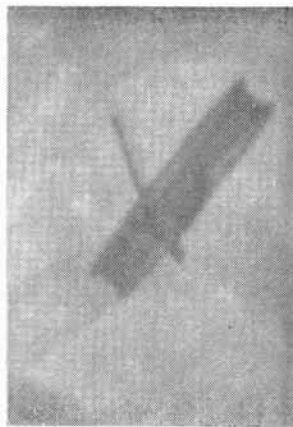


Fig. 4



The full opening of the tilting disc in a prosthetic valve is a matter of life and death for the patient. The radiographic evaluation of the tilting angle of the disc in patients is a routine practice at the Institute. The opening had become restricted due to clot formation in a patient (Fig. 3) in contrast to the full opening of the disc earlier (Fig. 4). The malfunctioning valve was replaced successfully.

Apart from continuing the studies on endomyocardial fibrosis, the cardiac radiology section undertook a fluoro-radiographic evaluation of the functional status of Bjork-Shiley heart valves in post-operative patients. This study made a significant contribution to the monitoring and care of post-operative patients with prosthetic heart valves.

In view of the growing importance of therapeutic angiography, the neuro-radiology section initiated discussions with the scientists at the Biomedical Technology Wing for the development of special catheters, embolic materials and other accessories.

BIOMEDICAL TECHNOLOGY WING

Head : Shri A. V. Ramani

1981 was a year of consolidation for the technological programmes which had moved to their permanent location at the Satelmond Palace during the previous year. Apart from the progress made by individual laboratories, the Biomedical Technology Wing saw during this period the gradual emergence of a composite culture which transcended traditional disciplines such as engineering, biophysics and toxicology. The inter-dependence of projects, weekly seminars and informal scientific discussions contributed to the growth of the new spirit of interdisciplinary research. The scientific efforts were matched by the development of the Satelmond Palace Campus which was adjudged the 'best campus for 1981-82' in Trivandrum by the Agro-Horticultural Society.

DEPARTMENT OF BIOMATERIAL SCIENCE

(i) Laboratory for Technical Evaluation of Biomaterials

Dr. V.V. Bhujle, Ph.D.	Scientist in-charge
Mrs. Prabha D. Nair, M.Sc.	Scientific Officer
Shri. K. Srinivasan, M.Sc.	Scientific Officer

The laboratory extended its routine analytical services to Polymer technology, Toxicology, Thrombosis Research Unit, Biomedical Engineering, Blood Bank and other divisions of this Institute. The nature of these services varied from thermal, spectroscopic, mechanical and chromatographic analysis of biomaterials to the chemical analysis of the PVC materials used in oxygenators and blood bags fabricated at this Institute. The detection and estimation of

phthalate esters in plasma was a difficult analytical problem which led to the development of a novel analytical procedure for the estimation of phthalate esters in plasma involving IR spectroscopy.

The laboratory undertook the compilation of thermal analysis data for several indigenous and imported synthetic polymers as a ready source of reference.

The laboratory continued its systematic and upto-date compilation programme of IR and UV spectral data for a wide range of chemical substances encountered in PVC formulations in medical usage. The laboratory, as a coinvestigator, is engaged in the chemical analysis/materials characterisation programmes of the following research projects.

1. Development of testing systems for the evaluation of cytotoxicology and quantitation of heavy metals in biomaterials.
2. Development of modifications of bio-compatible polyurethanes and their interaction studies with blood proteins at the interface.
3. Development of anti-thrombogenic polymer surfaces (albuminated) and their interaction studies with blood proteins.
4. Development of improved radiation sterilisable PVC formulations for biomedical applications.

The laboratory is also developing independent quality control/surveillance procedures to cover various synthetic polymers and other materials used in a variety of biomedical devices which would form the basis of its own research project entitled 'studies towards quality control/quality surveillance of PVC materials used in biomedical devices—A comprehensive analytical chemistry approach to safety measures'.

Other activities of the laboratory included phase transition studies of cholesterol and related substances and their biomedical significance, spectroscopic and thermal investigation of heparin and its complexes and the development of novel analytical procedures for the estimation and analysis of oligomers present in a variety of polymers used in biomedical devices. An analytical technique involving use of ATR spectroscopy in conjunction with paper chromatography was developed and its application potentials were assessed.

During the current year, the laboratory extended its analytical services to various outside agencies such as CSIR Regional Research Laboratory, Trivandrum, University of Kerala, University of Calicut, Travancore Titanium, Keltron. etc.

(ii) Laboratory for Thrombosis

Dr. M. Jamaluddin, Ph.D.	Scientist in-charge
Mrs. Lissy Kalyanakrishnan, M.Sc	Scientific Assistant

The major attention during this period was directed towards setting up the laboratory from scratch. As a result, it was possible to initiate work on the BRNS Project on "Blood Prosthetic Interactions" which seeks to study thrombosis from a biophysical angle.

The scientist-in-charge served as a visitor to the Centre for Theoretical studies, Indian Institute of Science, Bangalore during August 1981 and gave an invited talk on "Nuclei acid Vitamin Interactions : The case of Vitamin C." He was also an invited participant in the international meeting on "Condensed chromatin and X-chromosome inactivation" organised by the Microbiology and Cell biology laboratory, Indian Institute of Science, Bangalore in Dec. 1981.

DEPARTMENT OF BIOMEDICAL ENGINEERING

(i) Division of Internal Organs

Shri. G.S. Bhuvaneshwar, B. Tech., M.S. Biomedical Engineer.

The major project on the development of a prosthetic heart valve made further progress and the technique of fabricating the major strut integral with the valve ring became a turning point in the evolution of a durable titanium valve housing. The integral strut valves have successfully withstood over 200 million cycles in the accelerated wear tester and proven their durability beyond doubt. The *in vivo* evaluation of the valve in pigs is scheduled to begin in May 1982. The accelerated wear tester which was designed and fabricated in this laboratory functioned extremely well in these uninterrupted and long series of experiments.

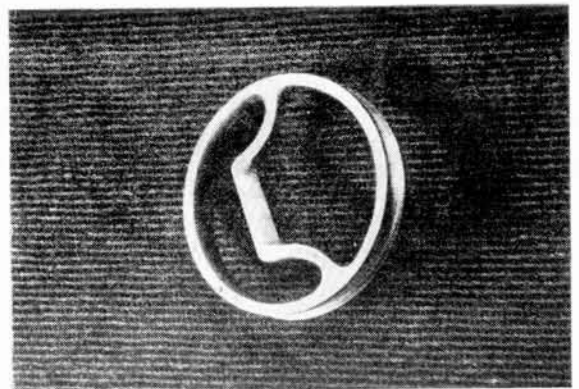


Fig. 5

The titanium ring with an integral strut which forms the housing of the Chitra tilting disc valve. This particular ring had undergone 200 million cycles in the accelerated wear tester and was none the worse for the trial.

The collaborative project on vascular grafts with South India Textile Research Association, Coimbatore reached a stage when the sample grafts could be regularly implanted in pigs for

evaluation. During the current year, 32 implantations were made, 16 each of test and control grafts. The initial results were encouraging and long term studies for patency and tissue response are in progress.

(ii) Division of extra corporeal devices

Shri V.S. Venkatesan, B.E.

Biomedical Engineer

The 6 KW welding machine in the sterile room facility was pressed into full use in fabricating disposable oxygenators. The disposable unit underwent continued and extensive tests which included a large series of vitro experiments using closed loop technique for periods upto 6 hours and many exvivo procedures in sheep ranging from 30 minutes to 2 hours. The highly satisfactory results in these experiments enabled firm plans to be made for their early clinical trial subject to the approval of the Ethics Committee of the Institute. The scale of experimentation would be apparent from the fact that over 200 disposable oxygenators were fabricated during this period.

The cardiotomy reservoir with integral filter which had been found to be acceptable in earlier studies was modified in terms of improved aesthetics and better quality PVC which was compounded in the sister division of Polymer Technology. The clinical trial of the modified unit is expected to begin in 1982.

(iii) Division of Biosurface Technology

Dr. Chandra P. Sharma, M. Tech., M.S.,
Sc.D., MEBE.

Scientist in-charge

Mr. Thomas Chandy, M.Sc.

Scientific Assistant

In developing different approaches to anti-thrombogenic surfaces, the laboratory observed

the effect of Vitamin C on promoting a passivating layer with less platelet adhesion. Surface modification for blood compatibility was also achieved using polyelectrolytes from natural rubber, anti-Hageman factor and other proteins. These studies led to a new understanding of anti-thrombogenicity which postulates that platelet adhesion may be more dependent on surface free energy rather than enzymatic activity. As an alternative approach to the development of an anti-thrombogenic surface, a project on the immobilisation of anti-coagulant enzymes was also initiated.



Fig. 6

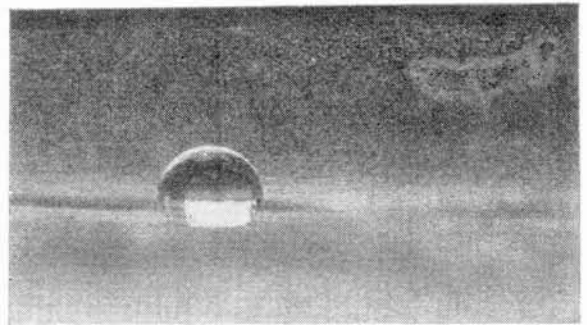


Fig. 7

A drop on a surface tells us much in contrast to a drop in the ocean. The two drops of water shown here (Fig. 6 & 7) appear strikingly different because the surfaces which support them are different. The surface free energy as determined from the contact angle of drops is a useful tool in understanding blood-prosthetic surface interactions.

Two major projects of the laboratory funded by the Department of Science and Technology and Board of Research in Nuclear Sciences respectively were 'Development and evaluation of biocompatibility of polyurethanes' and "Development of a new anti-thrombogenic polymer surface and its interaction studies with blood proteins at the interface." The range of new equipment in the laboratory included Ellipsometer with HP-85 Calculator, optical microscope, moisture analyser, microbalance electrophoresis set-up and radio-isotope Unit which will be supplemented by a spectrophotometer and flow discharge equipment shortly.

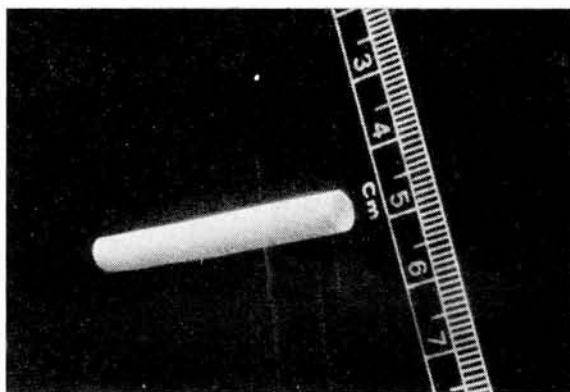


Fig. 8

While polyester grafts exceeding 1 cm diameter are already under long-term trial in pigs, a beginning has been made in fabricating small diameter grafts from polyurethane. Small bore grafts continue to remain an unbroken frontier in vascular surgery.

The laboratory also made a preliminary contribution to the application of anti-thrombogenic surfaces to surgery by developing a 5 mm vascular graft from polyurethane and albuminated shunts for temporary aortic bypass.

(iv) Division of Polymer Technology

Shri S.N. Paul, M.Tech.

Chemical Engineer

Shri Kalyanakrishnan, M.Sc.

Scientific Officer

In view of the difficulty in ensuring the composition and purity of PVC supplied by external agencies, PVC formulations were developed in the Division with excellent mechanical, optical and thermal properties. The leachability characteristics and preliminary toxicity results of the new compounds were found to compare favourably with those of imported samples. As the formulations could be prepared in a clean and controlled environment and their composition held constant, they offered a superior material for calendaring PVC sheets for disposable devices.

In collaboration with the Blood Transfusion Service of the Institute, the Division made substantial progress in developing a two bag unit for blood fractionation which passed the tests of toxicity, welding strength, leachability, low temperature behaviour, tackiness and centrifugation upto 5000 g. The bag was therefore taken up for a series of blood compatibility tests.

The Division was awarded a research grant by the Board of Research in Nuclear Sciences for a project on "Development of improved radiation sterilisable PVC formulations for biomedical applications."

It continued to provide support to other Divisions in the fabrication of plastic components of disposable devices.

(v) Division of Tool Room

Shri O.S. Neelakantan Nair, B.Sc.,(Mech.Engg.)

Tool Room Engineer

The wide range of support provided by the Division for ongoing research programmes will be apparent from the following parts and devices which were fabricated in the Tool Room.

- (a) Integral strut heart valve cages
- (b) Fitting fixture for sewing ring
- (c) Polypropelene collets for valve cage polishing
- (d) Modified welding fixture
- (e) Modified valve holder in wear tester
- (f) Moulds for needle holder, tubing clamp, tube extension die, blood bag welding die.
- (g) New rabbit cages from MS welded mesh.

The Division also undertook the supervision of engineering services for the Campus including electrical works, telephone installations, road repair with rubberised bitumen and other maintenance activities.

Division of Materials Toxicology

Dr. P.V. Vedanarayanan, BVSc., Ph.D.	Senior Materials Toxicologist
Dr. A.C. Fernandez, Ph.D.	Scientist
Shri K. Rathinam, M.Sc.	Scientist

Consistent with its basic responsibilities, the Division carried out over 100 tests (in-vitro and in-vivo) this year on a variety of biomaterials. Adverse reactions wherever noted, were promptly reported to the engineering groups to effect necessary modifications in the candidate materials for biomedical devices. The toxicologic assistance of the Division was also sought by other agencies notably RRL, Trivandrum, CGCRI Calcutta, IDPL, Madras and Bhor Industries Bombay.

The research project on cytotoxicity as an index of biocompatibility which was funded by DST and initiated under the guidance of Dr. P.V. Vedanarayanan made slow progress due to the long delay in the arrival of imported equipment such as CO₂ incubator and the damage suffered by the atomic absorption spectrophotometer in transit.

Apart from the evaluation of cytotoxicity, the Division initiated a major research project on "A study of changes taking place in the molecular targets -i.e., subcellular organelles."

Dr. R.M. Browne, Professor of Oral Pathology of the University of Birmingham, England, visited the Division and his lectures, seminars and discussions on dental materials were particularly appropriate and useful.

Division of Vivarium

Dr. Arthur Vijayan Lal, BVSc.	Veterinary Scientist
Dr. B. Mohan Chandran, BVSc.	Veterinary Surgeon

During the year under report, the Vivarium started functioning in the new block which is built at two levels to accommodate laboratories and animal housing respectively. The experimental surgery unit consists of a modern operating room with all ancillary facilities including a post-operative recovery room for animals. The new equipment added during this period included a Data scope unit for ECG and BP monitoring and Sarns modular pump. The new facilities greatly improved the quality of major operative procedures as well as the recovery of animals.

The vivarium included a modern kennel to house 40–60 animals which have individual cages with epoxy coated weld mesh in front and top. A piggery which can accommodate upto 60 stock and post-operative animals is also a prominent subunit of the vivarium. The old out houses of the palace continued to be in use as sheep shed and calf pen. The animal models for various ongoing projects were chosen on the basis of international experience and are given below :

Oxygenator	: Sheep
Vascular graft	: Pig
Parental Nutrition	: Dog
Thrombogenicity of materials	: Dog

The appointment of a Veterinary Scientist on promotion and the accretion of a new veterinary surgeon served to meet the increased demands for animal care and experimental surgery.

ADMINISTRATIVE BODIES

President	Shri G. Parthasarathi
Director	Dr. M.S. Valiathan

Institute Body

1. Dr. B.K. Bachhawat
Director,
Indian Institute of Experimental Medicine,
4, Raja Subodh Mullick Road,
Calcutta.
2. Dr. I.D. Bajaj,
Director General of Health Services
Nirman Bhavan, New Delhi.
3. Dr. K.P. Bhargava,
Principal,
K.G. Medical College,
Lucknow (U.P.)
4. Dr. V.R. Gowariker,
Director,
Vikram Sarabhai Space Centre,
Trivandrum.
5. Shri O.J. Joseph,
Member of Rajya Sabha,
Lal Villa, No "Subash Nagar"
Vallakadavu, Trivandrum.
6. Prof. P.J. Kurien,
Member of Lok Sabha,
Pallath House,
P.O. Vellikulam, Alleppey.
7. Dr. (Mrs.) Leila Ram Kumar,
Director,
Research and Medical Education Punjab,
Show Room No. 22, Madhya Marg,
Sector 7-C, Chandigarh.

-
8. Shri C.V.S. Mani,
Additional Secretary, Health,
(Ministry of Health & Family Welfare)
Nirman Bhavan, New Delhi.
 9. Prof. Y. Nayudamma,
Vice Chancellor,
Jawaharlal Nehru University,
New Delhi.
 10. Shri G. Parthasarathi,
49, Lodi Estate, New Delhi.
 11. Dr. (Miss) K.M. Pavri,
Director,
National Institute of Virology,
Pune (Maharashtra).
 12. Shri A.A. Rahim,
Member of Lok Sabha,
Malikaveedu, Quilon.
 13. Mr. A.V. Ramani,
Head, Biomedical Technology Wing,
Sree Chitra Tirunal Institute for Medical
Sciences & Technology,
Trivandrum-695 011.
 14. Shri P.K. Ramanujam,
Financial Adviser,
Department of Science & Technology,
Govt. of India, Technology Bhavan,
New Mehrauli Road,
New Delhi.
 15. Dr. S. Ramaseshan,
Director,
Indian Institute of Science,
Bangalore.
 16. Shri S. Sadasivam,
Deputy Educational Adviser (T),
Southern Regional office,
Shastri Bhavan, 26, Haddows Road,
Nungambakkam,
Madras.

-
17. The Secretary,
Department of Science & Technology,
Govt. of India, Technology Bhavan,
New Mehrauli Road, New Delhi.
 18. Shri.K. Srinivasan,
Secretary,
Health, Government of Kerala.
 19. Dr.M.S. Valiathan,
Director,
Sree Chitra Tirunal Institute for
Medical Sciences & Technology,
Trivandrum.
 20. Dr. A.V. Varughese,
Vice Chancellor,
University of Kerala.
 21. Dr.K.I. Vasu,
Chairman, State Committee on Science
and Technology, Govt. of Kerala.
 22. Dr. N.H. Wadia,
Director of Neurology, Jaslok Hospital and
Research Centre, and Consultant
Neurologist, J. J. Group Hospitals and
Grant Medical College, Bombay.

GOVERNING BODY

Shri. G. Parthasarathi, (Chairman)

1. The Secretary to Government,
Dept. of Science & Technology,
Government of India,
Technology Bhavan,
New Mehrauli Road, New Delhi.
2. Director General of Health Services,
Government of India,
Nirman Bhavan, New Delhi.
3. Chairman, State Committee on Science &
Technology, Govt. of Kerala.
4. Prof. S. Ramaseshan,
Director,
Indian Institute of Science
Bangalore.
5. Dr. N.H. Wadia,
Director of Neurology, Jaslok Hospital
and Research Centre, and Consultant
Neurologist, J.J. Group Hospitals and
Grant Medical College, Bombay.
6. Dr. M.S. Valiathan,
Director,
Sree Chitra Tirunal Institute for
Medical Sciences & Technology.
7. Shri. A.V. Ramani
Head, Biomedical Technology Wing,
S.C.T.I.M.S.T., Trivandrum.
8. Prof. D.K. Basu,
Professor of Neurochemistry,
Sree Chitra Tirunal Institute for
Medical Sciences & Technology,
Trivandrum.

STANDING COMMITTEES

Finance Committee

Director (Chairman)

Dr.V.R. Gowarikar,
Director, VSSC, Trivandrum.

Financial Adviser to the Department of Science &
Technology, Government of India.

Member of the Institute representing Department
of Science & Technology.

Financial Adviser & Chief Accounts Officer
of the Institute (Convenor)

Academic Committee

Director (Chairman)

Prof. B.K. Bachhawat,
Director, Institute of Experimental Medicine,
Calcutta.

Prof. G.B. Parulkar,
Director Professor of Surgery,
KEM Hospital, Bombay.

Prof. R.M. Varma,
Professor Emeritus,
NIMHANS, Bangalore.

Prof. P.S. Bidwai,
Professor of Cardiology,
PGI, Chandigarh.

Prof. P. Mazumder,
Professor,
S.C.T.I.M.S.T.,
Trivandrum.

Dr. M.P. Mohansingh,
Associate Professor,
S.C.T.I.M.S.T.

Dr. Damodar Rout,
Associate Professor,
S.C.T.I.M.S.T.

Prof. (Mrs)Vimla Virmani,
Visiting Professor of Neurology,
15 Gold Links, New Delhi.

Sri. A.V. Ramani,
Head, BMT Wing,
S.C.T.I.M.S.T.

Technology Development Committee

Director (Chairman)

Prof. S. Ramaseshan,
Director, Indian Institute of Science,
Bangalore.

Prof. C.N.R. Rao,
Chairman, Solid & Structural Chemistry Unit,
Indian Institute of Science, Bangalore.

Dr. C. Ambasankaran,
Director, BARC (Electronics Dn.)
Bombay.

Dr. V.R. Gowarikar,
Director, VSSC., Trivandrum.

Dr. S. Sriramachari,
Director, Institute of Pathology, New Delhi.

Sri. A. V. Ramani,
Head, BMT Wing, S.C.T.I.M.S.T.

Sri. G.S. Bhuvaneshwar,
Biomedical Engineer,
BMT Wing, S.C.T.I.M.S.T.

Dr. P.V. Vedanarayanan,
Senior Materials Toxicologist,
BMT Wing, S.C.T.I.M.S.T.

Building Committee

Director (Chairman)

Health Secretary,
Government of Kerala.

Construction Engineer,
VSSC, Trivandrum.

Head, BMT Wing, S.C.T.I.M.S.T.

Financial Adviser & Chief Accounts Officer,
S.C.T.I.M.S.T.

A member to be coopted by the Director as and
when necessary.

Senior Staff Selection Committee

Director (Chairman)

Dr. N.H. Wadia,
Director of Neurology,
Jaslok Hospital and Research Centre and
Consultant Neurologist,
J.J. Group Hospitals and Grant Medical College,
Bombay.

Head,
Biomedical Technology Wing, S.C.T.I.M.S.T.

A nominee of the Secretary,
Department of Science & Technology,
Government of India.

An expert from outside the Institute nominated
by the President.

A senior Professor of the Institute.

Junior Staff Selection Committee

Medical Superintendent of the Institute

Head, Biomedical Technology Wing of the
Institute

Administrative Medical Officer of the Institute

Financial Adviser & Chief Accounts Officer of
the Institute

Dr. C.G. Venkitachalam, Asst. Professor,
S.C.T.I.M.S.T.

A representative of the academic wing of the
Institute nominated by the Director.

PUBLICATIONS

1. Ashok.P., Sapru. R, Vimla Virmani, : Electromyographic studies in Endo-Myocardial Fibrosis. *J.Neurol.Science.* 54 : 1–12, 1982.
2. Ashok.P., Valiathan.M.S., Mohansingh.M.P. Vimla Virmani : Neurological complications following open-heart surgery. *Neurology (India)* 29:149, 1981.
3. Ashok. P., Sapru.R.P., Radhakrishnan, V.V., Vimla Virmani : Skeletal muscle change in tropical Endomyocardial Fibrosis. *J.Neurol. Scien* 54:1–12, 1982.
4. Ashok. P., Rao.V.R.K., Rout.D.: Malignant Invasion of Cavernous sinus: Ind, *J.Radio.* (in press).
5. Basu. D.K., Aruna.R.M. : Hexosaminidases, *Arogya* (in press).
6. Basu. D.K., Appukuttan. P.S., : Plant lectins specific for N-Acetyl-D-galactosamine (in press).
7. Bhujle V. V., : DSC studies of polyester fabrics used in sewing ring of a heart valve submitted for publication of *Bulletin of Materials Science*(Accepted for publication).
8. Bhujle. V.V., : Natural Radiation as a Hidden Variable in Biology : *Biomedicine*, 1.2, 43, 1981.
9. Bhuvaneshwar G. S., Venkatesan, V. S., Pattankar V. L., Kartha, C. C., Arthur Vijayan Lal and Valiathan M.S., Development of Textile Fabrics for surgical applications *Ind. J. Med. Res.* 74: 580, 1981.
10. Bhuvaneshwar G.S., Ramani A.V., Valiathan M. S., A tilting disc valve – Component materials and hydraulic function. *Bull. Mat. Science* (Accepted for publication).

11. Jayaprakash. P.A., Shanmugam.J., Hari-prasad.D. Hepatitis B surface antigen in Blood Donors—An epidemiologic study, *Transfusion* (in press)
12. Kumari. T.C., Shanmugam. J., Prabha. B., Vasudevan.D.M., prevalence of antibodies to Herpes simplex and Adenovirus in oral and cervical cancer patients a preliminary report. *Ind.J.Med.Research.* 75, No. 4, 590. 1982.
13. Mathai. A., Radhakrishnan. V.V. : In-vitro phagocytic as mechanism of Encephalated C.neoformas. (in press)
14. Radhakrishnan. V.V., Annamma Mathai, Shanmugam. J., Mathews. G. : The role of hyaluronidase in experimental Cryptococcal infection. *Surg. Neuro.* 17:4, 239, 1982.
15. Rao, V.R.K., Rout.D., Mohan.P.K., : Air myelography: An aid to surgical approach in Syringomyelia : In 'Continuing Medical Education Programme' Ed. by Kalyanaraman, S. 1981.
16. Rao.V.R.K., Pillai.S.M., Radhakrishnan.V.V., Mathews.G.: Tumours of posterior third ventricle. *Ind.J.Radiol.* 36:31–37, 1982.
17. Rao. V.R.K., Pillai. S.M., Shenoy. K.T., Mathews.G.: Cerebral magnification angiography: *Indian.J.Radiol.* 35:77–82, 1981.
18. Rao.V.R.K., Rout.D., Sapru.R.P.: Non surgical retrieval of a broken catheter from the Aorta-Neurology (in press)
19. Rao.V.R.K., Rout.D., Mohan.P.K., Pillai. S.M., Mathews. G. : Iothalate. (Conray–280) Ventriculography in the evaluation of brain stem tumours: *Ind.J.Radiol.*(in press).
20. Rathod R.C., Mohandas. K., Mazumder. P.: Use of Sodium Nitroprusside in Cardiac patients. *Ind. J. Anaes.* 29:1, 1981.

21. Shanmugam.J., Rajasekharan Nair: A three and half year follow up study of HBs-Ag carrier state in asymptomatic mothers. *Ind.J.Patho. & Microbiol.*(accepted for publication).
22. Sharma.C.P., Williams.D.F. : The effects of lipids on the Mechanical properties of polyglycolic acid sutures: *Engg. in. Med.* 10, 8, 1981.
23. Sharma. C.P., G.C.F. Clark, Williams, D.F.: The absorption of proteins on metal surfaces : *Engg. in Med.* 10, 100, 1981.
24. Sharma.C.P. : Study of charge of the intima and artificial materials-Comments : *J. Biomech*, 14, 813, 1981.
25. Sharma.C.P., Krishnan.V.K., Valiathan.M.S.: perspectives and problems of Blood compatible polymers: *J. Poly. Plast. Engg. & Tech*, 18: 2, 1982.
26. Sharma.C.P., Lissy Paul: Polycarbonate surface—Albumin Interaction, changes due to—Ascorbic Acid. *J. Coll. & Int. Sc.* (in press).
27. Sharma.C.P., Thomas Chandy: Variations in Glutaral-dehyde-Proteinated surfaces: *J.Coll. & Int. Sc.* (in press).
28. Sureshkumar.G., Appukuttan.P.S., Basu. D.K: Galactosespecific lectin from jack fruit seeds (*Artocarpus integral*) *J.Biosci.* (in press).
29. Thomas Chandy, Sharma.C.P. : Glutara-ldehyde-Proteinated surfaces : Blood compalibility: *Bull. Mat. Sc.* (in press).
30. Valiathan M.S., Biomaterials Research and Development *Bull. Mat. Science* (Accepted for publication).

-
31. Valiathan M. S., Blood compatibility of Materials. *Curr. Sc.* 51: 213, 1982.
 32. Vedanarayanan.P.V., Rathinam. K., Fernandez.A.C. : Toxicity screening of candidate materials for the fabrication of a bubble oxygenator : A preliminary report. *Bull. Mat. Sc.*
 33. Venkatesan V.S., Arthur Vijayan Lal., Bhuvaneshwar G.S., Valiathan M.S., Simplified invitro system for evaluating gas transfer characteristic of Oxygenator. *J. Extracorp. Tech.* 13: 209, 1981.
 34. Venkatesan V.S., Vijayan Lal A., Valiathan M.S., A Blood oxygenator from indigenous materials; functional evaluation using sheep lung as a deoxygenator. *Bull. Mat. Science* (Accepted for publication).

